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An official publication of FABTECH
The official publication of the Fabricators & Manufacturers Association
FMA 50th ANNIVERSARY

Edge troubles?

A punching troubleshooting guide

Also inside:


TRUMPF
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"We chose AMADA because we wanted the ability to cut and ship custom parts in as little as 12 hours."

— Jim Belosic, CEO
SendCutSend

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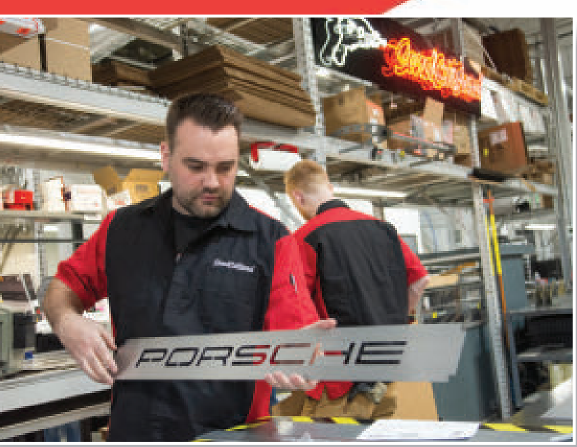

SendCutSend is a thriving shop that specializes in low-volume, quick-turn, custom laser cutting. This unique Reno, Nevada-based company's success powerfully reflects the following: when given the right training and technology, entrepreneurs with fresh ideas can uncover new markets with incredible potential. In this case, industry-leading technology came in the form of an ENSIS 3015 fiber laser, backed by AMADA's unmatched customer support.

SendCutSend's founder and CEO, Jim Belosic, summed up his company's partnership with AMADA. *"One of our engineers who had experience at another fabrication shop told us early on, 'Feel free to look at other brands, but AMADA is the Cadillac of sheet metal equipment, and their service is second to none.'"*

Belosic recalled his first meeting with the AMADA team. They discussed customers' increasing demands for quick delivery on low-volume orders.

During the meeting, Belosic said, *"We want to be able to produce and ship a single part in as little as 12 hours."* After listening to Belosic and discussing his specific manufacturing goals, AMADA provided the ideal solution.

ENSIS 3015 Fiber Laser Cutting System: AMADA's ENSIS fiber laser technology automatically changes the beam mode to accommodate the unique attributes of each material and thickness being processed. As a result, ENSIS processes a wide range of materials and thicknesses without requiring a lens change or additional setup. The systems' high-speed AMNC 3i control ensures fast, efficient results from operator to operator, and programming complex nests has never been easier. Consequently, an expanded nest of small parts can literally include work from more than 100 different customers — enabling SendCutSend to cost-effectively produce high-quality custom parts with maximum efficiency, speed, and flexibility.

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FMA 50th ANNIVERSARY

FMA In The Know

DEPARTMENTS

BUYERS' GUIDES

TECHNOLOGY

COMING IN OCTOBER

Keep cutting operations going.
Today's laser cutting technology is as productive as it has ever been, so crashes have to be avoided at all costs. Cutting software is helping fabricators maximize green-light time on their lasers.

Minimize injury risk on the shop floor.
A safety expert shares tips on how a shop should properly implement machine guarding—and with it, shape how much safety training is needed.

Are your welding operations ready for Industry 4.0?
Even small and medium-sized fabricating operations can benefit from the advantages of the connected digital enterprise. Here's a starter plan for those shops.

WHAT'S ONLINE?
THEFABRICATOR.COM

Welders come from all over.
Meet Eric Kelley, who left the education field after 12 years to become a welder. Darla Welton and Josh Welton continue their Still Building America series on www.thefabricator.com/blog.

Need a new table?
In his first video blog for www.thefabricator.com, Brown Dog Welding's Welton converts the wheel from a Grand Prix race car into a side table.

Need a new sign?
Barnes MetalCrafters had a new building, so it finally got around to making itself a sign. They also did sign fabrication for some local breweries. Fabricator Nick Martin has the scoop about the Wilson, N.C., shop's recent activities.


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Read more from Dan Davis at
www.thefabricator.com/author/dan-davis

Share your success—for your team and your industry

If metal fabricators want the best and brightest to consider a manufacturing career, they need to tell those young people what metal fabricating is about

I was having a conversation with an educator at a college in early August about the changing nature of students entering the school's engineering program. While some students enter with some hands-on skills, developed while working on a lawn mower engine or woodworking, others are strangers to power tools, drill presses, and welding torches. They know engineering concepts, but they come up short in actual real-world experience with fabricating things.

That's no surprise to metal fabricators, who have regularly encountered job-seekers who struggle to use a tape measure. It's a product of living in a society where a child is more likely to pick up a video game controller than a toy hammer.

Despite this well-known reality, metal fabricators still approach their livelihoods like they are guilty pleasures. "It's great, but I really don't want to go out of my way to let people know about it" appears to be the general mood of the industry. How can companies promote an industry and all that it has to offer when they don't rush to speak on its behalf?

The FABRICATOR runs into this situation every year when asking people to submit nominations for its Industry Award. The publication looks to honor a metal fabricator each year that has had success implementing operational improvements, growing the business, and supporting community projects and reaching out to local educational institutions. There are numerous success stories to share, but for whatever reason, many shops have a reluctance to tell their tale.

Maybe it's because these companies feel like they aren't large enough to be considered the best of the best. Indeed, many of our recent Industry Award winners are large companies, such as Mayville Engineering Co. (MEC) Inc., Mayville, Wis., in 2016 and BTD Manufacturing Inc., Detroit Lakes, Minn., in 2018. BTD's 2019 revenue exceeded $200 million while MEC's surpassed $500 million. But when *The FABRICATOR* started this awards program in 2008, the first company honored was Seconn Fabrication, Waterford, Conn., which was just approaching $10 million in annual sales. North America is dominated by small and medium-sized shops, so it would make sense that we should be getting more feedback from that sector. After all, MEC and BTD didn't open their doors and log $100 million in sales their first year in business. Everyone starts out small in the beginning.

Additionally, 2020 is already chock-full of metal fabricators and manufacturers stepping up to contribute in the fight against COVID-19. Whether it was making parts for ventilators like Miller Metal Fabrication, Bridgeville, Del. ("Miller Metal Fabrication keeps trying new things," p. 80), donating personal protective equipment to undersupplied health care workers, or dedicating a 3D printer to the production of face shields for local first responders, they rose to the occasion, often seeking out ways in which they could help their neighbors. That's the message that needs to get out.

The long-term outlook is just as positive for the metal fabricating sector. After all, in many instances, governors declared metal fabricators "essential" industries, as they were supporting supply chains that were considered integral to winning the battle against the coronavirus.

The Fabricators & Manufacturers Association's "2nd Quarter Forming & Fabricating Job Shop Consumption Report," released in mid-August, revealed that 38.3% of those shops surveyed expect a good business outlook, with another 38.6% expecting a stable situation similar to 2019. Probably most surprising is that most of these shops have been able to retain most of their workers during this slowdown. Only 27% reported that they were reducing their workforce numbers; on the flip side, 13.6% were adding jobs during the second quarter.

Lessons learned during two major downturns in the 2000s have made metal fabricators much smarter businesspeople. They have diversified their customer bases, so when one industry sector plummets, such as retail shelving, another one peaks, like exercise equipment has during the Great Shutdown. They have amassed cash reserves to see them through these slower times, but made key investments over the years that have allowed them to produce more with fewer people. These companies not only can compete with the shop down the street, but also the shop in Asia.

Metal fabricators are not just looking to hire press brake operators and welders. They are now looking for software developers and engineers, people that weren't part of any human resources discussion 10 years ago. But the industry has changed, and so has the need to be more open about the opportunities that await in the metal manufacturing industry.

Celebrate your team and elevate your industry. Let us know why you are worthy of *The FABRICATOR*'s Industry Award by visiting www.fmamfg.org/industryaward.

FMA'S CERTIFIED EDUCATION CENTERS

FMA Certified Education Centers (CEC) are community and technical colleges, trade schools, and universities that specialize in training adults for careers in the metal forming, fabricating, processing, and machining sectors. They offer coursework for local students year-round and serve as host locations for many types of FMA professional development programs as requested. A council of members convene six times a year to plan and execute special programs on worker training for educators and human resource managers from companies of all sizes.

To learn more about FMA's CEC program and view a list of the current member schools, visit https://www.fmamfg.org/membership/schools.

To discover how your local community or technical college can become a member, call 888-394-4362 or send an email to info@fmanet.org.

Event information may be out-of-date due to the coronavirus (COVID-19). Please check with the event organizer for cancellations or date changes.

Virtual ALAW—Advanced Laser Applications Workshop
Sept. 29-Oct. 1
Fabricators & Manufacturers Assn.
888-394-4362
www.fmamfg.org

AmCon
Sept. 30-Oct. 1—Houston
AmCon
800-829-7467
amconshows.com

Manufacturing Day
Oct. 2—North America
NAM
202-637-3426
mfgday.com

12th Annual Safety Conference
Oct. 6, 8, 13, 15—Virtual Event
Fabricators & Manufacturers Assn.
888-394-4362
www.fmamfg.org

RWMA 2020 Resistance Welding School
Oct. 7-8—Detroit
American Welding Society
800-443-9353
awo.aws.org

Virtual Robot Safety and Risk Assessment Training
Oct. 20-21 (two half-days)
Robotic Industries Assn.
734-994-6088
www.robotics.org

Virtual NBT Awards Gala
Oct. 22
Fabricators & Manufacturers Assn.
888-394-4362
www.fmamfg.org

Engage 2020
Oct. 27-30—Kansas City, Mo.
National Tooling & Machining Assn.
216-264-2845
ntma.org

RIA Robotic Grinding and Finishing Conference
Dec. 2-3—Saint Paul, Minn.
RIA, 3M
734-994-6088
www.robotics.org

Tube Düsseldorf 2020
Dec. 7-11—Düsseldorf, Germany
Messe Düsseldorf GmbH
312-781-5180
www.tube-tradefair.com

***The FABRICATOR*'s Technology Summit**
May 11-12, 2021—Elgin, Ill.
Fabricators & Manufacturers Assn.
888-394-4362
www.fmamfg.org

Coil Processing Workshop & Tours
June 9-10, 2021—
Michigan City, Ind.
Fabricators & Manufacturers Assn.
888-394-4362
www.fmamfg.org

Submit your industry event information for future publication to Editor-in-Chief Dan Davis at dand@thefabricator.com.

An Invitation for a Manufacturer Looking for a New Home

I really appreciate the article you wrote concerning the tragedy at 7-Sigma Inc. in Minneapolis. ["The link between civic viability and manufacturing," From the Editor-in-Chief, July 2020, p. 8]. My heart goes out to Kris Wyrobek, his family, the employees, and all affected by their great loss. The breadth and depth of such a loss is much more than I can imagine.

I would like to enlist your help in passing my sympathies to Wyrobek. I'm down here in Victoria, Texas, and if Wyrobek would like a much more pleasant place to relocate, I'd like to suggest Victoria. No, I'm not in local or state government or politics, and I'm not trying to sell any land. I'm just reaching out to offer an alternative that might bring some hope for a fresh start and a bit of optimism.

Even if Mr. Wyrobek doesn't have any intention of leaving the Minneapolis area, at least he might find a bit of comfort knowing that somebody out there is thinking of him and offering help in a troubled time.

Michael Atkinson
Monarch Machinery Inc.
Victoria, Texas

Mail for CAD Jockey Gerald Davis

I've just begun perusing some of your content written for *The FABRICATOR*. Would you have any interest in discussing a problem we are experiencing at my work? We are a job shop that fabricates a large variety of custom items. We seem to struggle with consistency in automating our bills of materials (BOMs) within SolidWorks.

I need to pinpoint whether our problem lies in misunderstanding BOMs in SolidWorks, lack of process, lack of training, or excessive variety of items. Then, of course, we need to make improvements.

Thank you for any time you may afford.

Anonymous

Editor's Note: Gerald Davis responds: "I'd like to help, but not really as a consultant. I'd rather try to work this into a magazine column. I'm hoping this sort of 15 minutes of good advice will sort it out for you. If you need a quick solution, maybe your value-added reseller can nail it.

"Here's what I suspect you need:

- *A BOM table template*
- *A Properties template/form that matches the BOM template*
- *A drawing template and matching sheet format*
- *A set of rules for using them that makes sense to everyone who makes and edits models in your shop.*

"The secret sauce that SolidWorks uses to autopopulate BOM tables is based on Windows custom properties. SolidWorks tried to replace the dreadful Windows File Properties interface with the Properties Builder/Custom Properties flyout tab. They were pretty successful, but it is not always intuitive as to why or how.

"The FABRICATOR *has published some articles on this topic, but it has been some time."*

I enjoy reading your articles in *The FABRICATOR*. You may have already addressed these topics, but thought I would submit them to you for consideration for future topics: plastic injection molding, mold creation, and more on weldment tips and tricks.

David Guza, PE
Applied Engineering Solutions LLC
Powell, Ohio

Looking for Fabricators to Benchmark

Good day! I watch over our press brake department, and I have been collecting data for the past few weeks on setup and run times, as well as cycles per day and per week.

I am trying to reach out to other high-volume press brake shops that would be willing to compare data. I am interested in seeing how efficient we actually are against other shops. I know the equipment salesmen say that their machines can do X number of bends per hour, but that does not include the human factor or lean process parts ordering.

Would you be able to point me in the direction of any manufacturing shops that could help out? I have reached out to a dozen or more shops that I found from Google results, but none have reached back.

Any help would be much appreciated.

Ari Prawdzik
Southland Trailer Corp.
Lethbridge, Alta., Canada

Editor's Note: The Fabricators & Manufacturers Association connects similarly sized metal fabricating companies looking for benchmarking partners in user groups, each comprising five to six geographically dispersed companies that meet quarterly. For more information on this, visit www.fmamfg.org/get-involved/user-groups.

Could You Recommend a Fabricator?

I found you through your digital magazine. Having not dealt in any manufacturing function, I thought it appropriate to contact you in that you have spent years connected to the metal forming and fabricating industry.

If possible, I would very much appreciate recommendations of manufacturers that we could contact to help us with our new product. Hopefully, we could develop an ongoing relationship for mutual benefit.

Jim Hofmann
Escondido, Calif.

Editor's Note: The Forming & Fabricating Industry Directory and thefabricator.com can provide you an extensive list of shops that should help you with your fabricating needs. Visit www.thefabricator.com/directory/category/287/general-fabrication-work to find a shop that might be able to help.

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FABTECH 2020 canceled; event partners cite ongoing pandemic

FABTECH event partners SME, FMA, AWS, PMA, and CCAI have announced that FABTECH, the largest metal forming, fabricating, welding, and finishing event, scheduled for Nov. 18-20 in Las Vegas, has been canceled because of the ongoing COVID-19 pandemic.

"The metal forming, fabricating, welding, and finishing industries are vital to manufacturing and to the economy, and FABTECH is proud to serve the companies and professionals of these industries," said Ed Youdell, president/CEO of Fabricators & Manufacturers Association Intl. "It's important that FABTECH is executed to a standard worthy of the industry's expectations. While we looked for viable alternatives, unfortunately we simply do not have a path forward in 2020."

"We explored every option to find a way to produce this event in 2020," said Sandra Bouckley, executive director/CEO of SME. "Unfortunately, COVID-19 has created an environment that makes it impossible to hold the event. Our top concern is always the safety of our exhibitors, attendees, speakers, sponsors, and employees, along with supplier partners and venue staff. While we didn't want to have to make this decision, we have found that we have no choice."

FABTECH is the premier event for the metal fabricating industry. Since its debut in 1981, FABTECH has grown from a regional tradeshow into North America's largest and most authoritative event for metal forming, fabricating, welding, and finishing. Event partners were quick to reassure the community that they are evaluating other options to serve the industry.

"FABTECH has long been a key element of AWS's efforts to support and advance the welding community," said Gary Konarska, CEO of the American Welding Society. "We look forward to continuing to work with our FABTECH event partners to identify new and enhanced ways—both online and physical—to connect the FABTECH community, share knowledge about the latest industry products and developments, and help companies move their business forward."

FABTECH will return as a face-to-face event in 2021, with FABTECH Mexico taking place May 4-6 in Monterrey, and FABTECH Chicago taking place Sept. 13-16 at McCormick Place. More than 1,700 exhibiting companies and more than 48,000 attendees are expected to participate in FABTECH Chicago.

EuroBLECH 2020 postponed until March 2021

Mack Brooks Exhibitions has announced the postponement of Euro–BLECH, which was scheduled to take place at the Hanover Exhibition Grounds in Germany Oct. 27-30. The new dates for the next EuroBLECH, 26th International Sheet Metal Working Technology Exhibition, are March 9-12, 2021. This decision was based on conversations with exhibitors and partners who have expressed their preference not to hold the show in October in light of the ongoing COVID-19 crisis and associated travel restrictions.

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On the dates in October originally planned for the tradeshow, the organization will present a Digital Innovation Summit, providing exhibitors with a platform to demonstrate their latest machines and arrange virtual meetings with international visitors.

AME releases white paper on revitalizing the manufacturing economy

To help manufacturers successfully navigate the postpandemic economy, the Association for Manufacturing Excellence (AME), Rolling Meadows, Ill., has published a white paper titled "A Manufacturing Marshall Plan." The paper maps out how companies can prevent postpandemic supply chain disruptions, advance their manufacturing productivity, and reskill workforces.

"A Manufacturing Marshall Plan" advocates for reshoring, nearshoring, and LeanShoring; an increased focus on Industry 4.0 innovations; and enhanced educational and training offerings to create a stronger workforce. These three actions will provide companies and their communities with a distinct competitive advantage while also boosting productivity and improving sustainable resilience in a fast-changing competitive manufacturing world, according to AME.

The white paper recommends that a switch to a more robust domestic supply chain and advanced manufacturing base could reduce the dependence on the increasingly fractured global supply system.

Offshore supply chains cause long-distance transportation, increased communications obstacles, unpredictable delivery times resulting in the loss of manufacturing capacities, and increased environmental pollution. As a result, reshoring and nearshoring—moving supply chain production to domestic or nearly domestic facilities—are gaining acceptance.

In response to current and future demands and to prevent future supply chain disruptions and takeovers from global competitors, companies must consider undergoing a supply chain renaissance, according to the white paper. To do this, they will have to implement new operational strategies and technologies, and the white paper discusses several resources for the establishment of these redeveloped domestic supply chains.

Manufacturers must also increase productivity, efficiency, speed, and quality to maintain competitiveness. By pairing a connected environment of data, people, processes, services, systems, and IoT-enabled industrial assets with the generation and use of actionable data, manufacturers can realize smart industries and ecosystems that foster innovation and collaboration. Unfortunately, Industry 4.0 creates additional demands for millions of new skilled jobs.

As the current workforce undergoes generational changes precipitated by retiring baby boomers, factories are evolving from the preautomation plants of the past to the smart factories of the future. Workers in smart factories, according to the paper, require digital fluency, technological savvy, and data analytics know-how.

The white paper states that the development of a skilled workforce begins with motivating a higher quantity and quality of recruits and that the demise of vocational education at the high school level has bred a skills shortage in manufacturing today. To close the growing skills gap, groups of employers, community colleges, workforce agencies, intermediaries, youth programs, labor organizations, and policy experts are advancing apprenticeship and work-based learning strategies—outlined in the white paper—as workforce development and talent solutions for U.S. businesses.

As the manufacturing industry moves into its "new normal," failure to reshore, nearshore, or LeanShore manufacturing jobs; enhance industrial innovation; and reskill the North American workforce leaves the continent susceptible to future supply chain disruptions and economic uncertainty. The three steps outlined in the white paper provide a start for manufacturers to prevent such supply chain disruptions in the future.

AWS, Arc Junkies launch welding podcast series

The American Welding Society and Arc Junkies podcast have launched the "Weld Wednesday with AWS" series of podcasts to inform the welding community about important innovations and industry trends. New podcasts will be released the first Wednesday of every month.

For the first podcast, which aired Aug. 5, Arc Junkies host Jason Becker spoke with AWS District 5 Director Howard Record to discuss the advantages of AWS section meetings and activities. Additional podcasts will cover such topics as the development of codes and standards and details on welding procedure specifications.

For more information on the podcast, visit aws.org/podcasts.

COVID-19 five times more disruptive to manufacturers than cyberattacks, says report

According to the "Supply Chain Resilience Report 2020" from 3D Hubs, cybersecurity issues have affected less than 10% of firms over the past 10 years, compared to 60% that have suffered directly as a result of COVID-19 disruption.

In 2020 the pandemic has emerged as the most potent threat to economic growth, more than trade sanctions, natural disasters, and cyberattacks combined. More than 96% of global companies are now planning to take measures to boost the resilience of their manufacturing supply chains. However, more than half (52%) admit they are yet to embark on that journey. As businesses develop long-term strategies, more than 59% of companies say geographic diversification of their supply chains is the most effective way of building resilience.

The report includes insights from an industry survey of

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1,281 professionals, its own order database of more than 36,000 customers, and 240 global manufacturing partners.

Around 72% of companies have experienced external disruptions to their manufacturing supply chain over the last 10 years. Pandemics, natural disasters, and trade wars are the most common disruptive events. Despite being a major concern for many companies, less than 10% have experienced disruptions due to cybersecurity issues.

The COVID-19 pandemic has been the single biggest disruptive event of the past decade, causing major volatility on both manufacturing supply and demand. Around 60% of all companies report the coronavirus directly disrupting their manufacturing supply chain.

Pioneer Industries receives Silver Boeing Performance Excellence Award

Pioneer Industries, a sheet metal fabrication and machining shop in Fairview, Ore., has received a 2019 Silver Boeing Performance Excellence Award. The Boeing Co. issues the award annually to recognize suppliers that have achieved superior performance.

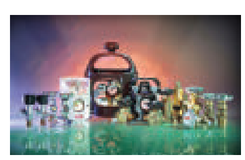
Pioneer Industries maintained a Silver composite performance rating for each month of the 12-month performance period, from Oct. 18, 2018, to September 2019. This year Boeing recognized 357 suppliers that achieved either a Gold or Silver rating.

Cincinnati partners with Multiax America for 3D printing turnkey

Machine tool manufacturer Cincinnati Inc. (CI) has partnered with Multiax America, a custom designer of CNC machining centers. Multiax America now offers CI's Big Area Additive Manufacturing (BAAM) machine, and CI in turn now offers the Multiax line of 5-axis routers.

BAAM machines are used to produce tooling and molds for the aerospace, marine, and automotive industries, and those applications require CNC machining after 3D printing to get the part to its final dimension and smooth the surface. A Multiax P series moving bridge machine is displayed alongside the BAAM machine at the CI showroom near Cincinnati to show visitors how this additive turnkey concept works.

ESAB introduces GCE specialty gas and valves in North America, opens Texas Configuration Center



Since acquiring Gas Control Equipment (GCE) in October 2018, ESAB Welding & Cutting Products, Annapolis Junction, Md., has focused on aligning its global product offerings into four areas: cutting and welding, health care, specialty gas equipment, and cylinder valves.

Furthering the global integration, the company has announced that North American distributors and end users now have full access to the GCE Druva specialty gas equipment and GCE Valves product lines.

To support the move, the manufacturer has completed a dedicated Configuration Center located at its Denton, Texas, facility. Serving both the GCE and Victor brands, the center is isolated from the manufacturing areas for Victor industrial products, which are also part of the ESAB portfolio.

"The Configuration Center provides build-to-order services for specialty gas equipment products in a specially designed clean-room environment," said Curt Rocha, global product and business director gas equipment, ESAB. "We have also added GCE-dedicated engineering, applications, assembly, and sales support teams to ensure 'best-in-class' equipment solutions and quick turnaround."

Manufacturers and distributors neglect key cybersecurity activities, report finds

Less than 40% of respondents in Sikich's "2020 Manufacturing and Distribution Report" said they perform important data breach prevention activities, such as penetration testing, phishing exercises on employees, and assessments of vendors' data security efforts. However, manufacturers and distributors remain vulnerable to breaches. Nearly half of respondents said their companies experienced cyberattacks during the past 12 months.

"The coronavirus pandemic, which sent many office workers to insecure remote environments, has only elevated the risk these companies face," said Brad Lutgen, partner-in-charge of Sikich's cybersecurity team. "Manufacturers and distributors must commit to a comprehensive cybersecurity strategy that includes everything from technical updates to employee training."

The report also reveals extensive use of some advanced technologies, but stubbornly slow adoption of others. Eighty-six percent of respondents said their companies use cloud storage and solutions, and more than 60% use forecasting software, data-driven customer service technologies, advanced analytical tools, data visualization, and the internet of things. But only about half of the executives surveyed said their companies use robotics, robotic process automation, and additive manufacturing.

While 65% of respondents said they believe the U.S.-Mexico-Canada Agreement will benefit their businesses and 60% said the same about the U.S.-China Economic and Trade Agreement, trade uncertainty persists. Companies reported exploring operational changes in response to this uncertainty. Notably, 56% of respondents said they plan to build more products and components in the U.S., up from 45% in the 2019 report.

"Though the coronavirus pandemic and resulting economic turmoil pushed trade tensions out of the headlines since we conducted our survey, we believe these findings reflect the current reality," said Jerry Murphy, partner-in-

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charge of Sikich's manufacturing and distribution team. "In fact, during this time of even greater disruption and uncertainty, it makes sense that manufacturers would be eyeing a return to domestic production in an effort to minimize risks."

More than 40% of respondents said they are responding to trade developments by sourcing purchased materials from new countries.

The report also found that 74% of executives said they have a succession plan, up from 60% in 2019. However, the report reveals many companies are not actively laying the groundwork for succession. For instance, 37% of respondents said it has been three or more years since they had their businesses valued. Further, 54% of respondents identified talent retention as the greatest hurdle they face related to succession.

"Having a written succession plan is a great start, but it by no means guarantees success when it's time to hand over the business to new leaders or owners," said Ray Lampner, co-leader of Sikich's business succession planning team. "An owner needs to have an up-to-date understanding of the value of the business and also actively build a bench of potential successors."

For the "2020 Manufacturing and Distribution Report," Sikich surveyed nearly 300 executives from manufacturing and distribution companies across sectors including industrial equipment, wholesale and distribution, metal fabrication, food and beverage, apparel, footwear and textiles, and transportation.

The full report at www.sikich.com/md-report-2020/ also includes findings about companies' workplace violence prevention efforts and environmental initiatives.

Power Pool Plus expands in South Carolina

New Jersey-based industrial generator manufacturer Power Pool Plus has announced plans to open a facility in Greenwood, S.C. In addition to producing industrial power-generation equipment, the plant will offer contract steel fabrication and commercial and critical-care generator services.

The $1.5 million project is expected to create 21 jobs. Plant operations are scheduled to begin in Q4 2020.

Nikola Corp. constructing EV factory in Arizona

Phoenix-based Nikola Corp., a hybrid-electric trucking startup, has begun construction of its first U.S. factory in Coolidge, Ariz. Phase 1 of the $600 million project is scheduled for completion in late 2021, with a second phase to follow over the next 12 to 18 months.

The company expects the 1 million-sq.-ft. facility at full production will support 6,000 workers across two shifts producing 35,000 trucks per year.

Kapco named as one of Wisconsin's Top Workplaces for 2020

Kapco Metal Stamping, Grafton, Wis., has been named one of southeast Wisconsin's Top Workplaces for 2020 by the *Milwaukee Journal Sentinel*.

The program, now in its 11th year, recognizes businesses that provide employees with the flexibility, training, and support needed to succeed based on an employee survey that measures 15 cultural components.

Since Kapco started as a husband-and-wife team in 1972, the organization has grown to nearly 500 employees. A few contributors to the 2020 Top Workplaces honor included Kapco University, an in-house skills and training program, and the company's "Beyond the Paycheck" benefits, which include perks such as a free gym membership and an on-site wellness center.

The company also is committed to giving back to the community. It sponsors an annual Grand Slam Charity Jam event to benefit Camp Hometown Heroes, a summer camp for children who have lost a loved one in the military. In conjunction with WTMJ radio, it also launched Kids2Kids Christmas in 2006 to educate kids on the spirit of giving around the holidays.

Survey says underused apprenticeship programs prove their worth amid COVID-19 skill shortages

Thomas has released the results of a survey canvassing 746 North American manufacturing and industrial suppliers to identify the major trends stemming from the global pandemic as the industrial sector pivots its supply chains and tactics to prepare for the new industrial landscape.

A key survey finding shows the value of apprenticeship programs in combating the skills gap: 26% of companies surveyed have adopted such programs, and those that have were overall less impacted by the lack of available skilled labor.

The survey also indicates that while 91% of manufacturers are confident the industry will recover, many predict it will take months to several years to earn back the lost revenue.

"Manufacturing and industrial companies continue to demonstrate remarkable innovation and resilience to overcome the challenges brought on by COVID-19. Our latest survey shows interest in reshoring acceleration," said Thomas President/CEO Tony Uphoff. "As companies work to adapt and implement the most impactful practices to support the industrial economy, the survey also shows expanding interest in automation, pivoting supply chains, and addressing the labor shortage."

More than half of the respondents indicated that they meet or exceed industry standards on automation processes. The top three automation technologies that manufacturers are most interested to invest in over the next 12 months are production performance (55%), product testing and quality assurance (48%), and process control (46%).

Nearly 70% of respondents report that they are extremely likely to bring production/sourcing back to North America in the future. Additionally, the top products North American manufacturers are looking to source domestically include metals (15%), machining tools and parts (13%), fabricated materials (13%), and personal protective equipment (12%).

More than one in three companies report they are actively hiring. Additionally, while 52% of companies have con-

(continued on page 18)

(continued from page 17)

tinued their apprenticeship programs during the pandemic, 40% report they have paused their programs in place and only 3% have ended them. Additional sentiment from the survey includes that reshoring will ultimately lead to an increase in high-paying jobs, growing demand for skilled jobs, and the need for an exponential number of support jobs.

To receive a copy of the report, visit business.thomasnet.com/covid-19-survey-reports.

Metalworx moves to Virginia

South Carolina-based Metalworx has announced plans to move its headquarters and production operations to an existing facility in Independence, Va. The $7.6 million project is expected to create nearly 60 jobs.

The company produces low- to high-volume components for industries including aerospace, defense, medical, steel, power generation, transportation, and wind energy.

Report shows severe COVID-19 disruption in global manufacturing and supply chains

The global manufacturing and supply chain ecosystems have been among the sectors hardest hit by the COVID-19 pandemic. San Francisco-based Fictiv's newly released "2020 State of Manufacturing Report" reveals industry leaders grappling with fallout from the pandemic while eyeing new opportunities created by the disruption.

The fifth annual manufacturing industry report polled hundreds of senior manufacturing and supply chain decision-makers at companies producing medical device, robotics, automotive, aerospace, and consumer electronics products.

Nearly 90% report a direct business impact because of COVID-19, including lower sales, increased costs of materials and production, and canceled or delayed product launches. While supply chain resilience is important to 99% of respondents, only 17% gave top marks to their supply chain's performance over the last year. Most are revisiting their reliance on China and looking to the U.S. as the next key manufacturing center.

Nearly all respondents (97%) said COVID-19 has created new opportunities, with 96% working to increase supply chain agility and 87% making digital transformation a high priority. Reducing cost (46%), increasing supply chain visibility (42%), and driving efficiencies (40%) are some of the top goals for these digital efforts.

"COVID-19 is a clear point of demarcation in the industry, accelerating the transition from traditional supply chains and manufacturing to a digitally enabled future," said Fictiv CEO Dave Evans. "This deep dive reveals an opportunity for those industries most profoundly impacted by the physical realities of the virus to iterate faster with finer tolerances and higher quality using digital manufacturing advances."

The report shows COVID-19 has negatively harmed most businesses (89%), with decreased sales, increased cost of materials and components, and lengthened production times. More than one-third of respondents have had to lay off good employees, and 24% have been unable to fill customer orders.

Most (83%) agree COVID-19 has been an extreme test of their supply chain, and 84% say they will be more cautious about offshoring now than in the past.

"While many businesses will examine reshoring as part of their future supply chain, China continues to offer important advantages in infrastructure and manufacturing talent, making it a stable part of any supply chain ecosystem," said Fictiv COO Jean Olivieri. "The opportunity for supply chain executives will be to introduce digital and AI capabilities through partners and investment that can build an agile, resilient supply chain able to flex across geographies and demand in real time and with complete transparency."

For a full copy of the report, visit www.fictiv.com/resources/2020-state-of-manufacturing-report.

Cadence marks 35 years in business

Cadence Inc. is celebrating its 35th anniversary as a contract manufacturer of products, technologies, and services to medical device, diagnostics, aerospace, and commercial companies worldwide.

Founded as Specialty Blades in July 1985 by engineer Martin Lightsey, the company developed a proprietary CNC sharpening process that featured multiple-step grinding and honing sequences to produce custom-made blades. The company continues to supply blades and needles and has expanded its services to include machining, tube fabrication, laser processing, metal stamping, and finished device manufacturing and assembly.

The company now employs about 500 people with headquarters in Staunton, Va., as well as locations in Connecticut, Pennsylvania, Rhode Island, and Wisconsin.

Bug-O introduces Live Support Program

Bug-O Systems, a provider of cutting and welding products in Canonsburg, Pa., has launched a Live Support Program, accessed at bugo.com/weld-training. This communication system has three areas of focus: distributor/dealer product support, Send and Show application solutions, and Field Fix user assistance.

The company also offers customized webinars to set up systems, answer questions, and troubleshoot problems. Customers are invited to send samples to Bug-O of work they are trying to do. Company representatives then will analyze the process, test options, and arrange a webinar with the customer to present a solution, as well as provide documentation of the expected productivity and results.

Pegasus Steel (USA) adds fiber laser system

Pegasus Steel (USA), a manufacturer of large, complex steel fabrications, has acquired a TRUMPF TruLaser 3060 8-kW fiber machine for the company's facility located in Goose Creek, S.C.

The machine offers a 20- by 8-ft. format, multisheet processing, and a BrightLine fiber for high edge quality and simplified part removal, the company reports.

NBT Foundation awards $55,500 in manufacturing scholarships

Thirty-seven students pursuing manufacturing careers received scholarships toward their postsecondary studies from Nuts, Bolts & Thingamajigs (NBT), the foundation of the Fabricators & Manufacturers Association Intl., Elgin, Ill. The following students received a $1,500 scholarship for the fall 2020 semester:

- Cameron Amspaugh, Glenford, Ohio, pipe welding at Hobart Institute of Welding Technology
- Elizabeth Anderson, Minneapolis, machine tool technology at Dunwoody Technical College
- Trevonne Beacham, Hazel Park, Mich., robotics and automated systems at Oakland Community College, Auburn Hills
- Scott Beebe, Ocean Springs, Miss., mechanical engineering at Mississippi Gulf Coast Community College
- Dylan Berguson, Jersey Shore, Pa., welding and fabrication engineering technology at Pennsylvania College of Technology
- Alyssa Biedenbender, West Bend, Wis., CNC/tool and die technologies at Moraine Park Technical College
- Christian Birks, Manilla, Iowa, advanced manufacturing at Des Moines Area Community College
- Jeremy Carlson, Russell, Pa., welding and fabrication engineering technology at Pennsylvania College of Technology
- Adam Colter, St. Charles, Mo., precision machining technology at State Technical College of Missouri
- Adam Dapore, Russia, Ohio, structural welding at Hobart Institute of Welding Technology
- Vanessa Guzman, Melrose Park, Ill., engineering technology/mechanical design at Triton College
- Francis Havlovic, Waverly, Neb., mechanical engineering at University of Nebraska-Lincoln
- John Johnson, Hampstead, N.C., industrial engineering technology at East Carolina University
- Jessica Kennedy, Arden Hills, Minn., electrical engineering at Colorado School of Mines
- Max Kolesnikov, Orland Park, Ill., electronic/computer controls technician at Moraine Valley Community College
- Jesse Larson, Yakima, Wash., instrumentation and industrial automation at Perry Technical Institute
- Sydney Lund, Aurora, Ill., engineering science at Waubonsee Community College
- Nathaniel Martens, Ferndale, Wash., mechanical engineering at Whatcom Community College
- Chethan Meda, Corning, N.Y., automated manufacturing technology at Pennsylvania College of Technology
- Jeffery Myhre, Cosmopolis, Wash., welding at Grays Harbor College
- Anthony Negethon, Yakima, Wash., instrumentation and industrial automation at Perry Technical Institute
- Domanick Nosker, Fayetteville, N.C., welding and fabrication at Ohio Technical College
- Wyatt Paxton, Stuart, Neb., machining and manufacturing automation at Northeast Community College
- Michael Petrenko, Palatine, Ill., precision machining at Harper College
- Chad Phillips, Dallas, Pa., welding and fabrication engineering technology at Pennsylvania College of Technology

• Nicole Pomeroy, Michigan City, Ind., mechanical engineering at Valparaiso University

• John Provenza Jr., Marysville, Pa., automated manufacturing technology at Pennsylvania College of Technology

• Ethan Rhodes-O'Brien, Dillsburg, Pa., manufacturing engineering technology at Pennsylvania College of Technology

• Alex Rojas, Yakima, Wash., electrical technology at Perry Technical Institute

• Benjamin Shook, Anton, Colo., welding technology at Northeastern Junior College

• Devon Storm, Patton, Pa., CADD with additive manufacturing and 3D printing technology at Triangle Tech, DuBois

• Matthew Swartz, West Hartford, Conn., engineering design technology and manufacturing engineering technology at Pennsylvania College of Technology

• Jason Theodore, Williamsport, Pa., welding and fabrication engineering technology at Pennsylvania College of Technology

• Abigail VanDuyne, Orion, Ill., mechanical engineering at Iowa State University

• Hunter Weber, Kendallville, Ind., industrial technology at Ivy Tech Community College

• Mason Whitaker, Cheboygan, Mich., welding at Hobart Institute of Welding Technology

• Lilly Zimmerman, DuBois, Pa., CADD with additive manufacturing and 3D printing technology at Triangle Tech, DuBois

"We are pleased to award scholarships to these deserving students and are happy to assist them in reaching their academic goals," said Edward Youdell, president of NBT. "They recognize that skilled manufacturing careers can be rewarding financially and fulfilling personally. The knowledge and skills they obtain will help them be more competitive in the current job market.

"The most difficult jobs to fill today are those in the skilled trades and engineering," added Youdell. "With majors in machine tool technology, structural and pipe welding, mechanical engineering, welding and metal fabrication, and precision machining technology, these students will be prepared for the skilled labor openings that American manufacturers must fill."

Eligible applicants are required to be full-time students meeting a specified minimum GPA and enrolled in a manufacturing-related course of study, engineering curriculum, or a trade or technical program leading to a career in manufacturing.

In addition to the scholarship, each winner will receive a complimentary one-year FMA student membership (valued at $25), and from NBT's industry partner SolidWorks Corporation, a 365-day license to its Student Design Kit CAD software package.

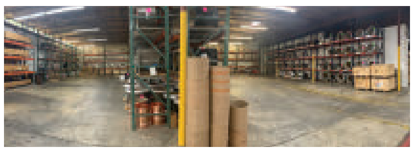
Scholarships are awarded for the fall and spring semesters. The application is open from July 1-Sept. 30 for spring awards and Jan. 1-March 31 for fall awards. For more information, visit www.nbtfoundation.org/scholarships.

East Coast distributors announce partnership with C.R. Onsrud

Machine tool distributors Mid-Atlantic Machinery (Harrisburg, Pa.), Southern States Machinery (Mooresville, N.C.), and Northeast Machinery Sales (Agawam, Mass.) have announced their partnership with C.R. Onsrud.

Based in Troutman, N.C., C.R. Onsrud manufactures routers and CNC machinery.

Sheet Metal Supply moving to new fabricating facility



Sheet Metal Supply, a fabricator and supplier of formed perimeter edge materials and processed coil and flat stock, has moved its operation into a new, 80,000-sq.-ft. facility in Grayslake, Ill. Its previous location in Mundelein, Ill., was 30,000 sq. ft.

The new plant includes a second aluminum composite material routing table and a 21-ft. bidirectional folder for forming long parts or multiple 10-ft. parts.

No better time than now to search for production efficiency

New book asks fabricators and manufacturers if they are looking at their operations in the right way

An economic slowdown may result in a loss of revenue for a metal fabricator, but it doesn't totally have to be a time of lost value. Reduced demand for a company's services gives that company time to focus on other things that it might not have had time to do when everyone was consumed with just getting parts out the door.

Andrea Dallan, CEO of Dallan SpA, an Italian manufacturer of coil-fed roll forming and punch/laser cutting systems, is happy to offer these manufacturers and fabricators something to think about with his new book, *The Revolution of Efficiency*. It's filled with the observations and wisdom of someone that has spent a lifetime helping customers boost production and quality, while reducing costs, in very challenging thin sheet metal manufacturing applications. Luckily, he had a good teacher, learning about making things from Ingegnere Sergio Dallan, his father and founder of the company.

Dallan frames the conversation around the need for metal manufacturers to focus on four factors when it comes to figuring out what the next important capital equipment purchase should be: efficiency, productivity, flexibility, and automation. By providing a discussion on formulas that can help with the decision-making, Dallan recognizes that facts and figures are the best way to reach a capital equipment decision that will make the most positive impact on an organization.

To learn more about Dallan's experiences that helped to shape the book and why he decided to release it now, *The FABRICATOR* interviewed the author in late July.

The FABRICATOR: *What was it like for you to learn from your father, an engineer and the founder of Dallan SpA, about the industry and about running a manufacturing technology company?*

Andrea Dallan: We were both trained to be engineers, but we are from two totally different generations. My father was an innovator in his industry because as computing power came along he started to develop programs to calculate the different ways to roll form sheet metal. When I entered the industry, there were other tools available such as finite element analysis. We were seeing roll forming and production from two different points of view.

And as all company founders, he was very much involved in the technical development and as a designer first and then as a developer of the business. Whereas I have grown inside the company, holding different positions from assembly to going to exhibitions to working in the technical office. So I have seen a little bit of everything.

Actually, the first eight years with the company, I was working in a different segment than my father. He was focused mostly on the roll forming, whereas I was developing the coil-fed punching and laser system. Of course, we didn't have the laser until 2014, so before then it was mostly punching. My father insisted that it was important to develop two independent points of view.

That turned out to be a big asset for the company. If you are growing a new brand or a new type of technology, you get to learn a lot more about how to run a company rather than joining a company that's already known.

We do have different views, and I think that enriches the company as a whole. So right now he's 75 and he comes to the company every day to check on everything. That's to be expected, of course, because the company is like his third child.

FAB: *Why did you decide to write this book?*

Dallan: I've always had the idea to collect some of the technical articles that I have written over the years on different subjects, such as efficiency, cost calculation, and machine technology, and pull them together in some form. I started to do that and pulling it together was quite hard.

At the same time, my children are growing older, and they have started to ask about the company and how it was founded. So I started to write things down. Then I thought that it might make sense to present this as more of a story rather than just a sequence of events.

I started it in November 2019. By mid-January, I was almost ready with the Italian version. During the lockdown, however, I had the ability to reorganize all of the ideas around the concept of efficiency, instead of building the book around the company history. I also had time to include stories from customers, which is not something we normally can do because they typically don't want us to share their names. But when I spoke to these customers, they all were very happy to share with us.

I think this worked out well because the customer stories give concrete examples of how technology has helped to solve real production problems.

FAB: ***In the book you describe how efficiency, productivity, flexibility, and automation play important roles in any discussion of upgrading manufacturing technology. Why do you call efficiency "the essence of them all"?***

Dallan: Being more efficient means to produce more results using less resources. The resources can be time, labor, raw materials, and energy, for example. So if we have the same amount of productivity using less energy, we have increased our margins. We have increased our efficiency. The same applies if we are talking about time, skilled labor, and raw materials.

Automation is one way that we can get to more efficiency. Flexibility can do that as well, but it is more connected to lean production.

So these four elements—efficiency, productivity, flexibility, and automation—are the main areas that our customers contact us about. No matter what we help them with, we are helping to improve their efficiency, which also improves their margins. That's why I wanted to include the references to manufacturing customers in Europe, North America, and South America. They are all different, but they all find new efficiencies in their operations.

FAB: ***Obviously, Dallan SpA is known for manufacturing coil-fed roll forming and punch/laser cutting systems that can process thin sheet metal. How would you characterize the awareness of this type of metal processing technology in Europe and North America?***

Dallan: Yes, there are different levels of awareness. We have to point out that roll forming technology was first developed in the U.S., but since then other companies have developed their own expertise. At Dallan, we have specialized on building systems that work with thin material.

The philosophy in production is a little different between the U.S. and Europe from what I have seen so far. In the U.S., companies want to focus on standardized production and on the larger production batches. There is also less awareness of how much automation can be introduced into processes, such as automatic packaging systems that are included on a line that produces metal blind profiles.

Also, the concept of coil-fed CNC laser cutting is not very well-known in the U.S. But there are some companies in the U.S. that have many of our machines, such as Sukup Manufacturing in Iowa that has at least six coil-fed lines. Every time one company starts to discover the advantages, then all of a sudden there is a lot of opportunity for them to be ahead of the competition.

FAB: ***Dallan SpA has incorporated elements of automation into lines that punch, cut, and form metal blinds and then assemble and package them for delivery to customers. Can automation be added to these systems for almost any manufacturing application?***

Dallan: We can't do it for all applications, but for many, we can do that. We have to take into account the type of product and the type of packaging. How do customers want to receive the material? Do they want profiles bundled?

For sure there are products where automation can provide real value by eliminating labor so that the finished element is ready for delivery. Companies need to realize that there are companies that can do this for them.

And this type of automation doesn't require highly skilled people to run the lines or create the programs. The search for skilled workers is only going to become more difficult. Automation can help with this, and it should always be discussed at the beginning of a new project.

FAB: ***The formulas that you include in the book to help determine true production costs and potential savings as part of the discussion to replace older manufacturing technology can be useful for many companies. Do you think manufacturers and metal fabricators fully use tools like this to help them get a true picture of their operations?***

Dallan: I don't think all companies use tools like this. They may not be trained to think about the investments in this way or to compare production processes. So whenever I receive a request for information on our coil-fed lines, I always ask some questions about production quantities, size of production batches, and how production is being done now. This provides information for me to decide what advantages we can provide.

For instance, production levels can be very low, or the current production system may fit their application at that moment. We can tell them that they need to reach a certain level of production before they can justify investment in our equipment or further automation.

So these formulas help me too. If we only look at production the way it's being done at the moment and we decide we need more of the same product, we just increase what's being done. If we can see it from a different point of view, looking at raw material usage, energy consumption, and labor costs in comparing different production processes, we can come back with information to change the game.

If I can use formulas such as this to determine the impact of new manufacturing technology, I can present my ideas in a much more powerful way. In fact, many of these calculations came from our own customers who taught me how they used them. So these formulas come from years of experience with manufacturers and a lot of discussions on improving operations.

For more information on the book, visit www.dallan.com/en/news/the-revolution-of-efficiency-book.

—Dan Davis, Editor-in-Chief

Laser welding technology for dissimilar metals helps reduce EV battery energy loss

SITUATION

The number of electric vehicles (EVs) in global circulation increased sixfold between 2013 and 2017, according to the International Energy Agency. In the U.S. alone, about 760,000 EVs traverse roads and highways. One force behind steadily increasing EV sales is the improved performance of the batteries used in these vehicles. Primarily lithium ion, these batteries must hold sufficient energy to propel vehicles at high speeds for hours on end.

Designing lighter, smaller, safer, and more efficient batteries is proving to be instrumental in continuing global EV sales trends. Advancements in welding technologies increase efficiency for automotive powertrains by improving energy storage, cutting size, and preserving reliability.

Whether using an EV for a daily commute or only sporadically, drivers expect that the battery will hold a charge and not lose too much energy in use. So manufacturers aim to design batteries that charge quickly and have a greater range between charges.

A primary cause of battery energy loss is resistance. The connection of a tab to a terminal implies a certain amount of loss, although this can be mitigated by using more conductive materials. With the standard stainless steel terminals of lithium-ion batteries, for example, this presents an engineering opportunity: To reduce resistance, weld the stainless steel to a dissimilar and less resistant metal.

Unfortunately, welding two different metals together creates challenges. They have different melting temperatures, different expansion coefficients, and sometimes incompatible chemistry. For example, aluminum melts at 660 degrees C—a full 840 degrees C lower than stainless steels' 1,500-degrees-C melting point. And although resistance welding has been a cornerstone technology for welding battery packs—it is used to join nickel tab material to steel battery cans—it has been less successful for welding some other metals.

"Resistance welding does not work well with aluminum or copper because they are more conductive, so the weld head cannot create the requisite energy buildup," explained Mark Boyle, product manager at Amada Weld Tech.

Thus, alternative technologies like laser welding need to be considered for joining conductive metals. But even with laser technology, bonding dissimilar metals is not straightforward because of the vast variance in materials' melting points, and the metallurgy of these different materials form brittle intermetallic bonds when fusion welded together.

RESOLUTION

New laser sources provide the opportunity for such dissimilar-metal joining, including CW and pulsed fiber lasers. A 500-W, single-mode, CW fiber laser microwelder from Amada Weld Tech, for example, concentrates the energy into a small spot to improve energy coupling into the material and resultant penetration. There is little change in penetration, even with increasing scan speeds, resulting in faster processing and minimized heat input.

A closer look at the process shows that it is not like traditional fusion welding at all, as there is no large mixture of the two parts. For example, a resulting weld between aluminum and cold-rolled steel has no cracks and minor porosity, a result unachievable with classic welding techniques because the intermetallic mix of aluminum and steel is naturally brittle.

In one case study with this new technique, mechanical testing found peel strength to be good; after thermal soak and shock, 50 samples of the weld peeled within ±2 N. This narrow band of peel shows the technique has the reproducibility and reliability needed for production welding.

Amada Weld Tech also has used a 70-W pulsed fiber laser to join thin dissimilar metals. These require more welds to create the same contact area in a weld zone and ensure appropriate weld strength at the material interface. (The pulsed laser delivers limited power and small spot size.) So the system is programmed to deliver a spiral weld pattern, which groups small spot welds in close proximity in a geometry that creates good weld strength.

"The [resulting] weld profile closely resembles [the] multistaking process," reported Boyle, "and does not show the characteristic form of conventional pulsed spot welds." A cross section of the weld shows that the intermetallic zone is less than 10 microns in size. Even though the individual welds are small, the technique produces single-layer shear strengths of around 44 N and double-layer shear strengths of about 88 N. In addition to aluminum to steel, potential weld combinations include copper to steel, titanium to steel, copper to titanium, and copper to aluminum.

Historically, parts have been mounted on an XY stage and moved relative to a fixed laser beam. But in the past five to 10 years, Amada Weld Tech has developed galvo scanning beam delivery to guide the laser beam over the part. In a 2D galvo scan head, two mirrors are adjusted to steer the laser beam in an XY plane. Since this system moves small, lightweight mirrors rather than the entire part, process speeds can reach up to 3 m/sec.

The challenge with this delivery system is properly tooling the parts so that each location of the weld is in intimate contact. As a secondary tooling concern, the laser beam must have access to the weld zone.

One solution to these challenges is simple—machine tapered holes to minimize openings but maximize laser access—but illustrates the type of tooling consideration required to integrate laser welding into a production process.

Although challenges remain in laser welding of EV batteries—such as the lack of laser weld monitoring—this developing technology has the potential to drive EV efficiencies in the short and long terms.

Amada Weld Tech
amadaweldtech.com

CMM with laser scanner helps aviation company retrofit aircraft

SITUATION

Located in Sugar Grove, Ill., Chicago Jet Group was formed in 2003 to serve the corporate aviation industry. The company provides aircraft acquisition, aircraft management, charter services, prepurchase evaluation, aircraft avionics, aircraft consulting, and aircraft maintenance.

Chicago Jet Group was retrofitting older Dassault Falcons avionics and needed a CAD model of the panel to see how it would fit.

The laser scanner's horizontally oriented laser scan line and fully automatic exposure settings help simplify general-purpose scanning, regardless of the application.

RESOLUTION

Joe van der Sanden, application engineer from Exact Metrology, scanned the panel with an 85 series Hexagon Romer Absolute Arm coordinate measuring machine integrated with an RS5 laser scanner. The machine offers tactile probing and high-speed laser scanning of surfaces and features on a variety of materials and finishes.

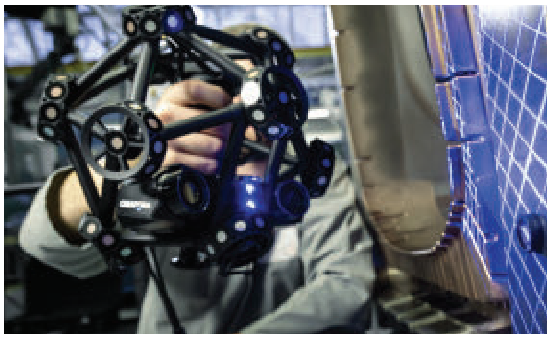
The laser scanner's horizontally oriented laser scan line and fully automatic exposure settings help simplify general-purpose scanning, regardless of the application. In addition, with midrange width at 115 mm, the laser scanner helps simplify digitizing of large surfaces. It can be removed from the arm for touch probing of hard-to-reach areas and remounted without calibration.

Through the on-wrist OLED display screen of the measuring arm, the laser scanner allows for measurement feedback and settings adjustment at the point of measurement.

After the panel was scanned, dimensions were obtained in Polyworks Inspector software, which covers the product development cycle from part and tool design and prototyping to final inspection of assembled parts. Reverse engineering was performed using Geomagic Design X, which combines history-based CAD with 3D scan data processing to enable the creation of feature-based, editable solid models compatible with existing CAD software. This software allows users to reuse existing designs without having to update old drawings manually or remeasure and rebuild a model in CAD.

Exact Metrology Inc.
www.exactmetrology.com

Optical CMM scanner needs no warm-up time



Creaform has released the MetraSCAN BLACK CMM scanner for performing metrology-grade 3D measurements and inspections on the production floor. The portable optical CMM scanner can be integrated in any quality control, quality assurance, inspection, MRO, or reverse engineering work flow and operated by users of any skill level in any type of environment, the company states.

The system, which requires no warm-up time, measures complex parts and assemblies from an array of industries and manufacturing processes, such as automobile, aeronautics, power generation, heavy industry, and sheet metal. It features 15 blue laser crosses for a large scanning area that takes up to 1.8 million measurements per second. Measurement resolution is 0.0009 in.

Creaform
www.creaform3d.com

Weld fume extraction equipment designed for automated, manual applications

Abicor Binzel has introduced turnkey systems for welding fume extraction in automated and manual applications.

The xFUME Advanced is a portable fume extraction vacuum system that supports up to two manual welding stations. Its two filters capture 99.5% of all dust greater than 0.1 µm and have an automatic cleaning function. Features include automatic start/stop and adjustable vacuum settings. It can be paired with the company's xFUME fume extraction GMAW torch for optimal fume capture efficiency and increased welder comfort, says the company.

For manual welding operations that require a high volume of fume extraction welding stations, the company offers the IndustriFume, which features a 28-HP motor and supports up to six manual welding stations per unit. It features automatic filter cleaning and automatic start/stop.

If capturing welding fumes at the arc is not an option, the xFUME Flex portable fume extraction arm can prevent fumes from spreading outside of the welding station, without obstructing the welder's view of the workpiece. It offers a reach up to 13 ft., locking caster wheels, and hood-integrated LED.

For capturing fumes at the source in robotic applications, the company has developed the xFUME Robo. Using a fume collector body that fits onto the company's robotic torches, this unit can capture more than 95% of weld fumes. It integrates into current operations without interfering with robot flexibility or access, the manufacturer reports.

Abicor Binzel
www.binzel-abicor.com

Laser multiwire technology joins thick materials, wide gaps

Strahlkraft Lasertechnik (SKLT) has introduced a new technology for laser joining that can handle thick steel and aluminum sheets. The process allows laser use on plate thicknesses up to 10 mm as an alternative to the electric arc process.

Laser multiwire technology is based on a laser processing head from Scansonic. At the process point, several filler wires converge and are simultaneously melted by an oscillating laser beam. This creates seams up to 10 mm wide in a single operation, depending on the number of filler wires used and the process parameters.

An autofocus keeps the spot size constant even when component position shifts, keeping the process smooth under erratic joining conditions. The process is efficient in applying individual homogenous layers during surface finishing. All materials available in wire form can be used in such processes.

This technology can create fillet welds at T-joints or lap joints with steel or aluminum materials that require large adhesion widths or seam volumes for manufacturing ships, construction machines, railway vehicles, machine frames, and containers.

SKLT GmbH
www.sklt.de

Automation systems designed for use with laser cutting machines

LVD Strippit has introduced new models in its MOVit line of automation systems for Phoenix and Electra laser cutting machines.

MOVit TAS (Tower Automation System) is a single- or double-tower storage system that can be integrated with up to two laser cutting machines, offering 16 configurations. MOVit WAS (Warehouse Automation System) offers a custom number of towers (minimum three) in single- or double-row configurations. Multiple laser cutting machines can be connected to the system using integrated load/unload devices.

Both systems offer the option for unloading directly on the machines. Cut sheets are unloaded on a third table, where parts can be sorted and made available for additional processing.

LVD Strippit
www.lvdgroup.com

Automated robotic deburring machine rotates media instead of parts

Bel Air has developed the AutoHone reverse drag finisher, which operates by dipping parts into the flowing media held within a rotating bin for deburring, polishing, cleaning, and drying.

The robot arm enables 5D motions, so parts can be inserted into finishing media at unique angles for specific finishing specifications. Following the finishing process, the robotic arm cleans the part within the optional ultrasonic cleaning station and can dry the part in the optional drying station before placing the part back into the tray.

Bel Air Finishing Supply
www.belairfinishing.com

Cooling method replaces metalworking fluids with ionized, cooled air

Oy ECE EcoCooling Eng. Ltd. has developed the EcoCooling method for cooling and lubricating workpieces and cutting tools in the machine tool industry. This clean method uses only ionized and cooled air, eliminating the need for oil-based fluids.

According to the company, this technology can be used even with hard metals such as chrome, titanium, and tungsten carbide. The ionized air penetrates the cutting zone and forms a dry lubricant that decreases cutting friction and generated heat while speeding up oxide layer formation.

Since the metal chips are not contaminated by any fluids, they can be fully recycled without cleaning,

Oy ECE EcoCooling Eng. Ltd.
www.ecocooling.fi

How to laser weld thick plate in one pass

No edge prep required

This weld in 0.787-in.-thick carbon steel, shown in the as-welded condition, was made in a single pass with a 50-kW direct-diode laser coupled with a hot-wire feed. The system has performed single-pass welding of as-cut butt-joint configurations (no weld prep) in material up to 1 in. thick. ***Photo courtesy of ADDere.***

By Tim Heston

Want to weld 1-in.-thick steel in an as-cut (no weld prep) butt configuration at 60 inches per minute in a single pass? Now you can, and as with so many processes in metal fabrication, the laser is making it possible.

That's according to engineers at ADDere, the additive manufacturing division at Midwest Engineered Systems (MWES) in Waukesha, Wis., who have developed a hot-wire laser welding system that could have significant impact in the arena of thick-plate welding. The system incorporates a Laserline 50-kW direct-diode laser and processing head; argon shielding; a Miller power source for heating the wire that's fed behind the weld pool; and closed-loop process monitoring. The system can be integrated with a gantry-mounted robot or other kinds of automation.

Earlier this year MWES welding engineers traveled to Laserline's lab in Germany to test a 60-kW direct-diode laser that couples several beam wavelengths ranging from 940 to 1,060 nanometers. The beam travels through a 2-mm delivery fiber, through a 90-degree processing head and 300-mm collimating optics, creating a 4-mm focus spot.

Engineers established a focal length of 600 mm between the focus point (just below the material surface) and the focusing optic in the processing head. The long focal length protects the optics from potential spatter and other impurities arising from the extremely large weld pool a 60-kW laser can create.

The impetus for these tests came from an MWES customer that was looking for an efficient way to weld 1-in.-thick carbon steel with high sulfur content. The application had little tolerance for hydrogen sulfide porosity or, for that matter, most other weld discontinuities.

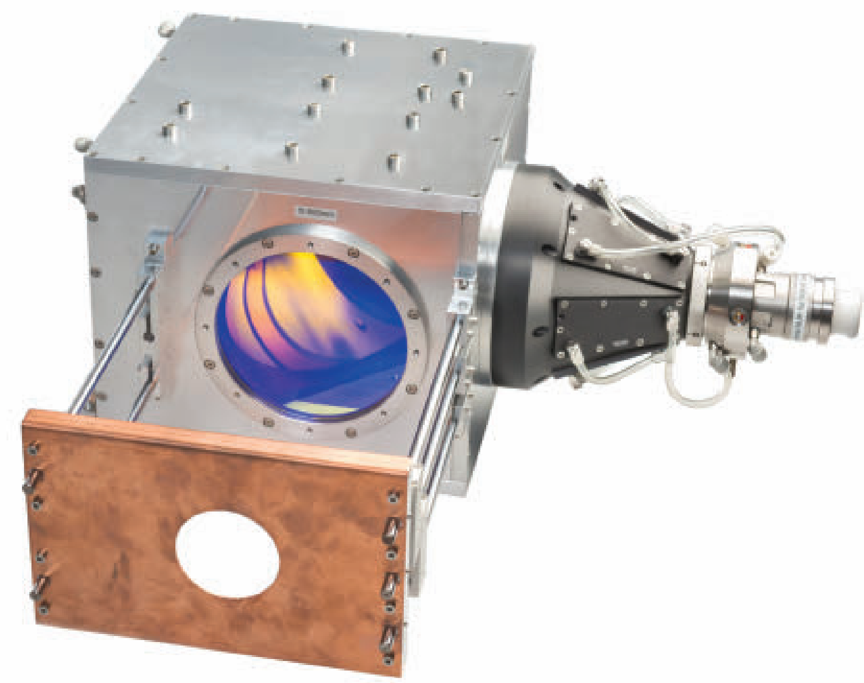
To achieve this, engineers turned to the direct-diode laser, and initial testing involved an array of process iterations. They even had some success welding the 1-in. steel butt joint autogenously in a single pass, though without filler metal the process became susceptible to underfill.

They also tested the process with cold-wire feed, which produced satisfactory results. "But by heating the wire, we found we can reduce the [laser] energy we need to put into the weld," said Steve Wise, project manager at MWES who spearheaded the testing and development effort. With a heated wire, engineers eventually found they were able to achieve full-penetration keyholes at 60 IPM—all with "just" a 50-kW laser.

The Miller Electric power source heats the 0.062-in. wire to about 1,000 degrees F. "That temperature needs to be consistent," said Peter Gratschmayr, MWES vice president of sales and marketing. "We want the wire to be a little harder than peanut butter. It still has enough body to make it into the weld pool, yet it's not reducing the temperature of the weld pool as it enters it."

The hot-wire feed along with the closed-loop feedback stemmed from development work in additive manufacturing done by ADDere, which has printed some enormous metal parts with directed energy deposition (DED). Oversimplified, DED is cladding on steroids. ADDere has successfully engineered a DED system that feeds a hot wire into a laser melt pool, depositing layer after layer after layer to create parts measured in feet and meters rather than inches and centimeters.

ADDere's DED processes incorporate hot-wire as well as a closed-loop feedback system that, as the company found, could be adapted to welding applications that push the limits of laser power, weld metal deposition, and travel speed. Adapted for laser welding, an infrared sensor outside the processing head measures the weld pool temperature, and a separate low-wattage distance-sensing laser is manipulated by a galvomirror above the laser optics.



This 90-degree processing head was used to laser-weld 1-in. plate at 60 IPM in a single pass. ***Photo courtesy of Laserline GmbH, Germany.***

"We essentially manipulate [the distance-sensing laser] in a circle around the weld pool," said Gratschmayr.

During development, engineers primarily used the feedback system for monitoring the weld keyhole characteristics. "We wanted to make sure we had a stable keyhole and maintained full penetration," Wise explained, adding that the laser power adjusted in real time to maintain that penetration and produce a clean weld joint that required no postprocessing.

The feedback system monitors the weld pool and the solidified weld, giving a complete picture of the keyhole and resulting bead's temperature and geometry during and after welding. Development at MWES has mainly involved tweaking the laser power in real time, but the system could also be engineered for on-the-fly adjustments of other variables like wire temperature, wire feed, and travel.

Regardless, a comprehensive feedback system is critical, sources said, especially for applications requiring extremely large, high-quality welds in just one pass. It's also critical for achieving what for many applications could be the most time-saving benefit of all: no secondary processing.

Thick plate welding can require hours of prep work. For a typical full-penetration V-groove weld, the goal is to create a geometrically perfect bevel and land width extending to the plate's bottom edge. The more consistent the gap between the lands, the more consistent welding will be.

Beyond this, heavy-duty multipass welds (some having literally dozens of weld passes) might require preheating, interpass heating, as well as postweld heat treatment. A single large weld might take hours, even days to complete.

With a 50-kW direct-diode laser welding system, the plate can be cut on a high-definition plasma table. From there the 1-in. plate goes directly to the weld fixture where it's butted together and clamped in place. The laser performs a full-penetration weld in one pass, with the feedback system adapting for changes stemming from the inevitable gap variation. After all, a high-definition plasma cuts a smooth edge, but not to machining-level tolerances.

The feedback system makes the process adaptable to some gap variation—not a huge amount, but enough to accept plates cut from a high-def plasma table. The company said that the system can accommodate larger weld gap tolerance windows when using laser power beyond 50 kW.

To perform a full-penetration weld in one pass, the process does require ceramic backing. That said, MWES has been testing an alternative setup without the backing in which the hot-wire laser welds to 95% penetration on one side, then is followed on the other side by a cold-wire-fed laser to complete the penetration.

Ultrahigh-power laser welding could have implications for even thicker-plate welding. For instance, the MWES team has tested the process on a narrow V-groove joint configuration with a ⅜-in. land. This configuration could apply to plates multiple inches thick that traditionally would have taken dozens of weld passes. An ultrahigh-powered laser with a hot-wire feed could complete the job in just a handful of passes.

"We're on the edge of a new era in heavy fabrication," said Scott Woida, MWES president. "If the system merely made a single-pass weld instead of three or four that a conventional GMAW system would do, this would be a great technology. But doing a single pass and at 1.5 meters per minute with a much smaller [heat-affected zone]? Now you have the potential to change industries." ***FAB***

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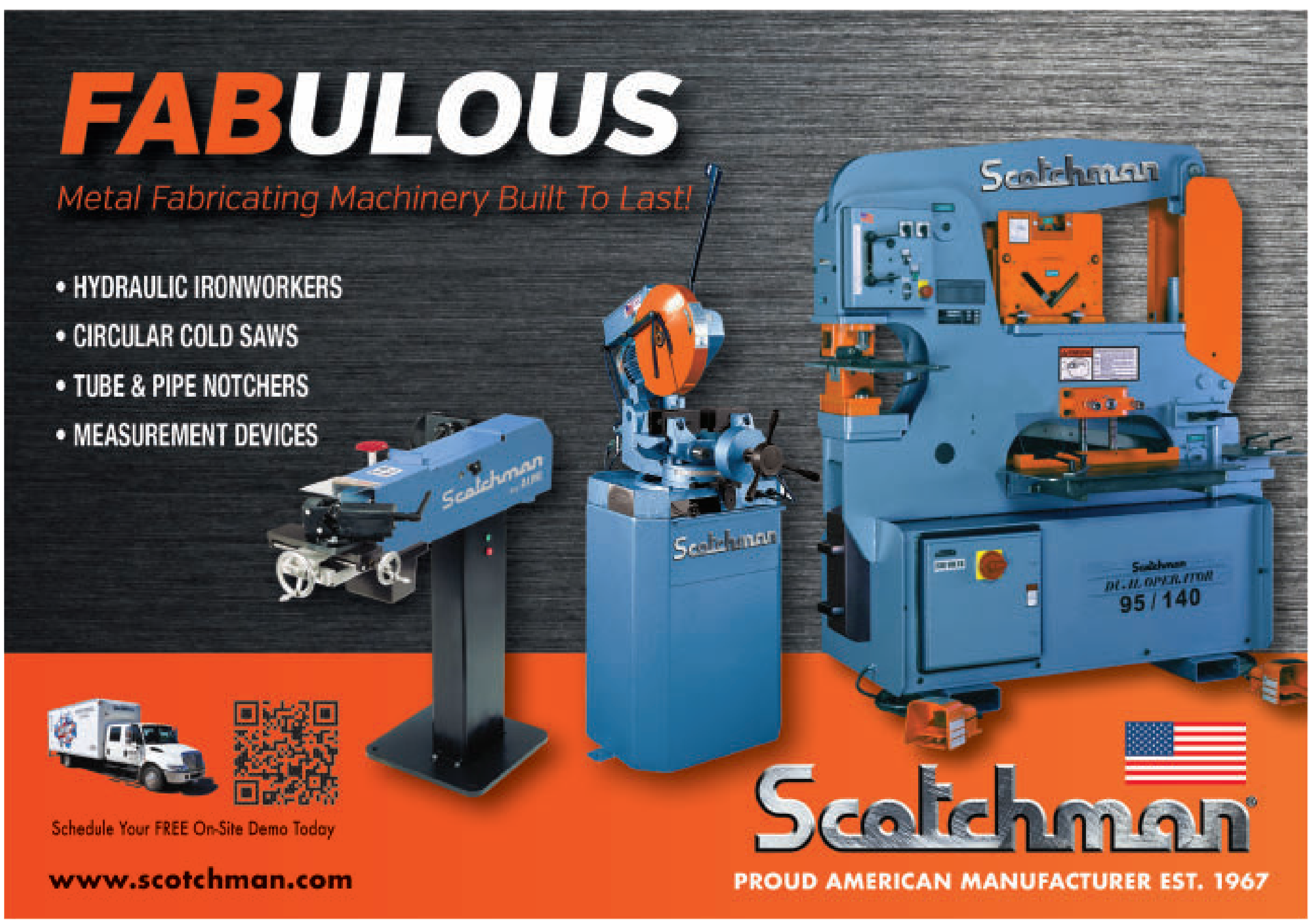
ADDere, www.addere.com

Midwest Engineered Systems Inc., www.mwes.com

Laserline, www.laserline.com



System automates pressure vessel nozzle welding

Pemamek has developed a complete robotic welding system for pressure vessel nozzles. Traditionally, this process is performed manually because it involves multiple passes, starts, stops, and repositions.

Automating the nozzle welding process helps reduce defect rates while saving manual welding hours, especially on thick-walled workpieces with irregular grooves, the company reports.

The company's advanced robotic welding systems are based on an easy-to-use programming software and control system, making them suitable for one-off production, such as heavy industries, shipbuilding, and offshore.

Pemamek
www.pemamek.com

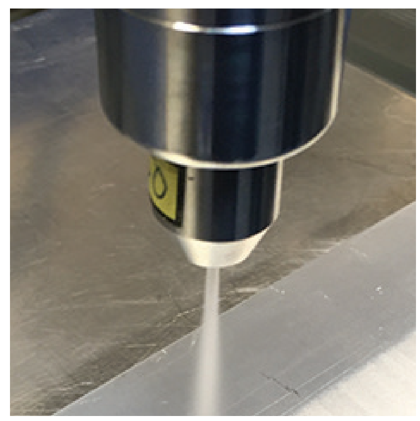
CNC plasma cutter fits in tight spaces

The ShopPro from Koike Aronson Ransome is a CNC plasma cutting machine available in three sizes from 4 by 4 ft. to 5 by 10 ft. Featuring steel construction, the machine offers a small footprint to fit into tight spaces, making it suitable for use in small fabrication shops.

The machine offers helical rack and pinion on both axes, a 1,000-IPM traverse speed, and a maximum power source of 125 amps. It comes with intuitive CAD/CAM/CUT software.

Koike Aronson Ransome
www.koike.com

Jet cleaning system preps bonding sites with CO_2 snow



The quattroClean snow jet cleaning system from acp systems AG provides selective or full-surface cleaning of components made from almost any material, including delicate substrates.

The cleaning medium is liquid CO_2, which is generated as a byproduct from chemical processes and energy generation from biogas. It is guided through a wear-free, two-component ring nozzle and expands on exiting to form fine CO_2 snow. This core jet then is bundled by a separate jacketed jet of compressed air and accelerated to supersonic speed. When the jet of snow and compressed air hits the material surface, thermal, mechanical, sublimation, and solvent effects combine to remove particulate and film.

acp systems AG
www.acp-systems.com

Surface conditioning belts suitable for large surface treatment

Superior Abrasives LLC has introduced SHUR-BRITE surface conditioning belts, which feature an open structure to resist overheating, part discoloration, or loading. Suitable for large-scale robotic applications, the belts can create linear scratch patterns on stainless steel food equipment and blend or reorient scratch patterns after repairs.

The belts offer high edge durability and flexibility without chunking, says the company, as well as smear-free removal of oxidation, paint, and adhesives. They can be used on ferrous and nonferrous metals, stainless steel, exotic alloys, plastics, and composites.

Superior Abrasives LLC
www.superiorabrasives.com

Tube bender can run autonomously

BLM GROUP USA's Smart bender is an all-electric, CNC bending machine for wires and tubes up to 1.1 in. It offers a compact layout and a variety of loading/unloading options that enable nonstop operation and the capability to run without a dedicated operator. It is suitable for bending complicated shapes and multiple-radii tubes.

The machine handles right- and left-hand bending of tube, wire, and tubes with flanges and end forms. Stack tooling provides multiple-radius capability.

The all-electric axis control enables the production of tight bend radii, even less than 1D, as well as complex shapes with multiple radii or for preassembled tubes with flanges, end forms, or fittings. Part bend positions, tooling information, and power parameters are saved together in the part program.

BLM GROUP USA
www.blmgroup.com

GMAW machine offer low power consumption

The Taurus Steel GMAW machine from EWM AG is designed for use in steel and metalworking industries, construction, and shipyards. According to the company, the machine's low power consumption saves more than 3,000 kWh per year in comparison to a step switch-controlled welding machine.

Suitable for continuous use in three-shift operation, the machine is available with 350-, 400-, or 500-amp output.

The 350- and 500-amp models offer a duty cycle of 60% at maximum current, while the 400-amp machine offers a 100% duty cycle for welding with full penetration.

EWM
www.ewm-group.com/en

Orbital welding controller features touchscreen interface, data analytics

AMI, an ESAB brand, has launched the M317 orbital welding controller for automated welding applications in the semiconductor, pharmaceutical, aerospace, nuclear, and other pipe fabrication operations.

Touchscreen features include an automated pipe schedule generator. A schedule editor allows operators to adjust, fine-tune, add, delete, and navigate amperage levels. Once in welding mode, a data analytics engine provides live data, while cameras offer a live view of the weld.

Paired with ESAB's WeldCloud and other orbital analytics, the system helps users collect, store, and manage data files locally or on the cloud.

ESAB Welding & Cutting Products
www.esab.com

Bimetal reciprocating saw blades designed for durability

Spyder Products has launched the Black series of bimetal reciprocating saw blades, designed for tough cutting tasks. Constructed from an 8% cobalt blend for durability, they are up to three times faster and 10 times longer-lasting than standard bimetal blades, the company states.

The blades are available in lengths of 6, 9, and 12 in. and have 6 to 18 teeth/in.

Spyder Products
www.spyderproducts.com

6-in. grinding and blending wheels added

Rex-Cut Abrasives has added 6-in.-dia. wheels to its Type 27 lines.

Aluminator grinding wheels, Max Flex, and the cotton fiber grinding and blending wheels are all available in the new size.

Rex-Cut Abrasives
www.rexcut.com

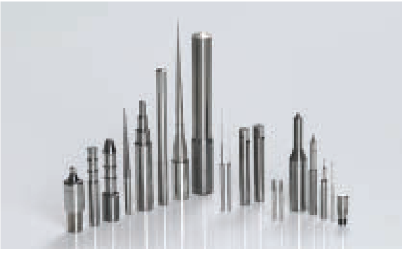
Plugs for tubes available with new top shapes

Mocap's heavy-wall polyethylene Tubing Plugs are designed to fit multiple tube gauges. They are available for round, square, and rectangular metal tubing in imperial and metric sizes, and many sizes have newly added top shapes, including domes, angles, and pyramids.

The plugs are suitable for use on office and patio furniture, tubular racks, appliances, and exercise equipment.

Mocap
www.mocap.com

5-axis pinch/peel grinder handles nonround parts



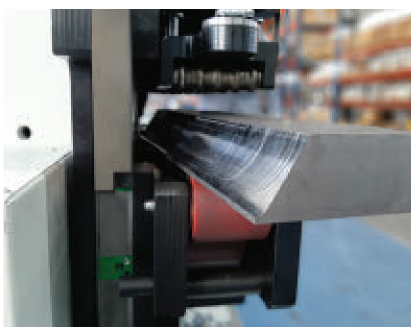
Rollomatic has introduced the ShapeSmart model NP50 for pinch grinding nonround parts such as oblong punches, form punches, squares out of center, and corner radiuses. According to the company, the process delivers high tolerances, form accuracy, and low TIR, which is important for thin and long parts.

The machine is designed for cylindrical grinding of carbide steel, high-speed steel, and stainless steel components with emphasis on surface finish and concentricity.

Rough and finish grinding are performed in one pass, eliminating a separate process and reducing cycle time. The machine uses two different grinding wheels running on separate spindles and positioned on independently controlled CNC linear slides.

Rollomatic
www.rollomaticusa.com

Beveling device delivers unchangeable 8-mm radius



Castellanos y Echevarría –Vitoria SA (CEVISA) has developed the J-Bevel for finishing J-chamfers. The chamfer radius only is applied in J-chamfer or U-chamfer welds. A configuration of a J-bevel or U-bevel weld usually is indicated by a bevel angle and a bevel radius. This device offers a constant and unchangeable radius of 8 mm.

Various connection geometries and weld seam types are available. Selection is based on accessibility to the welded joint, appropriateness for the design of the structure, and welding costs.

CEVISA
www.cevisa.net

Filter tower features improved extraction capacity

With the relaunch of the CleanAirTower, Kemper has improved the filter tower's extraction capacity and filter life.

A completely redesigned internal construction has increased extraction capacity by 10%. The newly developed pinball method prevents sparks and coarse particles from penetrating the filter and damaging it. Because particles collide with sheet steel elements on the inside, their energy is extracted automatically. This airflow extends filter life by 20%.

Extraction openings now are in the cover of the general ventilation system. A new tornado principle at the head of the filter tower ensures that the contaminated air is drawn in with high efficiency.

Kemper
kemperamerica.com

Waterjet-cut key allows no-contact door opening, button pushing

dtiEXACT offers the Hands-Free Key personal hygiene tool as a product for purchase and as a free cut program for manufacturers to waterjet-cut in their own shops.

Originally developed as a thank you gift for dtiEXACT's employees during the current COVID-19 pandemic, the keychain tool allows for no-contact door opening, button pushing, and touchscreen writing. Made from C260 brass antimicrobial material, the lightweight tool starts killing germs on contact.

The company will donate 10% of this product's profits to the Thurston County COVID-19 Response Fund.

dtiEXACT
www.dtiexact.com

Fiber laser cutting machines introduced

Esprit Automation has launched what it says is the first fiber laser cutting machines designed and built in the U.K. The Photon system, which offers acceleration up to 5g, is designed to deliver high-precision, clean cuts, the company reports.

The Photon One model is based on the manufacturer's precision-welded bed and gantry design and can be fitted with a variety of laser sources up to 6 kW to deliver vector speeds of 170 MPM. Designed with a hybrid gantry, the Photon 5G model can reach vector speeds of up to 325 MPM. It offers a visual nesting system and CNC interface.

Both machines feature a LiveNest vision system, LiveControl CNC, and LiveGuard anticollision technology.

Esprit Automation
espritautomation.com

Plasma cutting system cuts ¾-in. steel at 52 IPM

Thermal Dynamics Automation has introduced the Ultra-Cut 130 XT high-precision plasma power source and new 130-amp XT torch and consumables. With a cutting output of 130 amps at 100% duty cycle, the system is designed for piercing and cutting ¾-in. steel, stainless, and aluminum. Compared to the previous 100 XT model, it offers 30% more power, 20% faster cutting speed, and 50% longer parts life at 130 amps on mild steel.

The system cuts ¾-in. steel at 52 IPM and ½-in. steel at 85 IPM. It has a maximum cut and pierce capacity of 1½ in. The torch features the manufacturer's patented SpeedLok consumables cartridge, which allows users to change consumables in seconds. Improved torch head alignment helps reduce variations between cut sides for improved tolerances.

Thermal Dynamics
www.thermal-dynamics.com

Configurable system ensures correct part orientation for robot pickup

CenterLine (Windsor) Ltd. has introduced the PinPoint Solution, a configurable system to feed parts into robotic lines and cells. The operator loads parts on the pins, and as they advance down the system, they find their natural orientation for pickup by the robot. The system includes vision validation to ensure the part type and location are correct.

Applications include CNC machine tending, build-in-sequence traceability and errorproofing, and robotic pack-out cells.

CenterLine (Windsor) Ltd.
www.cntrline.com

Magnetic clamps hold angles up to 180 degrees for welding

Industrial Magnetics Inc. has introduced Magnetic V-Pad Clamps for low-profile holding of workpieces during welding. The clamps' dual pivoting magnetic heads can position and hold angles up to 180 degrees. Each contains four magnets: two on the back and one on each pivoting foot.

The clamps can be set up quickly on flat, angled, or round stock. They are particularly suitable for cradling pipe or tube, as they allow the tube to rotate for seam welding of the pipe or tube ends.

Industrial Magnetics Inc.
www.magnetics.com

3D CAD software update helps users improve product development

IronCAD has introduced IRONCAD 2020 PU1, an update designed to help users of the 3D CAD program improve product development from conceptual design to manufactured products.

With the update, load/save times of extremely large assembly data sets have been reduced, and view creation and view update speed in the drawing environment have been improved.

IronCAD
www.ironcad.com

CMM delivers high accuracy in compact package

FARO Technologies Inc. has released the FARO Gage CMM. Suitable for small and medium-sized businesses performing high-accuracy tasks, the CMM serves as an alternative to traditional hand tools for completing 3D inspections.

The lightweight, portable unit offers 20% more reach than the previous-generation Gage arm. It sets up quickly, including on-machine, with a universal quick mount. Features include a two-button design, six-point articulation, and built-in counterbalance.

FARO Technologies
www.faro.com

Read more from Tim Heston at www.thefabricator.com/author/tim-heston

We're all in this together

The pandemic-era mantra might do the fabrication industry a world of good

By Tim Heston

"We've had 60 years of individualism …. The solitary entrepreneur can be the hero. In my mind, we've overdone that. If you have 60 years of individualism, you weaken the bond between people, and you weaken the sense of common good and the sense of community. [Pre-COVID-19], we were already shifting away from individualism [and toward community], but the pandemic is accelerating that."

So said *New York Times* columnist David Brooks in a virtual edition of the Munk Dialogue, a Canadian public debate forum. In a roundabout way, that shift toward community may do the manufacturing industry, including the business of metal fabrication, a world of good.

As Brooks put it, in the pre-pandemic world, the individual, including the solitary entrepreneur, was the hero. This emphasis of the individual over the group has a negative implication: mistrust. *You've got to look out for No. 1.* And it's warranted. Over the 50 years of *The FABRICATOR* magazine's existence, the industry has endured globalization's march forward amid a roller coaster of booms and busts, an unforgiving environment for mismanagement. Job security became something your parents enjoyed, a historical aberration of the postwar boom years.

Thing is, the strong have survived for a reason. "We're in this together" has become a COVID-era mantra, but it's nothing new to the progressive metal fabricator, the one with extensive cross-training, lean thinking, and a lot of value generated per payroll dollar. It's not how many pieces per hour a laser cuts or a welder welds, but instead how quickly a purchase order turns into cash. Tie this together with the right automation, and a fabricator grabs market share, perhaps grows its market pie, and the value produced per employee skyrockets.

Growing the market pie is great, but what happens if the pie shrinks dramatically in a matter of weeks? That's what so many fabricators dealt with during the second quarter. Not all, of course. The pandemic has affected different sectors in different ways. Fabricators in the right supply chains—military, certain medical sectors, e-commerce, warehousing, cloud computing infrastructure—have kept growing throughout the pandemic. But for many in April and May, the market pie shrank in a matter of days as plants shuttered. An inventory draw-down was already expected in many sectors, but the pandemic accelerated that in a big way.

MEC's experience is a prime example. As No. 1 on *The FABRICATOR*'s FAB 40 list, published in June, the massive fabricator headquartered in Mayville, Wis., is a bellwether company. Capital expenditures at the $500 million company were $16.6 million for the first half of 2019 alone. It's an old joke in this business: Buy a bunch of new machines and watch the economy tank. MEC's second-quarter 2020 wasn't pretty. Sure, there were some bright spots: Its military contracts remained steady, and some of its business serving the PPE sector quadrupled in volume. Power sport orders remained strong too, with inventory at dealers at 20-year lows.

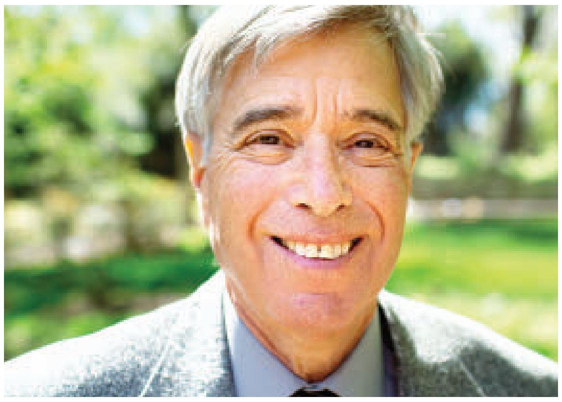
That said, the bright spots couldn't prevent dramatic order reductions elsewhere. MEC was already expecting an inventory draw-down. But then came the pandemic. Because its customers' facilities shut down for five to six weeks, MEC had to temporarily halt production at some of its plants. Business conditions also accelerated the closure of its Greenwood, S.C., plant. The lines that plant produced weren't lost entirely but just redistributed to other MEC facilities. Overall, second-quarter sales dropped a whopping 57% compared to Q2 2019. May was the low point, June was a little better, July a little better still.

So the old joke came to fruition: MEC bought a bunch of machines and then everything went to pot—right? Well, not necessarily. The company has a strong balance sheet and isn't overleveraged. And to strengthen its safety net, it amended a credit agreement and expanded its leverage ratio as an "added level of insurance against future macroeconomic events," according to CFO Todd Butz. Automation also creates an environment where employees are physically distanced—a good thing during a pandemic.

Q2 quoting activity was sky-high, and the company reported that it won a fair amount of takeover business. Opportunities lie in reshoring and near-shoring too, with customers bringing production closer to where the final consumers are. Overall, it's gaining market share when the market pie is extremely small, which could lead to huge gains when the recovery occurs. But MEC knows that they can achieve those huge gains only if they have the capability to respond quickly to increased demand, hence its capex strategy.

The reasons for automation have evolved. It began with distrust—understandably so, considering what's happened to manufacturing employment since the 1970s. During FABTECH 2019 I had conversations with company executives who said that, with skilled people retiring and record-low unemployment (remember that?), automation was really the only way the company could grow. Now it's about giving employees the tools they need to provide value: that is, keep jobs on the move and increase the team's capacity to produce. The team, from sales through engineering and production, is only as good as its weakest link.

Sure, it'll be a slog for most before a vaccine becomes available. Demand just isn't there. Even so, the pandemic age has brought that "we're all in this together" sentiment to the fore, and it's permeating our personal and professional lives. Considering the moves some of the industry's largest players are making, the post-pandemic era might be an unprecedented time for custom metal fabrication success. But it will be the team, not the individual, that will achieve it. FAB



Read more from Stephen Barlas at www.thefabricator.com/author/stephen-barlas

Congress presses Commerce Department on import exclusions

Critics say current rules encourage importing of semifabricated aluminum products

By Stephen Barlas

Congress appears to be backing complaints from domestic aluminum manufacturers that the U.S. Department of Commerce (DOC) is allowing too many exclusions from the 10% tariff President Donald Trump put on aluminum imports from all countries except Mexico. (He signed a proclamation in early August to reimpose 10% tariffs on aluminum imports from Canada following "a meaningful surge" in aluminum exports from Canada to the U.S., according to administration officials. This comes just after a month the U.S.-Mexico-Canada Agreement went into effect.)

The House Appropriations Committee just passed a DOC appropriations bill for fiscal 2021 that includes this language: "The Committee is concerned by industry reports suggesting that the Department has granted tariff exclusions for volumes of aluminum products that in some cases have exceeded historical import volumes and U.S. market demand. The Committee encourages the Commerce Department to improve its efforts to ensure that exclusion volumes are not unnecessarily disproportionate to historic import volumes and continue its efforts to leverage and advance domestic aluminum production through robust collaboration, research, and initiatives." Fiscal 2021 starts Oct. 1.

The House committee also appropriated $800,000 for the new Aluminum Import Monitoring System (AIMS) the DOC is setting up. A counterpart for steel imports already exists. AIMS is partly being stood up as its creators look to provide better data on imports. This has given the DOC time to fine-tune its exclusion process, which is currently in review since May 26, 2020.

The DOC's Bureau of Industry and Security (BIS) wants comments "on the appropriateness of the factors considered, and the efficiency and transparency of the process employed, in rendering decisions on requests for exclusions from the tariffs and quotas imposed on imports of steel and aluminum articles." In a letter to the BIS in July, the Aluminum Association said, "… [T]he current exclusion process incentivizes the import of semifabricated aluminum products, undermining domestic producers of flat-rolled products and driving down demand for primary aluminum in the United States."

But Ardagh Metal Packaging USA Inc. argued the availability of domestic tin plate is insufficient. Ardagh makes tin cans and has relied on domestic supplies of tin plates in the past. "For the past five years the availability and reliability of domestically produced tin plate have declined," the company told the BIS in a statement. "And the domestic steel industry has not demonstrated a meaningful commitment to increasing the quantity and quality of its tin plate production."

Boiler Emissions Designated for Reductions

NAICS 332, which covers fabricated metal product manufacturers, is one of the industry codes cited by the Environmental Protection Agency (EPA) in outlining companies potentially affected by its plan to reduce allowable hazardous air pollutant (HAP) emissions from industrial and commercial boilers.

The rule proposes to revise 34 of 90 emission limits for particular types of new and existing boilers and process heaters in a range of industries. Of the 34, 28 boiler emission categories will be more stringent than current standards and six would be modestly less stringent with no more than a 25% increase. The National Emission Standards for Hazardous Air Pollutants (NESHAP) for Industrial, Commercial, and Institutional Boilers and Process Heaters went into effect on March 21, 2011, and was amended twice subsequently, the last time in November 2015.

Environmental and industry groups submitted petitions seeking judicial review of the NESHAP and the U.S. Court of Appeals for the District of Columbia issued three rulings in 2016 and 2018 that prompted the EPA to make changes. The total selected metals (TSM) emissions limits would change for eight of the combustion sources, including for both new and existing dry biomass stokers, existing wet biomass stokers, new and existing biomass fluidized beds, and new and existing biomass suspension burners. The proposed rule applies to boilers, defined as combustion devices used to generate steam or hot water for on-site use in certain industrial plant operations.

Facilities will have up to three years after the effective date of the final rule, when and if it is published, to demonstrate compliance with the new emission limits. EPA stated that it is proposing the three-year allowance to give facilities time to install additional controls or monitoring equipment to meet the more stringent emission limits or modify the method of compliance.

The proposed rule is expected to result in nationwide emission reductions of selected HAPs, such as hydrochloric acid, hydrogen fluoride, mercury, and some metals, by an additional 37.35 tons per year as compared with the current rule. Additionally, the total annualized capital costs of the proposed amendments is $22 million in 2016 dollars, which includes costs for control devices, monitoring, and testing associated with the proposed changes to the emission limits. ***FAB***

Aluminum Association, www.aluminum.org

Environmental Protection Agency, www.epa.gov

U.S. Department of Commerce, www.commerce.gov

News and information from the Fabricators & Manufacturers Association, International®

in the KNOW

Patrick J. Simon

Director of Education and Membership

Fabricators & Manufacturers Association

A Note From FMA's Education and Membership Director

Over the last few months, as the Fabricators & Manufacturers Association, International®, (FMA) continues its commitment to ensuring safe events, we have shifted to virtual formats. Reconvening online enables us to provide you with valuable training and collaboration opportunities accessible by logging on from your computer.

FMA's premier laser industry event, Advanced Laser Application Workshop (ALAW®), is going fully virtual. Gain in-depth knowledge on the latest technology during interactive sessions led by laser welding experts and learn about the future of the auto industry from thought-leaders, all from the safety and comfort of your home. Learn more and register at fmamfg.org/alaw.

It is more important than ever to stay connected. I want to thank all of our incredible members and supporters for their continued commitment to FMA. We are dedicated to the industry and look forward to seeing you virtually this fall.

Take care,
Patrick J. Simon

FMA

UPCOMING **EVENTS**

Coming Soon…

World-Class Roll Forming Virtual Conference
Sept. 15-24, 2020

ALAW Virtual Conference
Sept. 28-Oct. 1, 2020

Looking Ahead…

Manufacturing Day
Oct. 2, 2020 | Organizations Worldwide

GOLF4MFG
Oct. 12, 2020 | Wheaton, Ill.

fmamfg.org/events
888-394-4362

Get an Inside Look at the State of the Industry

The free Forming & Fabricating Job Shop Consumption Report (FFJSCR) is now available. Find out how small- and medium-sized job shops and fabricators are currently operating in and responding to the current economic conditions and compare business data to last year's numbers.

Created by FMA, the FFJSCR provides insights about hiring, new orders, material costs, capacity utilization, and more. This firsthand knowledge is gleaned from data provided by real shops operating in today's economic conditions.

Plus, FMA Economic Analyst Dr. Chris Kuehl sheds light on current economic impacts brought on by the pandemic and what it means for "Manufacturers in the Age of COVID-19."

Download the free report | fmamfg.org/ffjscr

NUTS, BOLTS & THINGAMAJIGS®
The Foundation of the Fabricators & Manufacturers Association, Intl.

Support Manufacturing by Participating in NBT's Fall Events

GOLF4MFG®

Join Nuts, Bolts & Thingamajigs® (NBT) on Monday, October 12 for the eighth annual GOLF4MFG® fundraiser at Arrowhead Golf Club in Wheaton, Illinois. Enjoy Arrowhead's aesthetic beauty during the pinnacle of fall colors while playing three nine-hole courses forming three separate par 72 18-hole layouts. The course features bentgrass tees, greens, and fairways; white tour sand bunkers and water hazards.

Registration is $250 and includes 18-holes of play, cart, food and beverages, contests, prizes, and more. Bring a foursome or let NBT pair you with industry colleagues; everyone is welcome! Our staff and event partners will be following Illinois guidelines to ensure the safety of all attendees.

Learn more | Sign up | Sponsor | nbtfoundation.org/golf

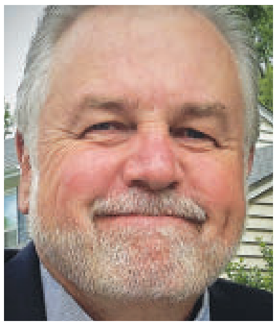
NUTS, BOLTS & THINGAMAJIGS AWARDS VIRTUAL Gala

Experience uplifting and inspiring stories at the Nuts, Bolts & Thingamajigs Virtual Awards Gala presented by Amada on October 22. It will be a night to remember as the NBT board of directors announce the Power of Industry, Impact on Industry, and Future of Industry Award winners during this virtual presentation.

Bid on one of the many beautiful pieces featured in the Gala Art Auction donated by professional and student artisans from across the country. Enjoy entertainment, raffles, prizes, and more at this exciting and celebratory occasion! Sign up for this no-cost event by October 15 to receive your free gift.

Learn more | Sign up | Sponsor | nbtfoundation.org/gala

NBT serves the manufacturing community through summer camp and scholarship programs that inspire students to join an exciting and vital industry. It's through fundraising events and campaigns that NBT programs can continue to grow and address the skilled labor shortage. Donate to NBT and help support the mission at **nbtfoundation.org.**



Steel market wrestles with slow recovery

Steel prices remain low compared to early in the year

For more information, visit
www.steelmarketupdate.com

By John Packard and Tim Triplett

Steel industry sentiment took a more pessimistic turn in July and August as COVID-19 continued to outsmart government and health officials who can't seem to unite on a strategy that will stem the spread of the virus. Steel Market Update's Steel Buyers Sentiment Indexes had been improving steadily since hitting bottom in early April, but backtracked last month, reflecting steel buyers' frustration over the slow progress of recovery.

Every two weeks SMU asks steel buyers how they view their company's chances for success in the current environment and three to six months in the future. The Current Sentiment reading in the survey taken the week of Aug. 3 stayed at +34, the same as the prior week and down 8 points from the first week of July (see **Figure 1**). Current Sentiment hit a low of -8 in the first week of April, its lowest reading since November 2010.

Likewise, SMU's Future Sentiment Index was unchanged at a reading of +38 (see **Figure 2**). That's down from +52 in the week of July 9. Future Sentiment hit a recent low of +10 in early April shortly after the pandemic took hold. Sentiment Index readings were in the upper +50s and +60s in 2019 and Q1 2020.

Future Sentiment readings are almost always higher than Current Sentiment, as it's human nature to be more optimistic about the future. The fact that Future Sentiment, at +38, is not much more positive than Current Sentiment, at +34, says something about how discouraged many businesspeople have become.

Steel Prices Near a Bottom?

Steel prices continued to slide in August. According to SMU's check of the market on Aug. 3-5, the benchmark price for hot-rolled steel was around $440/ton, including some deals reported well below that number (see **Figure 3**). Hot-rolled is down nearly 30% from pricing of over $600/ton at the beginning of the year before the coronavirus devastated the economy.

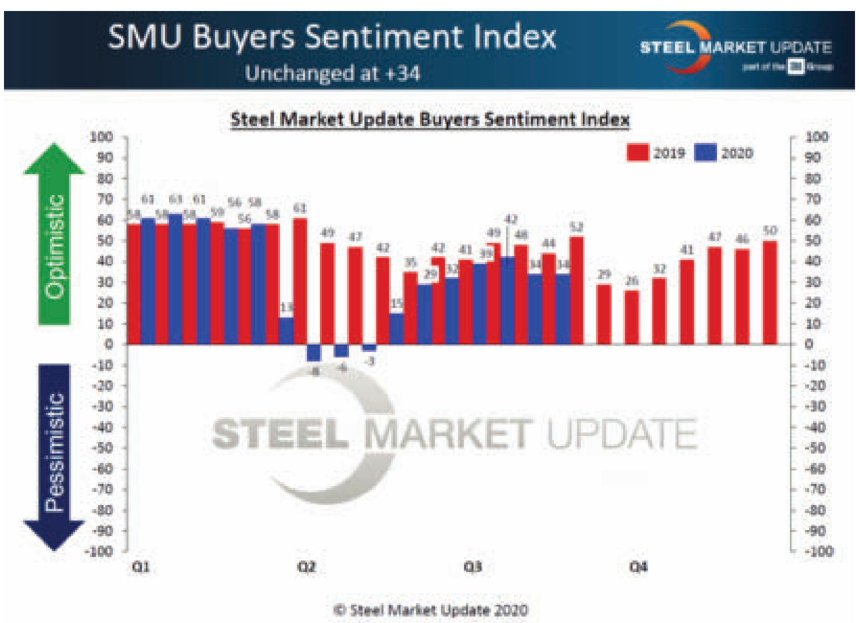


FIGURE 1
Steel buyers remain somewhat optimistic about the overall steel market, according to a Steel Market Update survey done in early August. The sentiment has leveled off a bit compared to only a few weeks ago but is much better than in April.

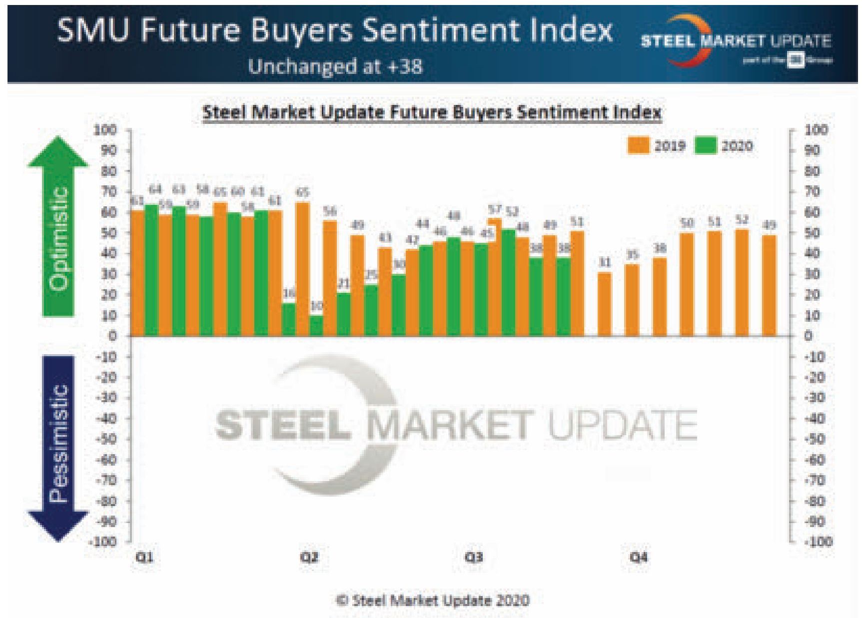


FIGURE 2
Steel buyers remain optimistic about the future, but not as much as one would think. The fact that Future Sentiment, at +38, is not much more positive than Current Sentiment, at +34, says something about how discouraged many businesspeople have become.

Other flat-rolled products prices firmed a bit last month. Cold-rolled and galvanized steels were selling at an average of $640/ton, FOB the mill, east of the Rockies. Galvalume was slightly higher at $685/ton. The price of steel plate was at $590/ton.

Seventy percent of the buyers polled by SMU in early August said they believed prices were near the bottom of the current market. A $40/ton price increase announced by the integrated mills on July 21 fell flat when the electric arc furnace mills declined to follow suit. Some buyers were expecting the minimills to raise prices in August, while others expressed doubts that steel demand had recovered enough for a price hike to succeed. SMU opted to keep its Price Momentum Indicators at Neutral at that point because the direction of the market remained unclear.

The cost of ferrous scrap has a lot to do with how much steel mills charge for their products. Higher scrap prices generally lead to higher finished steel prices, or vice versa. Scrap prices for August were not as weak as expected but varied widely by region. Prices on the East Coast and in the Southeast were up $30/ton because of strong export demand, and prices in other parts of the country traded sideways for obsolete grades and down $20 to $30/ton for prime grades. Looking ahead to September, most experts were predicting higher scrap prices overall.

"I think we are seeing an inflection point in the domestic market brought on by strong international pricing. The export market, which is being driven by exceptional demand in China, continues to rise with expectations that this trend will continue through October," commented one scrap dealer in the Northeast.

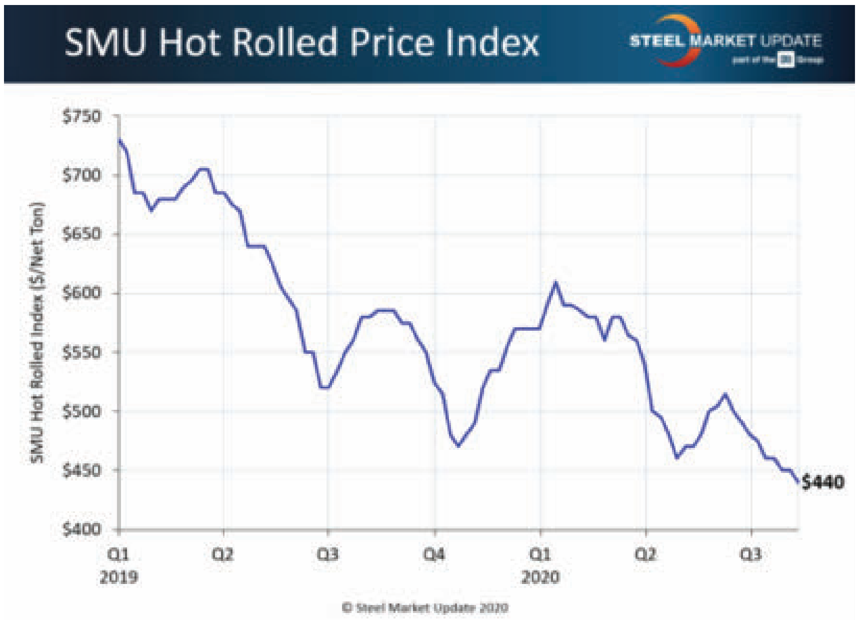


FIGURE 3
The pandemic has had a negative effect on the overall economy and steel prices as well. It was only 19 months ago that hot-rolled steel prices were above $700/ton.

SMU keeps a close eye on mill lead times, which are a leading indicator of buying activity. Longer lead times for steel delivery indicate that the mills are processing more orders. Lead times for spot orders of flat-rolled steel from the mills were at their shortest in the week of April 30 as orders dried up because of the coronavirus crisis. Since then lead times have extended by about half a week. As of mid-August, lead times for hot-rolled and plate steels were less than four weeks, while lead times for cold-rolled and coated were approximately six weeks. Lead times are still shorter than normal, however, which suggests that the mills could be busier.

Judging by steel mill capacity utilization, orders are picking up, though at a slow pace. The American Iron and Steel Institute reported that capacity utilization by the domestic mills topped 60% in the week ending Aug. 8. That's an 18.2% improvement (up 9.3 percentage points) from the trough in the week ending May 2 when the mill utilization rate was just 51%. The industry still has a long way to go to reach the pre-pandemic capacity rates above 80%.

What Respondents Had to Say

One of the best ways to gauge the health of the steel market is to talk to those that are a part of it. Here's what they are saying:

• "I believe a price increase by the minimills will be accepted. Demand is improving in lots of industries. Consumer spending is on the increase. Scrap will move higher in September. Iron ore is very high, so the integrated mills have to keep pushing prices higher. The minis will lead the way, knowing that."

• "We expect the minimills to attempt an increase, but there isn't much room to run, as a lot of idled capacity has come back online. Lead times for cold-rolled and coated steel will extend into the fourth quarter, and I don't think many players will be interested in major stock buys with lead times into 4Q. Furthermore, a lot of contract tons will continue to ship out in September at historically low pricing levels. Those who don't need spot may be content to rely on contract tons."

• "We're seeing some increase off of the recent lows and some firming for the hot-rolled base to get to $450 and then $460-$470. The chance for further erosion seems low. Base prices should follow where the scrap price leads in September and beyond. Scrap prices are expected to rise, according to normal seasonality this fall. Given the strength in the export market for scrap, that should be a no-brainer."

• "I think the upside for sheet pricing will likely be limited, and we won't see sizable increases. We're seeing a return by the mills of using nonbase factors as discount mechanisms in order to 'protect' or increase the base price. Freight, grade extras, size extras, etc., are being discounted as an incentive to generate orders, while technically using a higher base price."

• "COVID strikes again. A few customers are limiting operations or closing down again due to outbreaks in their plants. Just as things started getting back to normal."

• "It's difficult to make any accurate predictions due to the fluctuation of the virus in different areas of the U.S."

• "There are still too many unknowns."

• "I fear more of the same for the balance of the year."

If you find this type of content useful, consider signing up for an SMU membership. SMU's website, executive- and premium-level memberships, market surveys, and price indices offer information and insights available nowhere else. Premium membership includes access to SMU's proprietary Service Center Inventories Index. For more information, call 724-720-1012 or email paige@steelmarketupdate.com to set up a free three-week trial. ***FAB***

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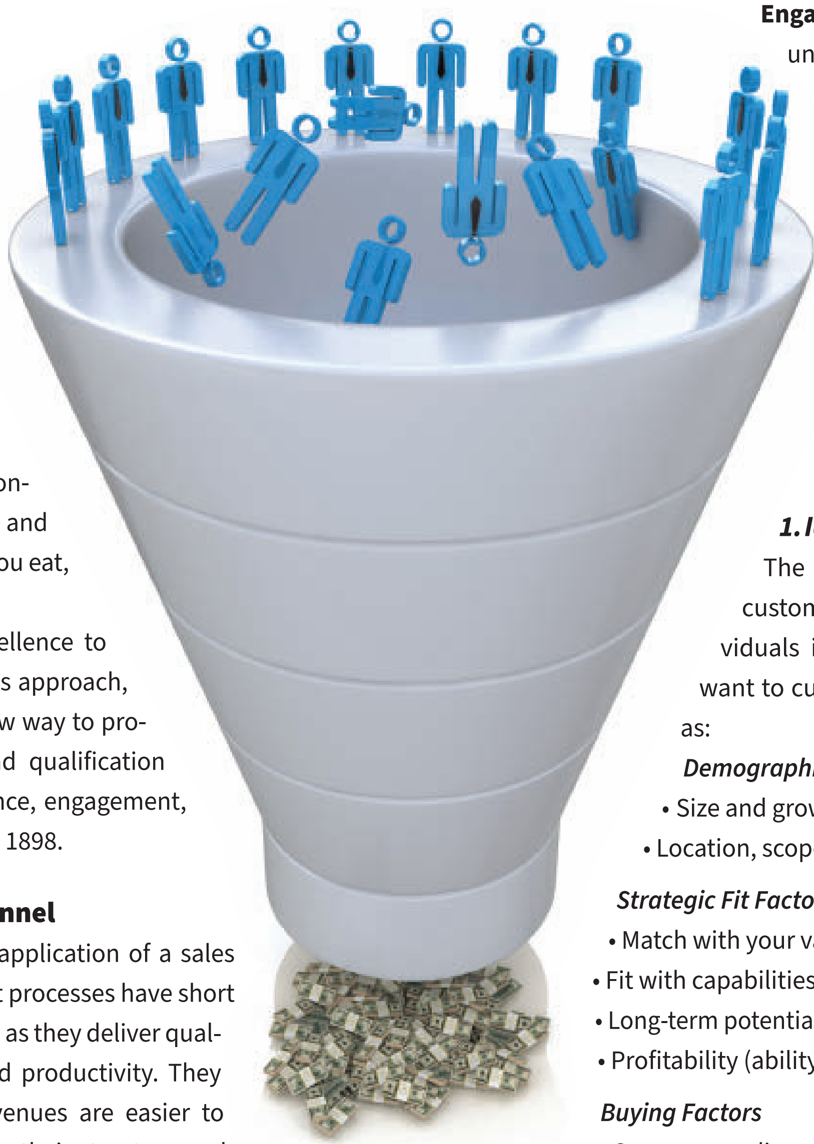
Steel Market Update's mission with its newsletters, website, conferences, and educational programs is to inform, educate, and motivate those in the flat-rolled steel industry. For more information, visit www.steelmarketupdate.com.

Ditch the funnel sales model for **go to market**

4 steps to move from funnel to pipeline model lead to better results

By Mark Coronna



The model of a funnel to represent how leads convert to sales is credited to a gentleman named E. St. Elmo Lewis, who devised it in 1898. It is ripe for improvement. Would you use 1898 manufacturing technologies to do business today? It would be amazing for a technology or business model to remain unchanged 120 years later.

As manufacturers, you are leaders in continuous improvement, process automation, and deployment of more effective equipment. You eat, think, and breathe operational excellence.

There's a way to apply operational excellence to the go-to-market side of your business. This approach, called the Intelligent Sales Pipeline, is a new way to proactively manage lead generation and lead qualification using prospective customer data, intelligence, engagement, and metrics—none of which were around in 1898.

Problems With a Traditional Sales Funnel

As a process, the traditional concept and application of a sales funnel is very flawed. Effective and efficient processes have short cycles and, therefore, operate at lower costs as they deliver quality results. They have high throughput and productivity. They produce known results and so future revenues are easier to forecast. They are operationally excellent in their structure and results.

Typical problems with sales funnels are:

Time. Buyers don't necessarily want to follow your process or wait for you to encourage their movement and buying journey, and their buying cycles are shorter.

Sequence. Today's buyer journey is anything but linear or one way. It jumps around as new information is introduced.

Quantity, Cost. Acquiring a mass of unqualified leads just won't work economically today, even if you get them inexpensively.

Lead Quality. A funnel model results in low sales productivity. Only after wasting time screening inquiries can you weed out poor-quality prospects.

Control. While you can influence through education and insight, you can't dictate what options your buyers are considering or competitors' prices.

Capacity Forecasting. When you keep filling funnels beyond their size and capacity with what many of us know as "junk in, junk out" approaches, this makes the funnel less predictive of the future growth of the business.

Introducing the New Pipeline Model

This model operates very differently than the traditional funnel model. Today selling is much more of a conversion process, built on a level of intelligence-gathering and engagement.

Intelligence. The intelligent part of the new model is that it is a proactive process of identifying prospects in a more effective way, based on prospect-focused engagement.

Engagement. Building rapport and a deeper understanding of pain points, needs, challenges, and goals through deeper interaction with a smaller number of prospects leads to better results.

Metrics. Starting with higher-quality, better-fitting prospects at the beginning of your interaction and placing more emphasis on quality versus quantity improve sales metrics.

The following are the key components of the new, intelligent pipeline model:

1. Identify Target Business

The model starts with identifying your ideal customer and buyer. Ideal buyers are the individuals in those ideal customer companies you want to cultivate. Profiles often include factors such as:

Demographics

- Size and growth: revenue, employees
- Location, scope: local, regional, national, global

Strategic Fit Factors

- Match with your value proposition
- Fit with capabilities, product, and service offerings
- Long-term potential (transactional versus relationship buyers)
- Profitability (ability to meet target margins)

Buying Factors

- Openness to discuss projects, share concerns, discuss options
- Purchase process (length, involvement, individual or group)

Ideal buyer profiles represent specific roles within the prospect's organization for your sales team to focus on. Some of these roles or people have more influence and decision-making authority than others. An important task is understanding the various stakeholders involved in making what is often a collective decision on a complex service or product. Each stakeholder may vary in influence, and it might be difficult to identify a decision-maker.

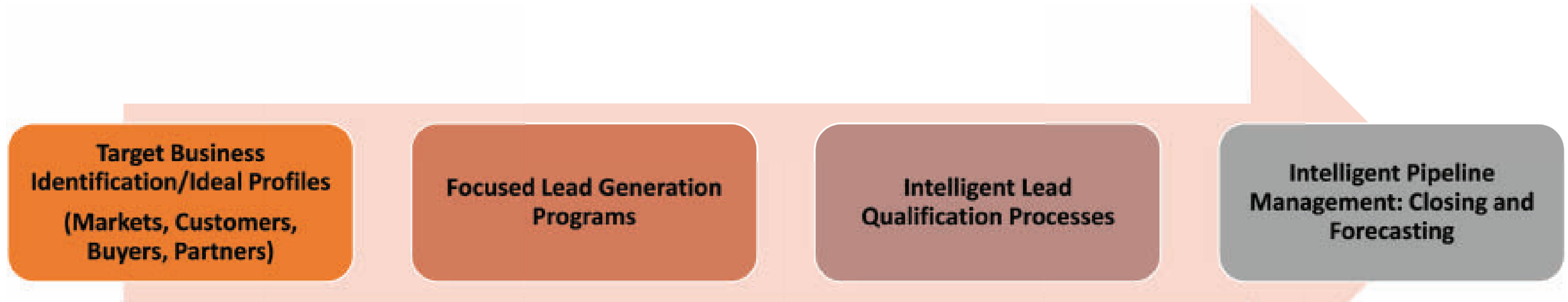
Typical influencers and buyers for a manufacturer's products often are vice presidents of engineering, COO/vice presidents of operations, vice presidents of product design/development, and vice presidents of procurement and supply chain management.

An Intelligent Sales Pipeline approach starts by understanding which organizations make for the best business relationships. This places significant emphasis on prequalifying prospects.

2. Focus on Lead Generation

Focused, proactive lead generation starts with these four questions—and the last three are much more important than the first one:

- What markets should we be in, based on their size, growth, and competitive coverage?
- Are these good markets for us, and can we win?
- Can we find our ideal customers and buyers in these markets?
- Can we find our ideal customers efficiently and effectively?



The Intelligent Sales Pipeline model follows a linear approach, starting with identifying your target business, then focusing on lead gen before qualifying the lead and closing.

If you have answered these four questions affirmatively, then you're ready to design a proactive go-to-market plan. By proactive, we mean an *intentional* plan to identify your ideal customers and buyers and communicate with them effectively. This is the first step in implementing an Intelligent Sales Pipeline.

Prequalification is a critical step. If you have identified your target business and focused your lead generation program, then you have already defined with whom you want to do business. Instead of dumping a large quantity of unqualified leads into this pipeline, you carefully curate leads that match your ideal customer profile and introduce them into the process.

An effective website is only one source of prospects. It is not optimal for hosting qualifying conversations. Creating and maintaining a best-in-class website with highly relevant content and search engine optimization is the foundation for all good go-to-market programs. But it alone is insufficient, because it relies on your target customers to find you through their search actions.

There are many ways of being proactive beyond your internet marketing initiatives. One of the best ways is to implement an account-based marketing program. These marketing programs start with your ideal customer and buyer profiles and use a third party to contact and qualify leads.

As you improve your target profiling, the quality of your lead stream will improve. Your focus should be on quality over quantity. Your sales team will be much happier not having to screen out poor-quality prospects and their productivity will improve.

3. Qualify Leads

The traditional way of qualifying leads was based on tasks. Often an organization's customer relationship management platform embeds this approach.

In task-based qualification, every task completed until a prospect is closed as a customer is given a percentage score. For example, an initial verbal qualification of an order worth $1 million may be assessed at 10%; if you give a prospect a demo, it might be assessed at 50%; and when you receive a request for quotation, it might be 70%. However, this method of scoring may be misguided, because the deal is worth nothing if you lose it, or it will be worth $1 million if you win it. It will never be worth $500,000 unless it is broken into individual orders.

Conversely, using the Intelligent Sales Pipeline model, you qualify and score prospects based on their answers to the factors mapped out in the ideal customer profile.

4. Close and Forecast

With improved qualification using the pipeline approach, your sales group will be able to have deeper, more valuable interactions with your best prospects. The qualification steps left to complete include qualifying budgets; qualifying the decision-maker and decision process (you have already identified the decision-maker through your ideal buyer profiling); and negotiating the final purchase price, terms, and conditions.

The efficiency and effectiveness of the new model comes through different indicators. The first indicator is how many active leads you have, measured as a percentage of qualified leads. You may be able to reach sales closing rates of 25% to 30%, which exceeds industry averages. You will also likely see increases in average order sizes.

Most significant, you are likely to see higher customer lifetime values, driven by longer-term, higher-margin business from each customer.

These types of metrics are paramount to measuring, managing, and predicting performance. **Figure 1** compares the dynamics of the traditional funnel model and the Intelligent Sales Pipeline.

Does the Pipeline Approach Really Work?

The Intelligent Sales Pipeline drives the following advantages:

- Fewer nonqualified suspects or prospects to process
- Lower customer acquisition costs
- Dramatically improved sales productivity, revenue growth, and margin improvement
- Reduced time from prospect to closed customer
- Strong probability of higher customer lifetime value

Smart Sales Pipeline Case Example

Figure 2 displays a before-and-after example from Dalsin Industries, *The FABRICATOR*'s 2020 Industry Award winner.

Dalsin Industries Vice President of Sales and Marketing Tom Schmeling had this to say about the new approach: "When we started, we weren't sure how this program would benefit us. Now, however, it has become a critical part of our go-to-market programs. Our program has a nice payback, which is important for a smaller company with resource constraints."

Those types of results are there for you, too, if you are willing to bring operational excellence to your go-to-market programs. ***FAB***

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Dalsin Industries, www.dalsinind.com

Factor	Traditional Funnel Model	Intelligent Sales Pipeline
Primary Lead Generation Approach	Website with Search Engine Optimization (SEO)	Proactive Lead Gen Programs such as Account-based Marketing (ABM)
Who Initiates First Contact?	Prospect	Business
Lead Volume Generated	High volume, priority is often to expand size of funnel	Much lower volume, priority is quality over quantity
Qualification Approach	Task-based, driven by activities completed	Scored responses to Ideal Customer Profile criteria
Leads "Wasted"	Large volume of tire-kickers, suspects	Very minimal
Key Metrics	Overall lead volume per month	Qualified leads as a % of overall volume
Ratio of Marketing Qualified Leads to Sales Qualified Leads %	10-20%	60%+
Conversion Rate Expectations (Qualified Lead to Customer)	5-10%	25-30%

FIGURE 1
This chart shows that the Intelligent Sales Pipeline model nets double to triple the qualified lead-to-customer percentage.

Business Model: Before with Funnel

- Go-to-Market Approach: Website with SEO and Limited PPC
- Ideal Customer Profile: No
- Monthly Web Volume: 10K
- Qualified Leads: 1%
- Sales Conversion Rate: <1%
- Average Order Size: $4,500
- Qualified Active Pipeline: $8-10MM
- YOY Growth Rate: Up and Down
- Gross Margin: Flat

Business Model: Today with Smart Pipeline

- Go-to-Market Approach: Website with SEO and Limited PPC and Outbound Account-Based Marketing
- Ideal Customer Profile: Defined and Refined
- Monthly Web Volume: 3.5K
- Qualified Leads: 5-7%
- Sales Conversion Rate: 25-30%
- Average Order Size: $50,000+
- Qualified Active Pipeline: $30-36MM
- YOY Growth Rate: 20%
- Gross Margin: Up 4-5%

FIGURE 2
A Smart Pipeline sales approach can yield more qualified leads, larger average order sizes, and higher gross margins.

How fabricators can survive the shutdown

Less business gives shops a chance to refocus the business

By Russ Branton, Kathy Conrad, and Dan Davis

Editor's Note: This feature is adapted from "Surviving the Shutdown: 3 Key Areas of Focus," a webinar presented by Russ Branton of FMCS Co. LLC and Kathy Conrad of Salvagnini America Inc. on June 25. To access the webinar, visit https://www.salvagnini-america.com/surviving-the-shutdown-post-pandemic-webinar.

An industry survey was conducted in the early summer to get a snapshot of where metal manufacturing companies are today. We also included questions about COVID-19 and how the pandemic has affected people's businesses.

When we look at the 330 people who responded to the survey, we had a good mix across several different industry groups, with the highest percentage classified as involved in sheet metal manufacturing, producing components or assemblies for industrial or consumer applications.

The question asking if they have been affected by COVID-19 reveals that more than 90% of respondents have been and more than 60% have been moderately or strongly affected (see **Figure 1**). That is a huge number. Of course, many companies deemed nonessential were forced to shut down or severely curtail their operations. Those that remain open are dealing with unplanned staff shortages, altered production schedules, increased safety protocols, and lower overall productivity. Many investments have been delayed or deferred until conditions improve.

Even with these challenges, companies are adapting in several ways, putting their best foot forward to tackle the challenges that they have now (see **Figure 2**). How are they adapting? The first way is teleworking, which has quickly become the lifeline for staying connected and keeping the business moving forward. We not only see survey respondents taking steps to deal with the lower demand for their services, such as workforce reduction, but also focusing on the business, with new efforts in marketing and new product development.

Clearly the biggest concerns going forward are reduced or uncertain demand, raw material lead times, reduced capital expenditures, and reduced workforce (see **Figure 3**). The raw material lead time is understandable given that suppliers are open but not fully operational.

Just over 70% of our respondents replied that they anticipated a reduction in sales this year (see **Figure 4**). As an example, one contract manufacturer of food service equipment indicated that he had seen a 90% reduction in daily shipments to a company that supplied a major fast-food company. That's a huge number that he was able to partially offset with work from others.

It is to be expected that manufacturing companies are revising forecasts frequently as the year continues. The decrease in sales revenue will certainly challenge many to reduce costs to maintain profit margins.

One bit of encouraging news is that colleagues involved in machine tool sales in Asia reported that their businesses have recovered very quickly and sales activity levels are tracking within 95% of the past two fiscal years. The metrics being followed, including customer inquiries, application reviews, quoting, and order intake, are all in line with the previous two record years. This is also being echoed by colleagues in Europe, as both regions are a little bit ahead of North America in the COVID-19 recovery curve.

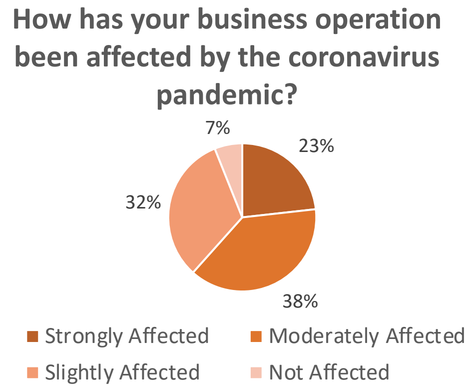

FIGURE 1
The COVID-19 crisis has affected a large majority of manufacturers, according to a survey conducted by Salvagnini America Inc. in the early summer. Only 23%, however, have been "strongly affected."

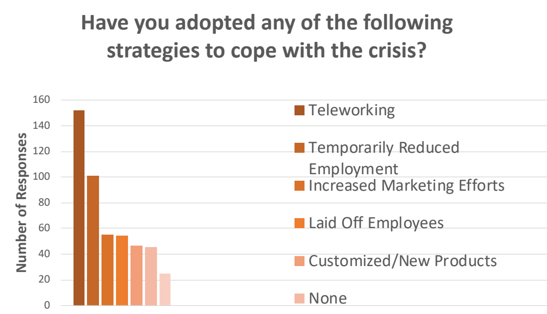

FIGURE 2
Remote working and temporarily reducing employment hours were the two most common strategies that manufacturers have used to deal with the drop in demand that coincided with the pandemic.

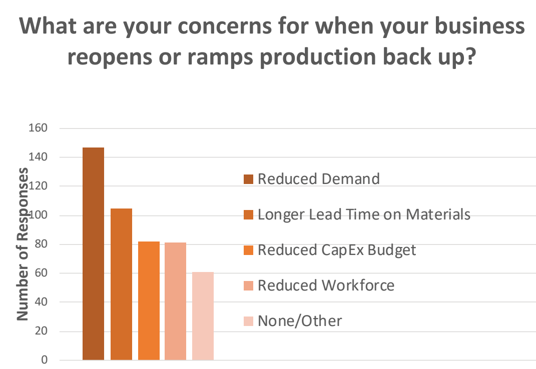

FIGURE 3
Coming out of the pandemic, manufacturers rank reduced customer demand as their No. 1 concern.

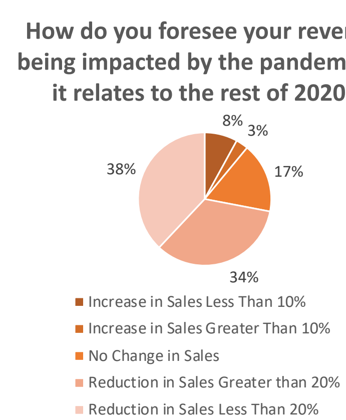

FIGURE 4
Only 34% of the manufacturers surveyed expect 2020 sales to be reduced more than 20%.

What Happens Now?

If there's a silver lining with this reduction in demand and business activity, it's that a company can take the time to focus on the business. In particular, a company can now look at three considerations for going forward.

Product Evaluation. The survey revealed that uncertain product demand pervades the market. That's a primary concern for manufacturers going forward. This is a great opportunity for a manufacturer to evaluate its product mix. It can assess what product manufacturing drives the business and look at it for long-term growth potential and profitability. The company can ask itself, "What do we do well?" and "How are our products going to drive recovery and growth?" In the product assessment criteria, it can obtain input from all departments and seek customer feedback.

This type of discussion can lead to targeting a new market segment, like health and wellness. How can the company capture a large market share, and how does pricing and delivery affect that market share? That's just a portion of the conversation that also includes considering industry trends and barriers to growth.

Product Redesign. One of the goals for all product reassessment activities is to keep employees engaged and energized and to produce the desired products that meet and exceed customers' needs. Metal manufacturers should realize that machine tool vendors have seen reduced business activity as well. Now's a great time to work together on new initiatives, which might include product redesign or new product introduction.

Design for manufacturability (DFM) can be another area of focus. DFM can increase profits on existing products by eliminating costly steps in the manufacturing process through efficient product design.

One example of a recent DFM project occurred in the lighting industry. The part was a 2- by 2-ft. light fixture for office environments (see **Figure 5**). These assemblies are typically made of three or more sheet metal components, each individually produced through multiple workstations, possibly over a couple of days. By using an automated panel bender, designers were able to create a plan to make the light fixture from a single sheet metal blank in a single machine cycle. It's now formed in 90 seconds with 36 bends. It's a part ready for assembly.

This entire DFM project begins in the office. A part designer creates a 3D model, defining what the outside geometry of the finished part is going to look like. The 3D model is then imported into the machine programming software, and the machine tool takes it from there and forms the part.

The machine operator simply calls up the part to be produced, walks over, picks up the punched or laser-cut blank, and presents it to the automated panel bender. While the machine operator was picking up the blank, the machine is setting up the tooling. The operator drops the part on the table and hits start. Everything from that point on is automatic (see **Figure 6**). The operator is able to do a secondary operation in the work area during the machine cycle. The panel bender takes the blank and rotates to each side for bending, indexing into the tooling where an upper and lower blade system makes a range of motions to produce the bend geometry. The machine works from the outer edge and into the center of the part.

Once the part is bent on one side, the machine raises the tooling, and the part indexes, rotates, and comes in with the second, then third, and finally the fourth side. Again, in one automatic cycle, a final part, which was once a three-part assembly, is completed at a significantly lower unit cost and is ready for delivery to downstream processes.

This DFM and production process has been used in many industries. In the HVAC industry, designers reconfigured a fan housing and reduced the amount of assembly hardware required. Door and cabinet manufacturers have been able to avoid welding thanks to DFM activities creating press-fit assemblies and new designs that integrate secondary components like stiffeners into the panels.

Also with DFM, a manufacturer can reconsider the material being used to make a product. For example, a manufacturer can redesign 20- and 22-ga. parts that make up a cabinet assembly to make them all from the same steel thickness.

The net result with DFM is that it challenges a company's manufacturing personnel, engineers, and product designers to work together to find a more efficient process. This is something that can be done today or in the next few weeks.

There are other ways a company can accelerate transformation during this time. A metal manufacturer could invest in new fabricating technology; upgrade its ERP system; introduce e-commerce technology for customers; or add new capabilities, such as machining or painting. It also can initiate training programs for employees during this slower time.

Many companies, including 34% of the survey respondents, are considering automation to reduce labor, to increase throughput and quality, and to maximize profits. This could be a fiber laser system with automated material handling, a robotic press brake for unattended or lightly attended production, or automated punching/shearing systems or panel benders capable of unattended operation.

LIGHT FIXTURE 2

Material	Aluminium	
Thickness (mm) / (gage)	0.6	23
Dimension (mm) / (in)	600x600	24x24
Number of parts	1	
Number of bends	36	
Process time (s)	90	
Highlights	ABS	

FIGURE 5
A typical 2- by 2-ft. light fixture made of 23-ga. aluminum comprises three or more sheet metal components. This particular light fixture was redesigned to be made from one sheet metal blank. It has 36 bends and can be produced on an automated panel bender in 90 seconds.

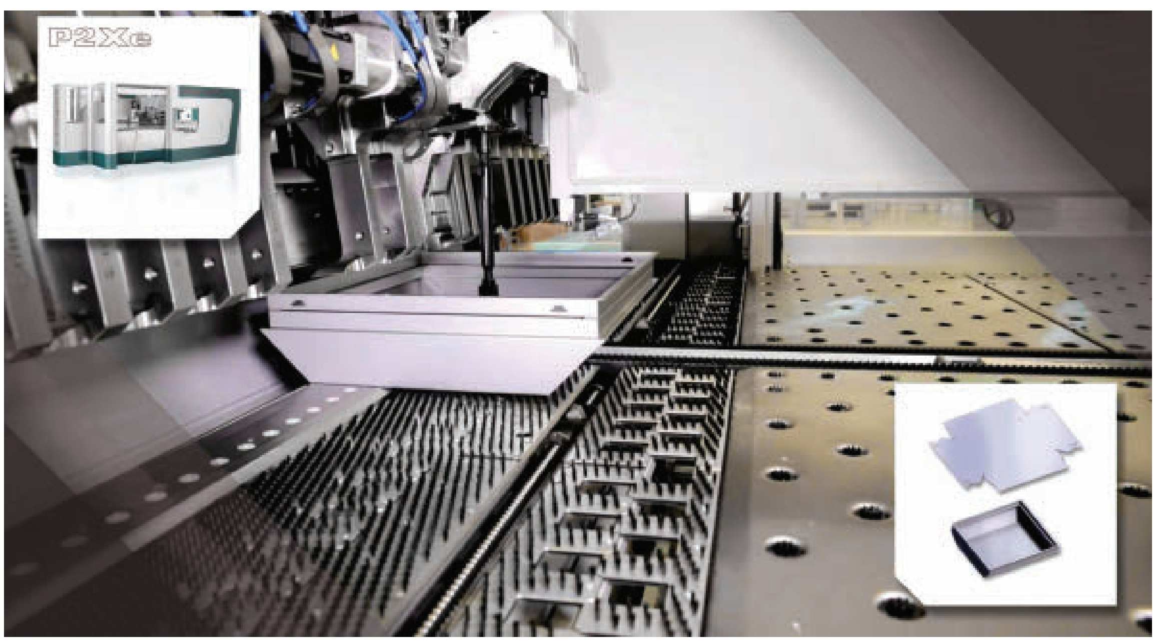

FIGURE 6
The light fixture is fully formed inside the automated panel bending machine.

Automation also can be combined into various configurations to provide for optimal processing of any part at any time. High-mix/low-volume production is now the norm. For many companies, automation can provide any product mix on demand and with minimal labor.

Other accelerated initiatives could be using low- or no-cost supplier financing to add new technology while maintaining open lines of credit with commercial lenders for other needs.

A business also could look at renewing its marketing presence. How long ago was your website updated? What can your company do to improve its social media engagement?

Target New Markets. The final consideration for getting back up to speed after this pandemic is targeting new markets and industries that have immediate growth potential. These include industries that are in demand and growing, such as health and wellness, information technology, e-commerce delivery, transportation, HVAC, and contract manufacturing. This type of growth can come in the form of new product introduction, business acquisition, or partnership.

This occurred recently with a major food service equipment supplier that acquired a large manufacturer of sanitizing equipment. Now the company has a complementary product to its ovens, refrigerators, and other commercial kitchen equipment that it produces.

The survey revealed that uncertain product demand pervades the market. That's a primary concern for manufacturers going forward. This is a great opportunity for a manufacturer to evaluate its product mix. It can assess what product manufacturing drives the business and look at it for long-term growth potential and profitability.

A company can use its existing skills and capacity to supplement the production of others. For instance, how can your company capitalize on the reshoring activity that likely will occur in the coming months?

Company leaders also can leverage and use their contacts to seek out potential needs. For example, a company that owns convenience stores contacted Salvagnini to find out who could fabricate point-of-sale shields. Salvagnini referred them to a company that was able to do the work and satisfy the needs during the same week.

A manufacturer can put together an in-house team that meets biweekly to identify new opportunities. The team could connect and interact with stakeholders, investigate production parameters, and respond with proposals to secure new orders.

It's clear that there's a lot of uncertainty going forward. To deal with this, companies need to be present and proactive. They can't wait for the return to normal. They need to create a new normal and ensure the organization's continued success. ***FAB***

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Avoiding mistakes while providing data for a BOM table

A hinge model reveals how to ensure the information remains correct, even as new models are made

By Gerald Davis

Figure 1 shows a tote box assembly's bill of materials (BOM) table. The 3D model was introduced in the previous episode of this column. A frequent reader of *The FABRICATOR* has asked about inclusion of cut length and cut width in the BOM. It is possible to do so. (See the highlighted portion of Figure 1.) But data entry errors have created a sense of sadness. This is a case of garbage in, garbage out.

As we look to goof-proof the data entry, we'll be covering specific procedures that are specific to a major CAD software brand. First let's cover some bad news, and then we can jump into how to do it.

CAD jockeys with experience from the early days may remember how the value of a dimension and the length of a line that that dimension points to could be controlled separately. This made for low overhead for the computer graphics, but also made for great confusion among humans trying to scale or visualize the drawing. Modern CAD software links the line length to the dimension value for less confusion over scale versus shape.

Manually entering information such as cut length and cut width creates real danger that the BOM table will display incorrect data if future edits are not made correctly because the modeled length is controlled separately from the displayed cut length. Linking values to modeled features is one technique to goof-proof the data entry for BOM table information. But even with that in place, the meaning of "cut" and "length" can be an exercise in enforced policy and procedure.

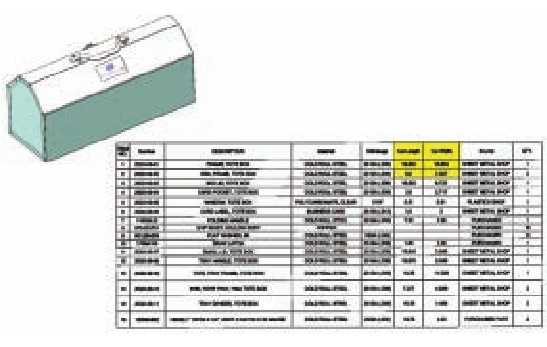

FIGURE 1
A BOM table for a tote box is shown. Columns for cut length and cut width show flat blank size, finished saw cut, or bounding box size depending on the type of component.

Consider the hinges that are welded to the lids of the tote box assembly. **Figure 2** highlights the hinges' BOM entry. We are interested in line item No. 16. The cut length is shown as 18.75 in.

Suppose that the purchasing department orders 18.75-in.-long hinges per the BOM table. Without knowing the tolerance or how to stake and split the knuckle during cut, or how to deburr it, the result could still be OK.

More consistent production will result if purchasing understands that "cut length" is informational, but not sufficient for manufacturing. The folks on the shop floor somehow must know that raw hinge stock is 6 ft. or so long, and purchasing has to round the cut length to the nearest foot to get three finished hinges per raw stick. (In this example, 18.75 in. becomes 24 in.) Eliminating "somehow" is a matter of policy and procedure that accompanies the decision to include cut length in the BOM table.

While pondering Figure 2, please take a peek at line item No. 15—the tray divider. This sheet metal part has a flat blank size of 18.25 in. by 1.464 in. Is that the final cut size? If this is farmed out to job shops, will they all use the same flat blank layout? Probably not.

Is the flat blank size supposed to be the cut size for the raw blank? Should the cut size be some nesting in the sheet size, which is 48 by 96 in.? These questions are answered by policy and procedure and, in turn, influence the CAD technique implemented.

In this scenario, it is desirable to display the modeled (finished) size as the "cut size." For sheet metal parts, the flat blank size—also known as the cut size—is modeled using an approved bend deduction and bend radius.

For parts made from sticks of raw material, the "cut length" shall be the modeled/finished length. The cut width is the unfolded hinge or finished dimension of the part.

For purchased parts, such as handles, rivets, and latches, the cut length and width are not linked to the model. They represent a bounding box that would contain the component.

Now, for the Next Act ...

With such policy and procedure in mind, we turn to the mechanics of linking dimensions to product manufacturing information (PMI).

The general procedural plan is to use the BOM table to display PMI stored in the components of the assembly. By "components," we mean parts or subassemblies of parts. In **Figure 3** the sheet metal frame and its end pieces are examples of components that provide PMI for line items in the BOM table.

Figure 4 is a Cut-List properties table in the sheet metal frame. This table is created by the software when a flat layout configuration is created.

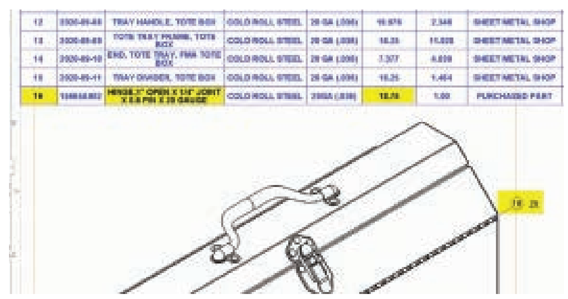

FIGURE 2
The hinge is line item No. 16 in the BOM table. The cut length of 18.75 in. is the finished size. A limitation of the BOM table is that it does not show tolerance or how to cut between the knuckles on the hinge. Perhaps another drawing is required. Perhaps policy and procedure is required to define how many parts come out of a raw stick of material.

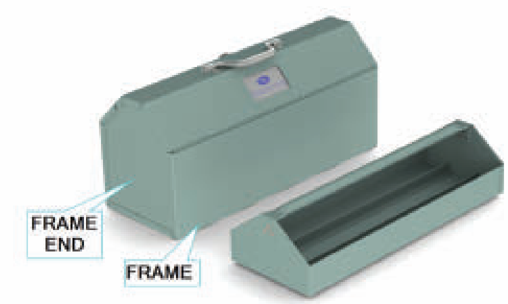

FIGURE 3
The components of the tote box include a frame and frame ends. These components drive line items displayed in the BOM table.

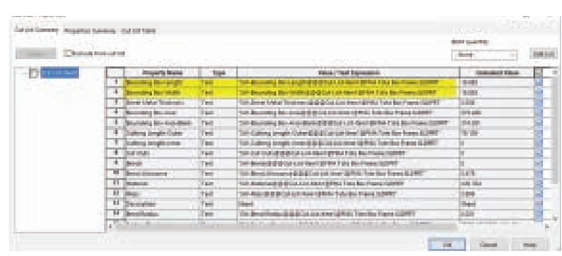

FIGURE 4
Sheet metal parts, which have a bounding box in their flat layout, also have a Cut-List property table that shows the length and width of the bounding box. The trick is to copy the value—for example, "SW-Bounding Box Length@@@Cut-List-Item1@FMA Tote Box Frame.sldprt"—so it can be pasted into another table.

ummary Information

Summary | Custom | Configuration Specific

Delete

	Property Name	Type	Value / Text Expression	Evaluated Value
1	Number	Text	2020-09-02	2020-09-02
2	Description	Text	END, FRAME, TOTE BOX	END, FRAME, TOTE BOX
3	Type of Part	Text	Fabricated Part	Fabricated Part
4	Revision	Text	A	A
5	Material	Text	COLD ROLL STEEL	COLD ROLL STEEL
6	SMGauge	Text	20 GA (.036)	20 GA (.036)
7	Tolerance	Text	X.XXX±0.020 X.XX±0.03 X.X±0.1 ANGLES±1°	X.XXX±0.020 X.XX±0.03 X.X±0.1 ANGLES±1°
8	Deburr	Text	REMOVE SHARP EDGES	REMOVE SHARP EDGES
9	Finish	Text	FREE OF GRIT AND OIL	FREE OF GRIT AND OIL
10	Source	Text	SHEET METAL SHOP	SHEET METAL SHOP
11	ModeledBy	Text	G. DAVIS	G. DAVIS
12	ModeledDate	Date	7/19/2020	7/19/2020
13	Client	Text	THE FABRICATOR MAGAZINE	THE FABRICATOR MAGAZINE
14	ClientStreet	Text	2135 POINT BLVD.	2135 POINT BLVD.
15	ClientCity	Text	ELGIN, IL 60123	ELGIN, IL 60123
16	Owner	Text	FABRICATORS AND MANUFACTURERS ASSOCIATION, INTL.	FABRICATORS AND MANUFACTURERS ASS
17	Proprietary	Text	(C) 2020 FMA COMMUNICATIONS, INC.	(C) 2020 FMA COMMUNICATIONS, INC.
18	Cut Length	Text	"SW-Bounding Box Length@@@Cut-List-Item1@FMA Tote Box Frame End.SLDPRT"	8.5
19	Cut Width	Text	"SW-Bounding Box Width@@@Cut-List-Item1@FMA Tote Box Frame End.SLDPRT"	7.027
20	<Type a new property>			

FIGURE 5
Paste the values from Figure 4 and create your own properties for PMI. Cut Length and Cut Width are shown as examples. The BOM table requires that every component have these two properties. If you're looking closely, you'll notice that the file name (FMA TOTE BOX FRAME END.SLDPRT) changed between Figure 4 and Figure 5. These custom property lines (Nos. 18 and 19) can be copied and pasted between components to speed typing. The file name updates itself if it can find a sheet metal flat layout bounding box. To help with this exercise, create the bounding box before pasting these new properties in from another completed component.

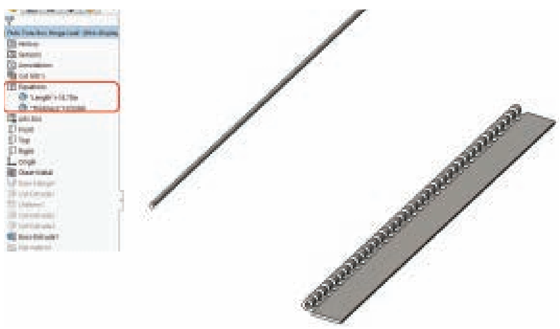

FIGURE 6
The PMI for the hinge comes from the extruded length of the pin (18.75 in.) that is defined in an Equation (also known as "Length") that is used to set the value for the property "Cut Length." The model for the hinge has three configurations—two for leaves and one for the pin. The leaves are excluded from the BOM. Only the PMI in the pin configuration matters to the BOM.

Here's a CAD tip: The flat layout configuration, bounding box, and Cut-List properties are automatically created by inserting a part as a flat pattern into a slddrw file.

The sheet metal flat layout displays a bounding box that includes just the flat part. The bounding box has properties for size in the Cut-List table that do not appear in the PMI table. The trick is to copy "SW-Bounding Box Length@@@Cut-List-Item1@FMA Tote Box Frame.sldprt" and paste it into the File Properties Table (see **Figure 5**).

In Figure 5 we see policy and procedure in action. The name of the property "Cut Length" matches what our BOM table template is looking for in order to display our Cut Length. Note the pasted value of the Cut Length property from the Cut-List property table.

The hinge—see **Figure 6**—represents a few additional CAD tricks. The hinge model has three configurations—pin, leaf1, and leaf2. Only the pin is

Linking values to modeled features is one such technique to goof-proof the data entry for BOM table information. But even with that in place, the meaning of "cut" and "length" can be an exercise in enforced policy and procedure.

included in the BOM table. The leaf models are excluded from BOM. The pin has an extruded length of 18.75 in. It has an equation that is set to the extruded length. The equation value, which is the length, is used to set the value of the property known as Cut Length.

The hinge leaf configurations derive their length from patterns of cuts and extrudes that are not as easy to link to an equation as the extruded length of the pin is. That's the entire motive in this hinge PMI demonstration.

Congratulations! You made it through a convoluted topic. Now for the problem of 18.75 versus 18.750, also referred to as the case of the trailing zeros in the BOM table. The newest version of this software is required to display trailing zeros. The Detailed Cut list is the secret check box, but you can't forget the document property to show trailing zeros. ***FAB***

Gerald would love for you to send him your comments and questions. You are not alone, and the problems you face often are shared by others. Share the grief, and perhaps we will all share in the joy of finding answers. Please send your questions and comments to dand@thefabricator.com.

Read more from Jeff Sipes at
www.thefabricator.com/author/jeff-sipes

Lean's role in business development

How lean manufacturing can be a powerful marketing asset

By Jeff Sipes

If your company has invested in lean processes, you have a marketable asset. If you're beginning the lean journey, you should be thinking about how this can be a marketable asset. If your company has no intention of exploring and implementing lean ways of conducting business, others might just leave you in their dust.

It sounds harsh, but there's a good reason to take it to heart. As companies emerge from the disruption caused by the pandemic, they have an opportunity to change their standing in the marketplace.

The Lean Way

You've streamlined work flow, boosted throughput, made what is important clearer, and substantially cleaned and organized workplaces. And you've made the operation safer for employees.

Because you've simplified information flow, you've reduced the need for so much shop floor reporting. As the material flows directly from operation to operation, bypassing the exit ramps of warehouse and work-in-process inventory locations, there is less need for detailed reporting. Less reporting means that the information that's truly needed is more accurate and requires less reconciliation.

All this challenges the traditional managerial reporting relationships. As the operations get simplified and the employees get tuned in to operating in a lean way, you can push day-to-day decision-making deeper into the organization. Your supervisors and managers spend more time *improving the system* and less time *working in the system*. The role of the supervisor and manager changes from overseeing and directing to leading and coaching. At this point you are conducting business in a lean way.

You have relentlessly driven non-value-added work out of your production, office, and administrative processes. As a result, you can focus on optimizing the remaining value-added work. Financial performance improves, freeing up cash to reinvest in the business.

Lean thinking makes your business strategy possible. The strategy includes how you approach customers and prospects, those targeted companies for which you're putting on your full-court marketing press, along with companies outside your prospecting sphere—those hunting for fabrication capacity yet don't know you exist.

Customers and prospects value what you value: consistency and predictability. When people at your company commit—be it to a delivery schedule, certain activities in new product development, or anything else—they follow through.

Customers appreciate having few surprises. Even when a surprise arises, such as a product defect, missed delivery date, or billing error, your company quickly jumps on a root cause-based analysis and finds a resolution.

Streamlined and clearly defined processes minimize variation in both the products you ship and the information you communicate to customers. All this builds greater customer confidence, which in turn leads to greater business opportunities, not to mention greater economic security for your workforce and stakeholders. Your lean journey enables this virtuous cycle.

Make Lean Investment a Marketable Asset

As you look at your lean journey through the lens of internal benefits and external marketplace benefits, you'll discover that it's a marketable asset, especially if your competitors' lean investments are lagging or nonexistent. So how can you make your lean investments a marketable asset that will help develop an optimal customer mix and strong financial performance? How can you make your lean investments a driver in your business development strategy?

> Even if you've invested heavily in lean and continue to reap its benefits within the walls of your company, you still could be leaving opportunity on the table if you do not treat your lean environment as a marketable asset.

Imagine your shop floor, with all the elements of your lean journey on display, as a showcase for business development. What would that look like to customers as they walk through your facility? Let's take that walk and look through the customers' eyes.

The Shop Tour, Real or Virtual

A tour of a lean shop can be a powerful marketing tool, and it's an adaptable one too. Visits can be real or virtual. During this time of social distancing, anyone with a smartphone and perhaps some inexpensive video-steadying equipment can become a tour guide.

You greet your customers in the lobby, face-to-face or virtually, and lead them to a neat and orderly conference room. A first impression is made. 5S and visual management are evident. On the wall they see key, easy-to-understand, up-to-date metrics displayed indicating your performance as it relates to quality, deliveries, throughput velocity, and cleanliness. You've set the tone for a great plant visit.

You pass through to the office. It might be nearly empty during the pandemic, evidence that you have remote processes in place to keep work flowing. But even during an actual tour with an office full of workers, the place has a library feel—no loud arguments, no rush to correct problems, no competing for a constrained resource like a robotic welder or a machining center. A calmness permeates the space. People seem to have what they need. Moreover, customers on the tour can tell what functions are located where. They can "see" the flow of information.

As the tour continues to the shop, customers see clean floors in every workcell and clearly marked aisles. They see where pedestrians are expected to walk and where material is expected to flow. And they can see from one end of the shop to the other. All this instills a sense of clarity.

Customers stand at the edge of a workcell and observe the welder performing her work. The tools on the shadow board are clearly labeled. If a tool is not in use, it is hung in the appropriate location. It is easy to see where incoming material and the outgoing products are staged on the floor. The welder's movements are efficient. Every move seems to have a purpose. It is clear what the welder is working on and what she is doing, because standard work instructions are evident in the cell.

A customer chats briefly with the welder and comes away with a sense that she knows what she is doing, understands her impact on upstream and downstream processes, and takes pride in her work.

As you continue through the shop, customers see the flow. Visual management makes it clear where material should move. The kanban squares indicate how much material should be staged where and where the process constraints are. Movements occur at a measured pace, and customers truly feel the rhythm of the shop.

One customer speaks with a production supervisor, who describes how he is using *takt* time to manage his operation. Instead of fighting the latest fire, he focuses on making sure employees have all the resources they need. The supervisor describes how the employees are involved in the plant's total productive maintenance (TPM) process and how maintenance technicians provide tender loving care to the equipment.

The supervisor also describes how he spends about a quarter of his time improving processes and coaching production employees. Customers get the message. This is not your typical production supervisor.

Imagine what your customers are thinking during the tour: *This plant really has its stuff together.* That is a good thing for business development.

Even if you've invested heavily in lean and continue to reap its benefits within the walls of your company, you still could be leaving opportunity on the table if you do not treat your lean environment as a marketable asset that helps your company develop new business.

What does the customer want? Consistency, predictability, a sense that the supplier knows what it's doing, and confidence that problems will be resolved at a root cause level quickly and fairly. Make it easy for customers to say yes! ***FAB***

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Read more from Steve Benson at
www.thefabricator.com/author/steve-benson

Sometimes lying is the right thing to do

... if it works

By Steve Benson

Before I get to the question at hand, I should review the topic of lying. What is it, why do we do it, and what are the possible ramifications? We know better, but we still do it.

As children we were told not to lie. We were told about the consequences of deceiving others. Some of us got the message immediately, while others required regular, often painful "encouragement" before the message sunk in, which it ultimately did for most of us.

As adults we teach our children about the morality of being truthful, no corporal punishment required. I like to think we're a bit more enlightened these days—well, some of us anyway.

Lies come in many forms and many colors. If I tell a blue lie, it's for the collective good. If I tell a gray lie, we both benefit. If I tell a red lie, we both lose. If I tell a white lie, I lose in some way but you get a positive result.

OK … wait a minute. What does a discussion about lying have to do with bending on a press brake or, for that matter, sheet metal in general? Before I answer that question, let's look at an inquiry from one of my readers. It got me thinking about when and why it might be OK to lie.

With the age of artificial intelligence (AI) upon us, is it OK to lie to a machine to obtain a better outcome? Will the machine notice our lying? Will AI at some point find out we're liars and refuse to work with us? Or will it accept the lie for what it is? Yeah, you're probably saying to yourself, *That ain't never gonna happen 'round here.* Think again. It's coming fast.

OK, with all that said, now on to the question.

Question: *We're maxing out our angle correction at -14 degrees to get a 90-degree bend in 301 half-hard stainless steel using an 86-degree punch and die angle. We routinely subtract 14 degrees to get a 90-degree bend, and often we are a couple of degrees open.*

I do not like the idea of "lying" to the machine. It seems like the operation has a lot of stress and strain, and ultimately the material is being coined. Do you have any rules for forming material with so much springback?

Answer: I would rather not lie to machines, yet sometimes we must lie to the controller for the sake of getting good parts.

Regarding tooling, if you are getting high tonnage loads and you hear the press brake straining, you may be using a die opening that is too small. I recommend you check your die size and make sure it's appropriate. Remember that smaller die openings relative to the material thickness tend to increase the number of angular variations and springback found in a part .

Regardless, the amount of angle correction you're applying does seem a bit high; you should seriously consider having your press brake and controller recalibrated. Recalibrating the press brake should get you much closer to your desired angle with less correction. That itself will reduce the need for you to lie. Until then, you might need to continue to lie to the machine, and you can only hope the controller (and its AI) will not pass judgment on you for lying to it.

Before resorting to the white lie, though, analyze your application, including your bending method, the tooling you're using, and, not least, the consistency of the material you're bending.

Bending Method

I assume you're air bending (see **Figure 1**). Because you're using 86-degree angles on both your punch and die, you're probably not bottom bending or coining (see **Figures 2** and **3**). Coining, a rarity in the modern shop, requires the punch to penetrate the material to a less-than-a-material-thickness position.

Bottom bending requires angular clearance, with the die having a greater (more open) angle than the punch. A typical bottoming setup for a 90-degree bend in stainless steel would use a punch cut to an 88-degree internal angle; the die, which sets the angle in a bottom bend, would be cut to 90 degrees. The 2 degrees of angular clearance between the punch and die compensate for springback. For more on this topic, check out "Taking the danger out of bottom bending," archived on thefabricator.com.

Material Variables

The modern press brake is a remarkable machine by any standard. It touts ram and backgauge-location repeatability measured in microns. The machine's controller calculates exact values based on pure mathematical modeling, predicting the backgauge location and the ram's depth of penetration into the die space. In manufacturing, AI is rising.

Modern precision-ground tooling is just as nice. Precise to ±0.0004 to ±0.0008 in. over 3 ft., precision-ground tools are required to get the most out of any modern press brake.

If you have a modern brake and are using precision-ground tools, why are your calculations way off the mark—putting you as the operator in the position of having to lie to the controller just to produce parts?

Again, because you need to correct the angle by a full 14 degrees, your machine controller might need calibration. Generally speaking, though, even modern machines and controllers can be off the mark. Why? It often has to do with the material being formed.

Materials represent the one variable we still cannot control. Regardless of where you purchase your material, each batch will be slightly different from the last. With so many material variables in play, you will begin to understand why you may need or even want to lie to the controller.

The variability goes beyond just the material type. It also has to do with the material's fundamental components. What is the percentage of iron, nickel, and chrome? Steel is produced from iron and carbon, and stainless steel contains at least 10.5% chromium.

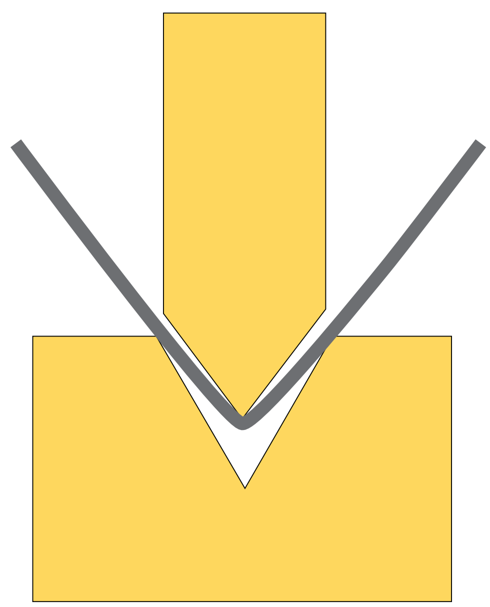

FIGURE 1
In air bending, the inside radius forms as a percentage of the die opening, and the punch's depth of penetration into the die space determines the bend angle, accommodating for springback.

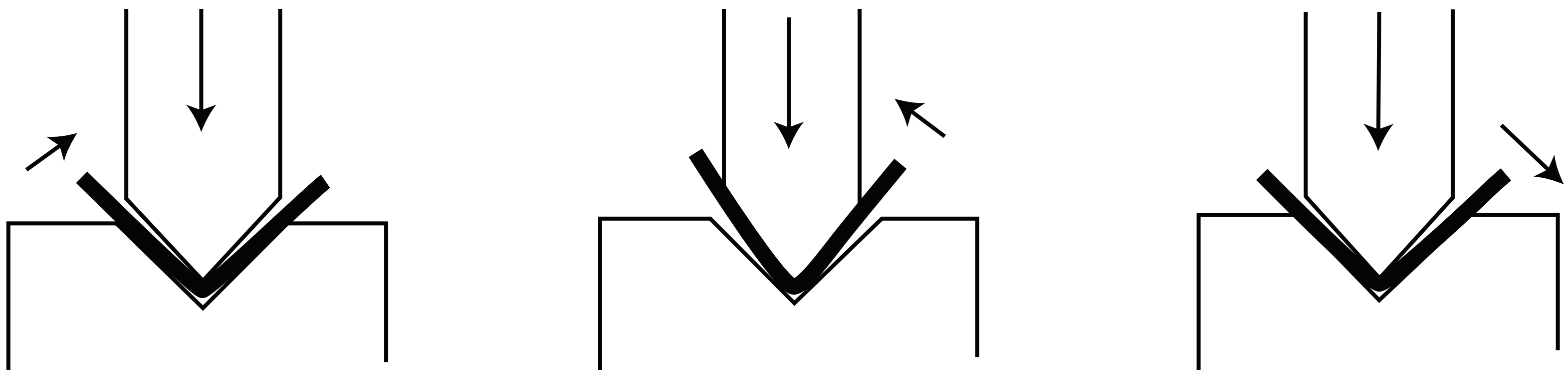

FIGURE 2
Bottoming (different from coining) requires angular clearance between the punch and die. The die angle determines the bend angle.

Is the material hot- or cold-rolled? Is it coarse- or fine-grained? Is it anisotropic (bending angle is affected by the grain direction) or isotropic (the material has little to no noticeable grain direction and bend angles are not affected)?

And we're just getting started. Is it full- or half-hard? Is it rolled to a gauge? Remember, each gauge has a tolerance range. For example, 10 ga. can be as thin as 0.1285 in. and as thick as 0.1405 in., with a nominal thickness of 0.1354 in. That's a variation of 0.012 in.

The variation in thickness creates another problem. Because we float a radius when we air-form, the final bend radius will vary a little. If the radius changes, so do the bend allowance and the bend deduction, perhaps enough to knock the backgauge off the calculated location.

Of course, we would not want to forget our old friend, the temper. Is the metal soft or hard? Like the variables I just mentioned, temper also has an acceptable tolerance zone, as do the material's yield and tensile strengths. For more on this topic, check out "Don't forget about sheet metal tolerances," archived on thefabricator.com.

Changing material variables make it impossible to calculate exact values for an angle or dimension. They leave us with only one option: the white lie, where you lose in some way to attain a positive result. In this case, you give up on the values being perfect every time, while the machine gets a positive result and makes excellent parts.

Lying to machines has consequences, just like lying to people does. I've lied to machines in some way and then have had to set up the same job the next day. The controller remembered changes to the program, but it didn't remember changes to the origin position, origin points, or other aspects of the physical environment. Making the parts a second time was just as challenging as the first time.

Springback

Another variable is, of course, springback. You can never get rid of springback entirely, though you can minimize its effects.

The punch nose radius is an essential part of how much springback you will encounter. The closer you can get to a one-to-one inside bend radius-to-material-thickness relationship, the better. Again, in air bending the inside radius is produced as a percentage of the die opening. Once you choose your die opening and determine what the floated radius will be, you choose a punch nose radius that's as close as possible, though does not exceed, that naturally floated radius.

At the other end of the spectrum, profound radius bends—which have an inside bend radius greater than 10 to 12 times the material thickness—suffer from multibreakage, where the material separates from the punch nose during bending (see **Figure 4**). Multibreakage occurs because of the springback found in all types of material. The phenomenon also shrinks the inside radius and, without corrective action, will change the bend allowance and bend deduction.

Avoid Sharp Bends

Avoid having a sharp relationship between the punch nose and the material, where a narrow punch nose penetrates and creases the material surface. Bending sharp succeeds only in amplifying bend angle and springback variations. For more on sharp bends, see "How to avoid a sharp bend," archived on thefabricator.com.

Where and when a bend turns sharp is a bit of an arbitrary thing. As a guide, you can refer to the free sharp calculator on my website, theArtofPressBrake.com, under the "Tools" tab on the main menu bar.

When It's OK to Lie

The subtleties abound in press brake operation, and even modern machines with advanced controls don't account for them all. In these cases, it's OK to lie.

Before resorting to the white lie, though, analyze your application thoroughly. Again, your machine might need to be recalibrated. If the machine is calibrated correctly, go back to the basics.

If you're air bending, the bend angle is set not by the die angle (as it is in bottoming) but by the punch's depth of penetration into the die space—a depth that includes overbending to account for springback. The radius forms not from the punch radius but as a percentage of the die opening (for stainless steel, it's 20% to 22%, though the percentage varies with tensile strength). And in many of the most consistent bending operations, the inside bend radius equals or is close to the material thickness.

Do you have the correct die width that gets you close to that one-to-one inside-radius-to-material-thickness relationship? Is the punch radius large enough to avoid a sharp bend yet still smaller than the naturally floated radius in the part?

If the brake is calibrated and the operational fundamentals are sound, alas, you might have to lie to the controller. But because you'll be telling white lies, we can only hope that the AI within the machine controllers, now and (especially) in the future, will not remember that we lied and not judge us too harshly for current folly, at least in the long term. ***FAB***

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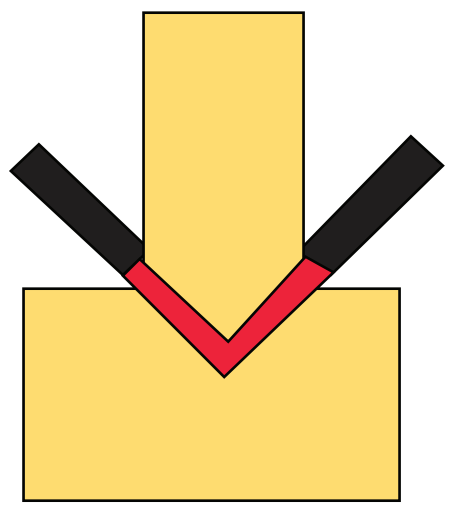


FIGURE 3
Rarely performed in the modern fab shop, a coining operation penetrates the material thickness.

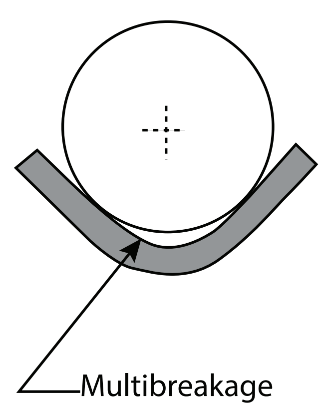
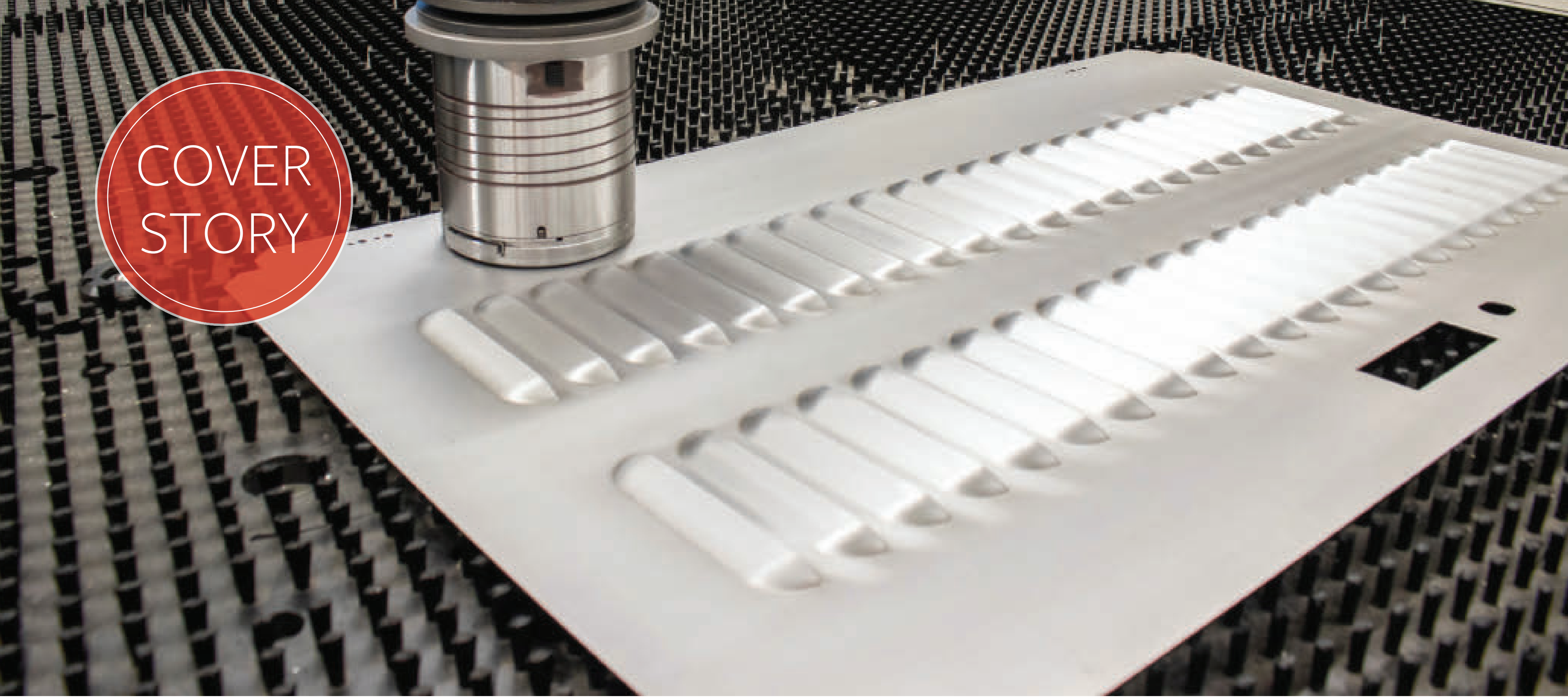


FIGURE 4
In this multibreakage scenario, the sheet metal pulls away from the round punch as it descends. This shrinks the inside bend radius, which in turn alters the bend allowance and bend deduction.



How to perfect the punched edge

A troubleshooting guide

By John Ripka

Worldwide, CNC punch press operators produce millions, if not billions, of parts monthly. The process appears straightforward, but the subtleties abound. Sometimes part quality is affected by its finished edge.

How do you avoid producing parts with inferior punched edges? As with so many problems in metal fabrication, various factors come into play. The trick is to consider them all before jumping to a conclusion, taking corrective action, and discovering that your edge problem stubbornly persists.

Tool Sharpening

Worn or dull tooling can produce punched edges with more burrs. Increased burring can affect the way parts assemble and can be a safety hazard when handling parts. Dull tools also force machines to work harder to produce the same holes or features, accelerating machine wear and maintenance.

When a visibly larger rollover appears on a part's punch edge, it's probably time to sharpen the tools. Sharpening tools regularly will help produce good-quality parts and help extend tool life. Tools should be sharpened when cutting edges are worn to a maximum radius of 0.010 in. (0.25 mm).

To inspect for this radius, hold the edge near a light source and look for reflections as the light bounces off the radiused edge. Also try the fingernail test: Lightly (and carefully) drag your fingernail across the edge; if that's enough to lightly shave your fingernail, the punched edge is sharp and the tool has some life left. If you don't see shavings, it might be time to sharpen your tool.

When sharpening tools, it's best to remove a small amount of the tool surface more frequently rather than large amounts less frequently. Light, frequent sharpening helps extend tool life and improve part quality (see **Figures 1** and **2**).

After sharpening a tool on a tool grinding machine, use a sharpening stone to remove the small burr that develops on the punch point. Doing this will create a minimal radius, between 0.001 and 0.002 in., on the tool's cutting edges.

The tools become magnetized when sharpened, so be sure to demagnetize them afterward. Forget this step and you might find punched slugs sticking to punch points and possibly ending up on top of the sheet, where the machine can press them into the sheet and create unwanted marks or dents. Slugs on top of the sheet and close to the punch point might result in a double material thickness being punched, which can damage the sheet and cause premature tool wear.

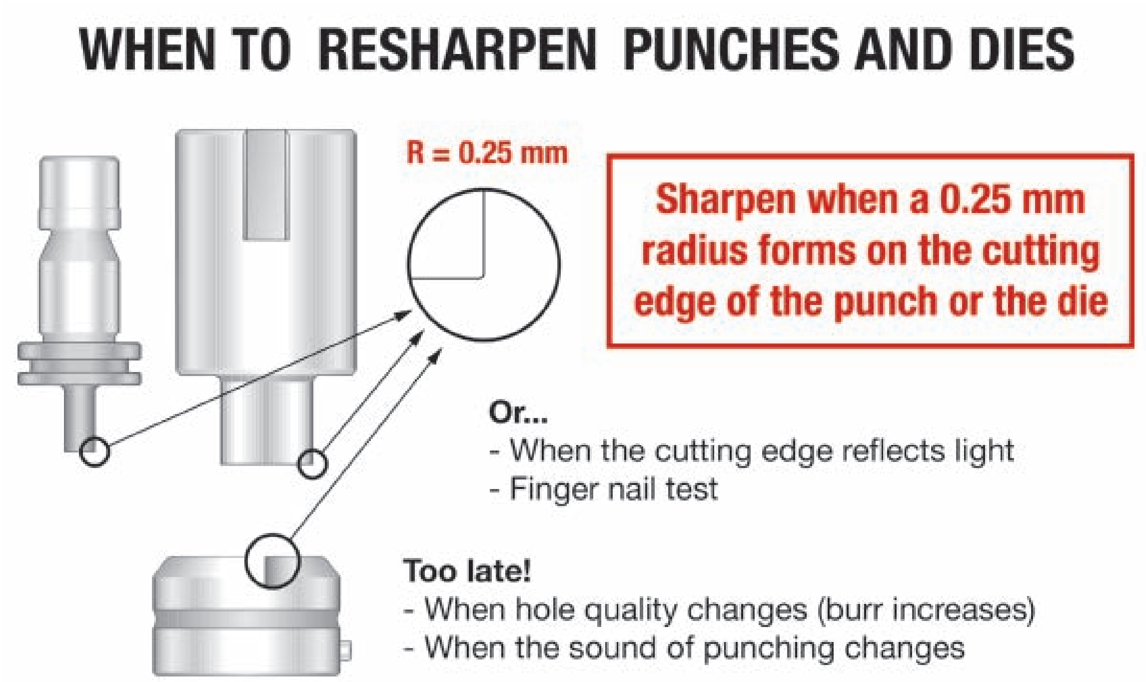


FIGURE 1
When edges have a radius greater than 0.25 mm, it's time to sharpen both your punches and dies.

IMPORTANCE OF FREQUENT SHARPENING

IMPROPER SHARPENING		PROPER SHARPENING	
Total Holes Produced	*Radius Formed*	*Total Holes Produced*	*Radius Formed*
100,000	0.25 mm	100,000	0.25 mm
50,000	0.50 mm	100,000	0.25 mm
25,000	0.75 mm	100,000	0.25 mm
10,000	1.00 mm	100,000	0.25 mm
185,000 Total Hits	***1.0 mm Total Removed***	***400,000 Total Hits***	***1.0 mm Total Removed***

More than *DOUBLE* the tool life when sharpened frequently!
= Lower cost per hole!

FIGURE 2
Proper sharpening can increase the total number of hits you can get out of a tool.

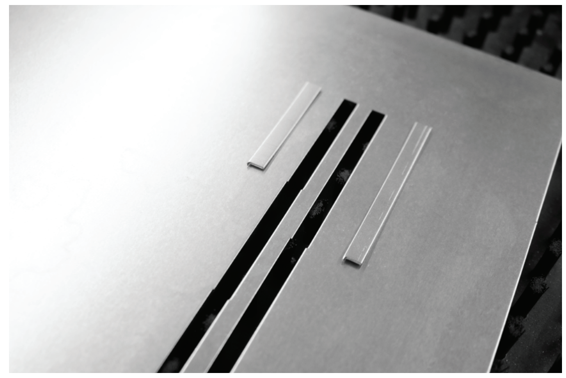


FIGURE 5
Two different-length tools punch with the same overlap in a station that's out of radial alignment, creating a "sawtoothing" effect.

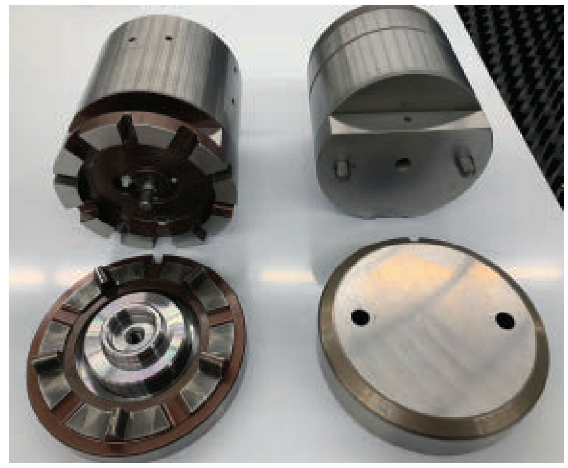


FIGURE 6
Available in two-pin versions and LED models, these alignment tools ensure tools are aligned both vertically and radially.

Dull Tooling

What if you sharpen tools regularly, yet they still don't stay sharp for long? In this case, look at the toolstation alignment. Improperly aligned toolstations cause premature tool and machine wear, poor part quality, not to mention inaccurate holes and features.

Uneven tool wear or excessive burrs along the punched edge might indicate that the station needs vertical alignment (see **Figures 3** and **4**). Vertically aligning tooling stations ensures that the punch pushes the material through the die opening with the same amount of clearance on all sides of the punch point.

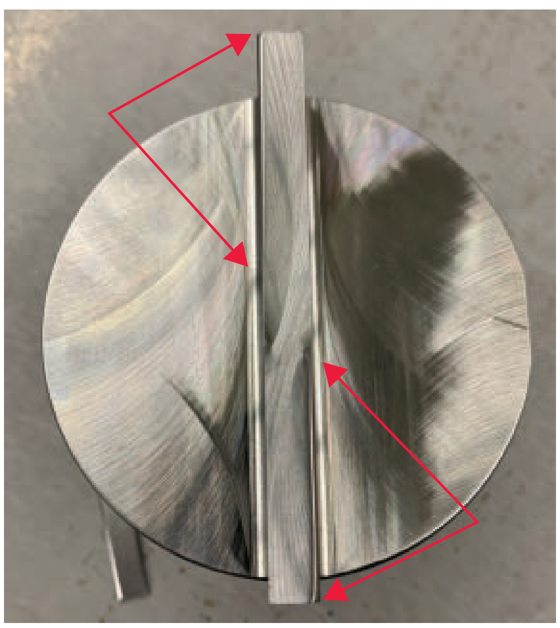


FIGURE 3
This punch is damaged by uneven wear caused by a station out of alignment. Note that the wear is mirrored on opposite corners.

FIGURE 4
This slug was produced by the worn punch in Figure 3. Note the excessive rollover at the ends on opposite corners, tapering toward the middle.

Also check for radial alignment, which keeps edges and contours straight and uniform. Radial alignment refers to the rotation or angular setting of a station. A misaligned station angle can create stepped or uneven punched edges, as well as incorrect angles for shaped punches.

A slitting or parting tool (typically a long rectangle) in a station that's out of radial alignment can produce jagged edges in the punched part, an effect known as *sawtoothing*, creating a small step at the end of every punch location along the edge. It's a good indicator that you need to realign the station radially. The longer the parting tool, the more pronounced the step is (see **Figure 5**).

Every fabrication shop should have a good set of alignment tools for periodic punch station inspections and adjustments. Whether you're using the standard two-pin variety or more elaborate LED tools, both are designed to align tools vertically and radially (see **Figure 6**). To set stations radially, you will typically need a magnetic-based dial indicator and a sturdy steel sheet, ideally 14 ga. or thicker, to traverse the indicator along a screw-on bar for the alignment tool to measure angularity.

To Nibble or Not?

Nibbling can prematurely wear tool edges, which in turn can affect edge quality in holes and contours. A punch tool usually nibbles with one full-sized hit followed by a number of partial hits. Side-loading occurs when less than half of the punch point contacts the sheet surface, with the punch point deflecting toward the open area of the sheet and away from the contact point between the punch and material. Such deflection changes the clearance around the sides or circumference of the punch.

With extreme deflection, or even just a little deflection when punching with very tight clearances, the punch point can actually contact the die edge on the open side of the material, damaging the worn cutting surface in that area. This can cause excessive or uneven burrs, as well as oblong or egg-shaped holes with round punches.

You can avoid nibbling by using specially shaped tools that match the contour being punched. Such tools will produce a better edge and reduce the number of hits required to punch a feature, which also reduces tool and machine wear.

FIGURE 7
Inspect the tool's interior components, including the lifter pins, which should be straight and undamaged.

If you can't avoid nibbling, use fully guided tools, which can minimize punch deflection or eliminate it entirely. With multiple or extended guiding surfaces that control the punch-point position, fully guided tools can be ideal for nibbling applications and punching hole diameters smaller than the material thickness. That said, they might not be the best choice for punching soft materials such as aluminum or hard materials such as stainless steel—both of which are susceptible to galling, or a buildup of the punched material on the punch tip. Galling adds to the punch point's overall diameter and decreases clearance between the punch and stripper (or the punch and die), which can lead to stripping issues, poor hole quality, and premature tool wear.

Treated and Coated Tools

Particularly useful when punching materials with a tendency for galling, tooling treatments and coating options abound. Tooling treatments are typically infused into the punch material to improve its properties, while coatings are thin layers or additions to tooling that add lubricity. Both can minimize or eliminate problems with galling.

Lubricated punch pads, which provide lubrication on the punch tip, can also help reduce or eliminate galling. All of these products will increase tool life and improve tooling performance.

Tool Stripping

Stripping errors can lead to distorted or puckered holes when a punch point sticks in the sheet and doesn't strip properly. If a punch is repeatedly sticking or the sheet is "popping" off the punch point, it might be time for some punch assembly maintenance.

Stripping errors could be caused by worn, damaged, or broken springs in the punch assembly. Although these springs are durable, they may wear over time. If springs are fatigued, cracked, or broken, they should be replaced.

Keep interior punch components clean and well-lubricated. Dirty or dry tooling components—such as the punch body, guide body, guide interior, and turret bore (if applicable)—prevent the springs from performing to their ability and can lead to stripping issues.

If you have turret presses, make sure lifting pins and lifter springs are straight and undamaged (see **Figure 7**), and replace them if they're worn or damaged. Worn or damaged turret keys should also be replaced and aligned when needed.

Because dull tools also can contribute to stripping problems, keep tools sharp and clean. If you are punching heavy or thick material and experiencing stripping problems, consider using heavy-duty tool configurations.

Die Clearance

To create a hole, a punch presses material into and through a die opening. As the material is forced through the die opening, it begins to crack and eventually fracture, producing a slug that is pushed through the die and into a slug collector or scrap bin.

Proper clearance between the punch and die is essential. If the die clearance is too tight, the resulting hole may be good, but the force required to create that hole increases, and stripping becomes difficult. All this generates more heat, which fosters galling on the punch point. At the other extreme, excessive die clearance causes more rollover, or rounded top edges, in the punched part, and increased cracking and fracturing create rough edges and large burrs.

Tool Steel

One type of tool steel cannot punch every material equally well in every application. Should you select a tool with greater toughness or wear resistance? How do you plan to treat or coat your tools?

Consider a tool steel's material composition and know that not all tool steels are created equally. M2 high-speed steel has poor toughness but good wear resistance. A2, an air-hardened tool steel, has good toughness and fair wear resistance. D2, a high-carbon chromium steel, has fair toughness and good wear resistance. S7, a shock-resisting tool steel, has exceptional toughness but poor wear resistance. PM-M4, a powdered-metal tool, has excellent abrasion resistance and fair toughness.

Don't Overlook the Machine Design

Most punch presses are constructed with a C or O (portal) frame. Both can produce high-quality parts at exceptional speeds, though which performs best will depend on the punching applications you have.

C-frame machines have the ram at the top and end of the frame, while O-frame systems have the ram centered within the frame. If processing thicker or heavier material, or if you have high-tonnage applications, you might consider a portal-frame machine. The O-style frame helps prevent deflection or distortion when punching. Higher-tonnage hits might deflect in a C-style machine, where more flexing of the frame is possible.

The Big Picture

Poor edge quality can have many root causes. Poor tool sharpening and maintenance practices might be to blame, but you might find other culprits too. Your machine might be out of alignment. You might need special-shape tools or tools with treatments or coatings. The tool steels in your punches and dies might not suit the application. The machine's design, including its frame type, also can factor into the equation.

If edge problems persist, try not to jump to a conclusion without first considering all the potential causes. Doing so will help you get back to doing what really matters: producing high-quality parts. ***FAB***

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This rafted roll former is designed to streamline the changeover process.

Time to get rolling

The basics behind justifying the roll forming process

The fundamental concepts behind roll forming go back to Leonardo da Vinci. The first continuous roll forming lines can be traced back to the 1910s. Yet even after all this time, many still don't know what roll forming really is. It's a staple in certain sectors like automotive, aerospace, and the metal building industries, but to many the century-old metal forming technology remains entirely novel.

Knowing just what roll forming can and cannot do opens the door to a host of metal forming possibilities. And in most cases, it all starts with a continuous part profile with high-volume requirements.

Roll Forming 101

Even those who do know roll forming continue to be amazed about what's possible. These days some manufacturers have developed proprietary methods to push roll forming's limits, coining the metal to produce a part profile that looks extruded, not formed from a coil of sheet metal. Others have found ways to form shapes with noncontinuous cross sections, like a C-channel that "squeezes in" like a bowtie.

But most conventional roll forming applications still require a continuous cross section, or profile. It could be a simple C- or U-channel or an incredibly complex, irregular shape. The part can be straight, curved, even twisted into a helix. But amid all this geometric variety, the part profile is continuous.

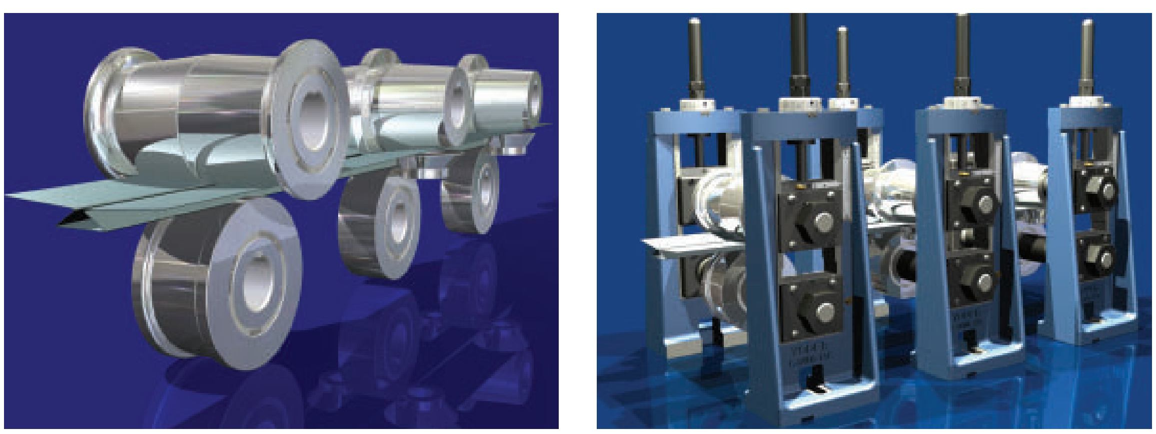

FIGURE 1
A roll form profile is formed through sets of roll tooling. Roll stands are removed to illustrate the workpiece transition.

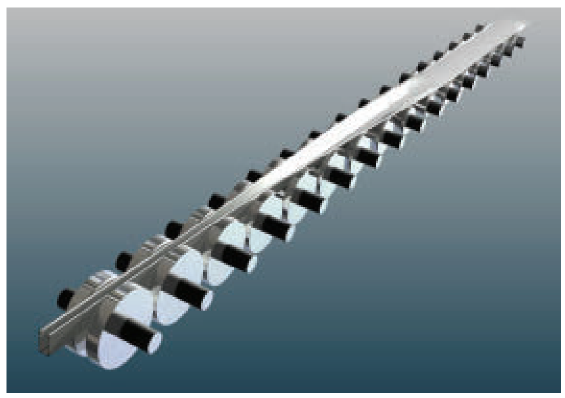

FIGURE 2
A solid model, with the upper rolls removed for illustrative purposes, shows how a metal strip forms as it passes through different stations in a roll former.

To understand why requires a basic understanding of the roll forming method (see **Figures 1** and **2**). Material emerges from a coil or blank through a precision leveler (if the application requires it), and then into the first stand of a roll forming line. The upper and lower roll tools on every stand perform a certain amount of forming that together create what's known as the *roll form flower,* an illustration showing how a part is rolled to its finished profile.

As the metal strip feeds through, the upper and lower roll tools on each stand form the profile a specified amount that depends on the metal thickness, grade, material yield and tensile strength, part

FIGURE 3
A sweep block uses a series of rolls and blocks to maintain straightness or put a desired curvature into a part.

FIGURE 4
A cutoff die cuts roll formed parts to length as they exit the line.

geometry, feed rate, and other variables. And just like stamping and press brake forming, roll forming must deal with springback. The metal forms as it squeezes through the first set of rolls, then relaxes slightly (thanks to springback) before entering the next roll set or forming pass. That next station forms the piece to the next "petal" of the flower pattern, accounting for previous springback from the prior pass. And so the process continues until it reaches a *straightening station,* or *sweep block,* which eliminates or induces camber (see **Figure 3**), before being completed or cut to length at the end of the line. The resulting parts can be straight, curved, or even formed into a helix pattern.

Roll Forming Dies

Roll forming lines incorporate a variety of rolls, of course, but they also have at least one but often several kinds of dies. Every continuous line has a *cutoff die* that cuts the final roll formed piece to length (see **Figure 4**). Some blank-fed roll forming lines are hand-fed, but others have a *pre-blank die* that cuts the strip to length before being fed into the roll forming line.

Other dies on the line punch holes and other cutouts. When it occurs before the metal is formed, it's called *prenotching* or *prepiercing*. When the press operation occurs after or between forming stations, it's called *midnotching*—a sometimes necessary step if, say, punching a hole before forming would lead to undesirable stretching.

Notching and blanking dies can remain stationary, fixed to a ram and bolster, or they can ride along tracks mounted to the bases, where the entire hydraulic or pneumatic press assembly, or sometimes just the die, moves linearly (see **Figure 5**). These *flying dies* increase a roll forming line's flexibility.

Some lines incorporate specialty dies that form embossments, slots, tabs, louvers, and other value-

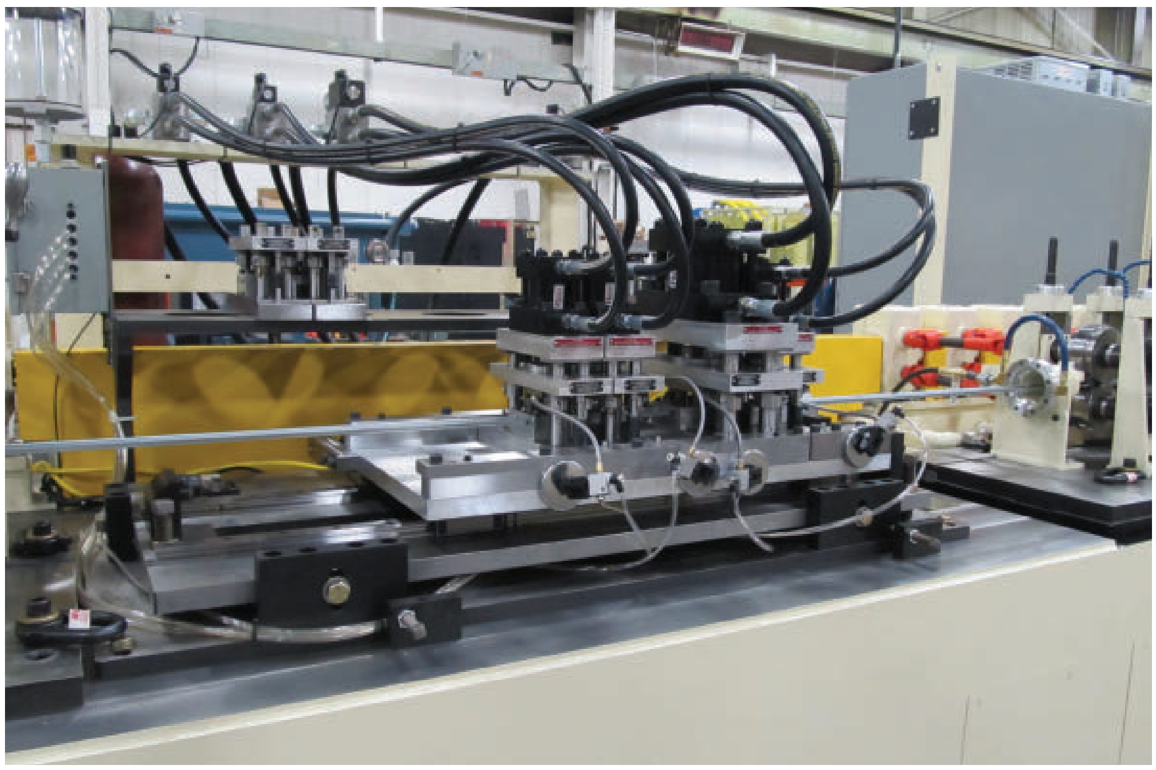

FIGURE 5
These flying notching (hole punching) stations ride along tracks mounted to the base of the roll former.

added features. On applications that require high rates of speed, a rotary die can be used. As the die rotates, the cutouts and forms are created at speeds over 100 feet per minute.

If you see a roll formed part with spot welds along a seam—and no secondary spot welding station on the floor—it's highly likely they were put there with a process called *rotary resistance spot welding*, which traps the material between two copper electrode wheels and allows welding to take place while the material is moving. This process is used in the automotive industry for bumper beams and door frame sections. In fact, for many years rotary spot welding was the preferred choice for bumper beams. Today many roll form lines produce custom welded tubes with high-frequency welders (see **Figure 6**).

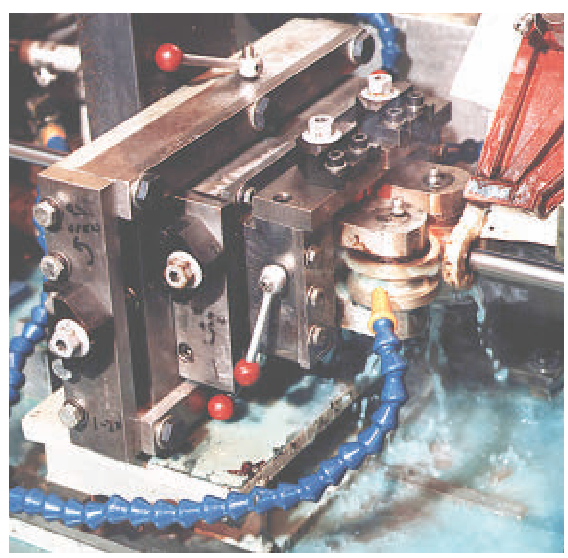

FIGURE 6
A high-frequency welding station on a roll form line welds the longitudinal seam onto the workpiece.

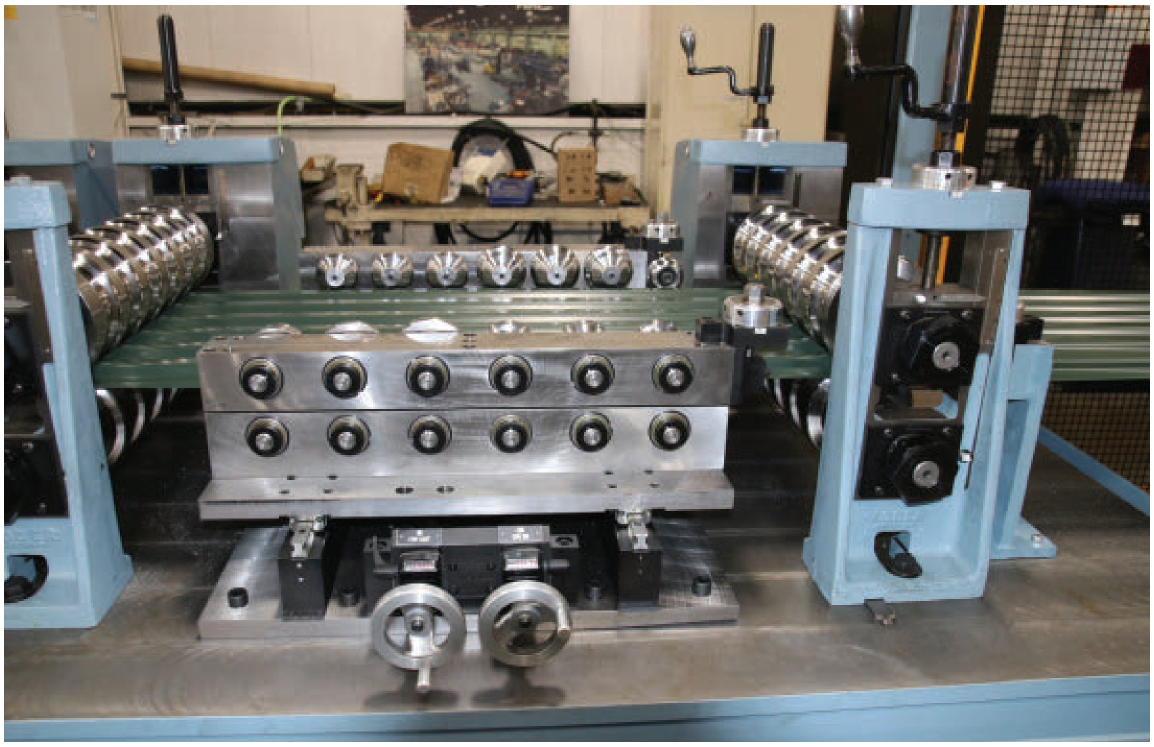

FIGURE 7
This panel line uses a duplex style forming station to work the outside edges of the material to achieve the desired cross section.

Roll Forming Idiosyncrasies

Like any forming process, roll forming induces stresses into the part, which can result in some kind of distortion. This includes what's known as *end flare.* If not compensated for, all roll formed parts will emerge with a toe-in on the leading edge of the part and flare on the trailing edge. The phenomena usually occur within the first and last 6 in. of the part length. The root causes have to do with the metal's elastic properties, similar to springback in stamping and press brake forming.

To compensate for this, roll form lines have *anti-flare units* comprising a series of blocks, rollers, and mandrels. The units overbend portions of the part so that it springs back to the desired shape.

One of roll forming's greatest strengths is its ability to form a variety of material, including high-strength/low-alloy (HSLA) steel. Engineers can accommodate for bending stresses by controlling the roll pressure with inboard and outboard adjustments on the roll stand. They can also reduce the number of degrees bent at each roll stand. For instance, instead of bending the part 25 degrees in one tool stand, an engineer might decide to break that form into 5-degree increments among five roll stands.

Additional roll passes can help work the "material memory" out, but those passes need to be strategically placed. A part's geometry sometimes requires certain roll stands to work the material more than others. Adding stands can make a world of sense, but they need to be placed where they'll do the most good, and this can vary with the application.

Regardless, adjusting the number of stands (and the tooling on each) gives engineers another "knob to turn" to tune in and perfect the process. All those "tunable knobs" is one reason roll forming can form so many different kinds of materials into such a wide variety of shapes.

Width and Length Factors

Sometimes roll forming makes helixes and other shapes impossible to make any other way. But when the decision to roll form is based on part geometry alone, it usually has to do with the part's size.

Theoretically speaking, roll forming has no limit on part length. The only true limits are practical: that is, how you handle the part as it emerges from the line. Extremely small, short parts are sometimes handled with chutes. Slug evacuation systems under dies can actually turn into part evacuation systems; that is, the slug is the part.

At the other extreme, parts can be extraordinarily long. Stamping presses have bed size limits, and press brake beds can be only so long. But even the most compact roll forming line has no theoretical limit on part length. The only limiting factor is having the space and capability to manipulate the formed part.

Regarding width, the only limiting factor is usually the width of a coil. Some roll form lines have been known to process a wide range of workpiece widths (see **Figure 7**). These include duplex lines that form only near the material's edges and can move in and out to accommodate different widths without tool changes.

Changeover Considerations

Duplex lines that reorient themselves quickly illustrate how flexible some roll forming lines really are, particularly when processing part families that share certain attributes. Some roll form lines in the bleacher and seating industry can produce one different part after another. The parts share the same profile but have different lengths and hole patterns. It's all kitted and shipped in the exact order installers need them on the job site.

Quick changeover in roll forming can occur in various ways. For instance, a specialty line can be built to roll form a handful of different parts, each of which uses specific roll stands. This works only for certain kinds of part geometries and certain tolerance requirements—essentially, the roll form line is custom-built around the needs of a specific, usually high-volume part mix—but it is an option in select circumstances.

New programmable controllers can change punch patterns, part lengths, and other attributes. The changeover might not be immediate or on-the-fly for different patterns per part, but it can happen in a matter of minutes.

Another quick-change option is to use rafted lines (see **Figure 8**), where entire groups of upper tools are preset in a raft and can be lifted into place. Small roll forming lines can consist entirely of a single raft that can be swapped out as needed. This technology introduces quick changeover for broader product mixes. Rafted changeovers aren't immediate, but they're faster than the traditional manual changeover, in which operators can spend hours manually swapping and aligning tools.

Labor Factors

Labor costs in roll forming typically run between 3% and 15% of the total job cost. Why the wide range? It's thanks largely to the varying levels of automation available as well as the product mix and complexity of the roll former line.

A roll form line requiring manual changeovers can have high labor content, depending on the number of changeovers the line requires. At the other end of the spectrum, some companies might have just one employee managing three separate lines. Controllers manage most of the changeovers, and parts are offloaded automatically into kanban bins. That one employee might spend most of his time monitoring the process and staging new coils for the next job. In some high-production environments, a roll former might have no operator at all.

Reducing labor content even further, automated calibration helps reduce some of the black magic of roll setup and in many cases can actually make real-time adjustments. Just as press brakes offer real-time angle measurement, roll forming lines now offer real-time adjustments to account for material variability and keep the final part geometry well within the tolerance window.

FIGURE 8
Designed for quick changeovers, rafted lines have preconfigured tool sets that can be lifted into place.

After setup, roll forming has always offered high consistency from part to part. Standard profile tolerances are ±0.030 in., with ±2 degrees on the angles. Twist tolerances can be less than 0.120 in. over 40 in.; camber tolerances can be within 0.040 in. over 40 in.; and bow tolerances can be within 0.040 in. over 40 in.—though again, these numbers vary depending on the application. All these tolerances can be even tighter depending on the part geometry. Regardless, automated calibration just takes that consistency to the next level.

All this said, labor content in roll forming is just one piece of the puzzle. A roll form line even with high labor content still could help reduce overall costs, especially if the line integrates secondary processes like welding. For instance, a large roll form line might require one operator to monitor the roll form process and another to run and monitor the welding operation. Labor content at the roll former might rise to 15%, but because multiple secondary operations are eliminated, overall costs plummet.

In fact, eliminating secondary processes is one big reason many parts that were previously extruded become roll formed. Extruding has the benefit of simple, inexpensive tooling that can produce extremely complex geometries; and because you're not starting with sheet metal, you don't have to worry about end flare and other metal forming idiosyncrasies.

The downside is that extrusions often require a good amount of secondary processing. Window frame parts are a prime example. When aluminum prices rise, producers look for alternatives to reduce costs, which often leads them to roll forming lines that integrate various secondary operations. They need to adapt the profile, of course; outside some specialty processes, conventional roll forming cannot produce the sharp corners common in extruded parts. Regardless, adapting the profile to roll forming is a small price to pay for eliminating a host of downstream operations.

Because we live in a global market, reducing labor costs is key. Numbers can vary depending on the application, part geometry, and market demand, but in a typical scenario, roll forming becomes competitive when the material content makes up between 60% and 90% of the total job cost.

Volume and Capacity

Many parts start their life cycle on a press brake but then end up being produced on a roll former. In fact, once part volume exceeds 250,000 linear feet a year (note this is feet, not number of parts), roll forming often becomes the most cost-effective option.

This number varies with part complexity, though. A part with just a few simple bends might require up to 500,000 linear ft. a year for roll forming to make sense. Then again, you could have only 10,000 linear ft. a year, but because the part is so complex, roll forming is still the least expensive option. The numbers could go even lower if a roll former helps eliminate secondary welding or other operations.

Know that these numbers are just generalizations. Consider a part that starts at a manual press brake, then is transferred to a robotic press brake cell. The robot cell can meet customer demand, but the part itself might not be taking advantage of the bending cell's strengths. Offline simulation, intelligent material staging, flexible grippers, and automated tool changing all create a system that can produce an extraordinarily wide variety of parts—and it's not limited to parts with a continuous profile.

And yet the robotic brake cell continues to produce large volumes of a narrow part family, all of which have a part profile perfectly suited for a coil-fed roll forming line. Why not move the part family to a roll forming line, then open capacity at the robotic bending cell to form other relatively low-volume parts?

The decision to roll form—or use any other process, for that matter—really boils down to making the best use of metal forming capacity. Sometimes this calls for questioning the status quo. Considering the state of the world, all the future uncertainty, and the continual advancements in manufacturing technology, questioning the status quo has become more important than ever. ***FAB***

This article is based in part on "Justification for roll forming," prepared for the FABTECH conference, www.fabtechexpo.com, by Brian Rodgers, senior application engineer, Formtek Inc., 4899 Commerce Parkway, Cleveland, OH 44128, 216-292-4460, www.formtekgroup.com.

FIGURE 1
A worker at the weld prep station grinds stainless steel pipe.

A ROAD MAP FOR GRINDING AND FINISHING STAINLESS STEEL

How to perfect processes and relieve bottlenecks

By Marc Brunet Gagne and Cédrik Rochon

Imagine a fabricator lands a contract involving critical stainless steel fabrication. Sheet metal and tubular sections flow through cutting, bending, and welding, then land at the finishing station. The part consists of a plate welded vertically to a tube. The weld looks OK, but it's not the stack-of-dimes perfection the customer is looking for. So the grinder spends time removing a bit more weld metal than usual. Then, alas, some significant bluing emerges on the surface—a telltale sign of excessive heat input. In this case this means the part won't meet customer requirements.

Usually performed manually, grinding and finishing require dexterity and finesse. Mistakes in finishing can be extraordinarily expensive, considering all the value that's already been put into the workpiece. Add an expensive, heat-sensitive material like stainless steel, and costs for rework and scrap mount even more. Add complications like contamination and passivation failure, and a once profitable stainless steel job can become a money-losing, even reputation-losing misadventure.

How can fabricators prevent all this? They can start by developing a knowledge of grinding and finishing, what role each plays, and how each affects a stainless steel workpiece.

Grinding Versus Finishing

They aren't synonymous. In fact, each has a fundamentally different goal. *Grinding* removes material like burrs and excess weld metal, while *finishing* puts a finish on the metal surface (see **Figures 1** and **2**). The confusion is understandable, considering those grinding with a large-grit wheel remove a lot of metal quickly and in so doing leave a "finish" of very deep scratches. But in grinding, scratches are just the aftereffect; quick material removal is the goal, especially when working with heat-sensitive metal like stainless steel.

Finishing occurs in steps as the operator starts with a larger grit and steps down to finer-grit sanding discs, nonwoven abrasive, and perhaps a felt cloth and polishing paste to achieve a mirror finish. The goal is to achieve a certain final finish (scratch pattern). And each step (finer grit) removes the deeper scratches from the previous step and replaces them with smaller scratches.

Because grinding and finishing have different goals, they often do not complement one another and, with the wrong consumable strategy, actually can work against each other. To remove excess weld metal an operator uses a grinding wheel and leaves very deep scratches, then passes the part on to a finisher who now must spend a lot of time removing those deep scratches. This sequence, moving from grinding to finishing, might still be the most effective way to meet a customer's finishing requirements. But again, they're not complementary processes.

Quite often workpiece surfaces designed with manufacturability in mind do not require both grinding and finishing. Parts that undergo only grinding do so because grinding is the fastest way to remove a weld or other material, and the deep scratches left by the grinding wheel fall well within customer requirements. Parts that require only finishing are fabricated in such a way that they don't require excessive amounts of material removal. A prime example is a stainless part with a good-looking gas tungsten arc weld that only needs to be blended and matched to the base material's finish pattern.

Grinding Strategies

A grinder with a low-removal-rate grinding wheel can face significant challenges working with stainless steel. Again, excessive heat can cause bluing and change the material properties. The goal is to keep stainless steel as cool as possible throughout the process.

To that end, it helps to choose a grinding wheel with the fastest removal rate possible for the application and budget. Wheels with zirconia grains grind faster than aluminum oxide, but in most cases a ceramic grinding wheel works best.

Extremely tough and sharp, ceramic grains wear in a unique fashion. Instead of wearing down smooth, they maintain their sharp edge as they gradually break down. This means they can remove material extremely quickly, often in just a fraction of the time other grinding wheels can. This usually makes ceramic grinding wheels well worth their extra cost. They're well-suited for stainless applications because they remove large chips quickly, generating less heat and distortion.

FIGURE 2
A worker finishes a stainless steel frame using a sanding disc.

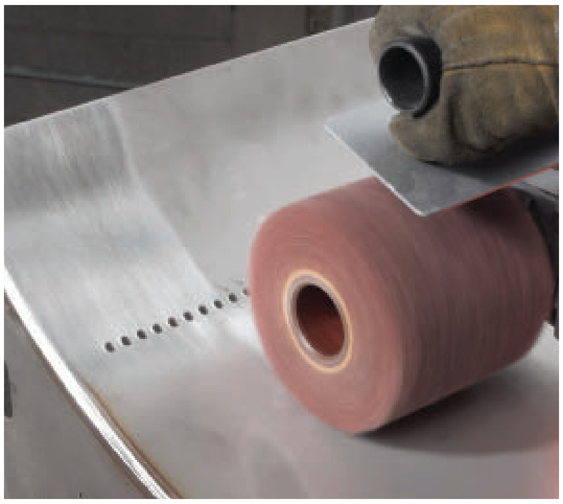

FIGURE 3
A nonwoven drum finishes a stainless steel surface. For effective finishing and optimal consumable life, different finishing media run at different RPMs.

No matter what grinding wheel a fabricator chooses, it needs to keep the potential of contamination in mind. Most fabricators know they can't use the same grinding wheel on both carbon steel and stainless steel. Many physically separate their carbon and stainless steel grinding operations. Even a miniscule spark from carbon steel landing on a stainless workpiece can cause contamination problems. Many industries, like pharmaceutical and the nuclear sectors, require consumables rated as contaminant-free. This means that grinding wheels used on stainless steel must be nearly free (less than 0.1%) of iron, sulfur, and chlorine.

Grinding wheels on their own don't grind; they need a power tool. Anyone can tout the benefits of an abrasive wheel or a power tool, but the reality is that power tools and their grinding wheels work as a system. Ceramic wheels are designed to work with angle grinders with a certain amount of power and torque. Although some pneumatic grinders have the necessary specifications, most ceramic-wheel grinding occurs with electric power tools.

A grinder with insufficient power and torque can cause major problems, even with the most advanced abrasive. A lack of power and torque causes the tool to slow significantly under pressure, essentially preventing the ceramic particles on the wheel from doing what they're designed to do: remove large chips of metal quickly and, in so doing, induce less heat into the material.

This can exacerbate a vicious cycle: Grinding operators see the material isn't being removed, so they instinctively push harder, which in turn generates excessive heat and bluing. They eventually push so hard that they glaze the wheel, which makes them push even harder and generate more heat before realizing that they need to change the wheel. If working this way on thin tube or sheet, they eventually just break right through the material.

Of course, this vicious cycle can happen even with the best tools available if operators aren't trained properly, especially when it comes to the pressure they apply to the workpiece. The best practice is to stay as close as possible to drawing the grinder's nominal rated amperage. If operators are using a 10-amp grinder, they should press just hard enough so that the grinder draws about 10 amps.

If a fabricator processes a lot of expensive stainless steel, using an ammeter can help standardize grinding operations. Of course, in reality few operations use an ammeter regularly, so the next best thing is to listen carefully. If operators hear and feel the RPM dropping rapidly, they're probably pushing too hard.

Listening for too light of a touch (that is, too little pressure) can be difficult, so in this case it can help to pay attention to the spark flow. Grinding stainless steel produces darker sparks than carbon steel, but they still should be visible and projecting away from the work area in a consistent manner. If operators suddenly see fewer sparks, it's probably because either they're not applying enough pressure or the grinding wheel is glazed.

FIGURE 4
A polishing wheel creates a mirror finish on a stainless steel workpiece.

FIGURE 5
A belt sander puts the desired finish on a stainless steel tubular assembly.

FIGURE 6
To ensure proper passivation, a technician electrochemically cleans a longitudinal weld seam in a rolled section of stainless steel.

Operators also need to maintain a consistent work angle. If they approach the workpiece at a near-flat angle (almost parallel to the work), they risk overheating a wide area; if they approach at a too high angle (closer to vertical), they risk digging the edge of the wheel into the metal. If they're using a Type 27 grinding wheel, they should approach the work at 20 to 30 degrees. If they have a Type 29 wheel, their work angle should be about 10 degrees.

Type 28 (conical) grinding wheels are normally used to grind on flat surfaces to remove material on a wider grinding path. These conical wheels also operate best at a lower grinding angle, at about 5 degrees, so they help reduce operator fatigue.

This introduces another critical factor: choosing the right grinding wheel type. Type 27 wheels have a *point* of contact on the metal surface; Type 28 wheels have a *line* of contact because of their conical shape; and Type 29 wheels have a *surface* of contact.

By far the most common, Type 27 wheels get the job done for many applications, but their shape makes it difficult to work with parts with deep contours and curves—say, a welded assembly of stainless steel tube. The contoured shape of Type 29 wheels makes it easier for operators who need to grind a combination of curved and flat surfaces. Type 29 wheels do this by increasing the surface contact area, which means operators need not spend a lot of time grinding in each location—a good strategy for mitigating heat buildup.

In fact, this applies when using *any* grinding wheel. When grinding, operators should never stay in the same place for long. Say an operator is removing metal from a fillet that's several feet long. He could manipulate the wheel in short up-and-down motions, but doing so could overheat the workpiece, because he's keeping the wheel in one small area for a prolonged period. To reduce heat input, the operator can traverse the entire weld in one direction near one weld toe, then lift the tool (giving the work time to cool) and traverse the work in the same direction near the other weld toe. Other techniques can work as well, but they all share one trait: They avoid overheating by keeping the grinding wheel on the move.

The commonly used "comb down" technique helps accomplish this too. Say an operator is grinding down a butt joint weld in the flat position. To reduce heat stress and excessive digging, he avoids pushing the grinder along the joint. Instead, he starts at the end and *pulls* the grinder along the joint. This also prevents the wheel from digging too much into the material.

Of course, any technique can overheat the metal if the operator goes too slowly. Go too slow and an operator can overheat the workpiece; go too quickly and grinding can take a long time. Finding the feed rate sweet spot usually comes with experience. But if operators are new to the job, they can grind on scrap to learn the "feel" of a proper feed rate for the workpiece at hand.

Finishing Strategies

Finishing strategies revolve around the material's surface condition when it arrives and leaves the finishing department. Establish the starting point (as-received surface condition) and ending point (desired finish), then develop a plan that finds the best path between those two points.

Usually the best path does *not* start with a highly aggressive abrasive. This might sound counterintuitive. After all, why not start with a coarse grit to achieve a rough finish and then move on to finer grits? Wouldn't starting with a finer grit be extraordinarily inefficient?

Not necessarily, and it has to do again with the nature of finishing. With every step up to a smaller grit, finishers replace deeper scratches with shallower, finer ones. If they start with, say, a 40-grit sanding or flap disc, they're putting deep scratches into the metal. If those scratches get the surface close to the desired finish, great; that's why those 40-grit finishing consumables exist. But if the customer demands, say, a No. 4 finish (a directional brushed finish), the deep scratches created by that 40-grit abrasive will take a long time to remove. Finishers will either be stepping down through numerous grit sizes or be spending a long time with a fine-grit abrasive to remove those large scratches and replace them with smaller ones. All this is not only inefficient, but also introduces excessive heat into the workpiece.

Of course, using a fine-grit abrasive on a rough surface can be slow-going and, combined with poor technique, introduce excessive heat. Here's where the two-in-one, or interleaved, flap disc can help. These discs comprise an abrasive cloth combined with a surface conditioning material. They effectively allow the finisher to remove material with the abrasive while also leaving a smoother finish.

The next step toward the final finish might involve using a nonwoven material, and this illustrates another characteristic unique to finishing: The

FIGURE 7
A stainless steel sheet is tested to ensure proper passivation.

process works best with a variable-speed power tool. A right-angle grinder running at 10,000 RPM might work with some abrasive media, but it will outright melt certain nonwoven material. For this reason, finishers reduce the speed to between 3,000 and 6,000 RPM before starting a finishing step with a nonwoven consumable. Of course, the exact speed depends on the application and consumable. For instance, nonwoven drums (see **Figure 3**) are usually used between 3,000 and 4,000 RPMs, while surface conditioning discs are used between 4,000 and 6,000 RPMs.

Having the right tools—variable-speed grinder, different finishing media—and determining the optimal number of steps essentially provide a map, revealing the best path between the as-received and finished material. The exact path varies depending on the application, but experienced finishers drive down that path using similar finishing techniques.

First, they take their time. If they see that a thin stainless steel workpiece is getting hot, they stop finishing in one area and start in another. Or they might work on two different workpieces at once. They work a little on one and then the other, giving the other workpiece time to cool.

When polishing to a mirror finish, a finisher might cross-sand with a finishing drum or disc, sanding in a direction perpendicular to the previous step. Cross-sanding highlights areas where the previous scratch pattern needs to be blended, yet it still doesn't get the surface to a No. 8 mirror finish. To create the desired shiny finish, a felt cloth and polishing wheel are needed after all the scratches are removed (see **Figure 4**).

To achieve the right finish, a fabricator needs to give finishers the right tools, both actual tools and media, as well as communication tools, like samples that establish standards as to what a certain finish should look like. These samples—posted near the finishing department, in training documentation, as well as sales literature—help get everyone on the same page.

Regarding the actual tools—including the power tools and abrasive media—some part geometries can present challenges even for the most experienced employees in the finishing department. Here's where specialized tools can help.

Say an operator needs to finish a thin-walled tubular assembly of stainless steel. Using a flap disc or even a drum can cause problems, inducing excess heat and sometimes even creating a flat spot on the tube itself. Here, belt sanders designed for tube can help (see **Figure 5**). The belt wraps around most of the tube diameter, spreading the point of contact, increasing efficiency, and reducing heat input. That said, like anything else, the finisher still needs to keep the belt sander moving to different areas to mitigate excessive heat buildup and avoid bluing.

The same applies to other specialty finishing tools. Consider a finger belt sander designed for tight spaces. A finisher might use it to feather down a fillet weld between two sheets at an acute angle. Instead of moving the finger belt sander vertically (a bit like brushing one's teeth), the finisher moves it horizontally along the upper toe of the fillet weld, then the bottom toe, all while being sure that the finger sander doesn't stay in one place for long.

Proof of Passivation

Welding, grinding, and finishing stainless steel introduce another complication: ensuring proper passivation. After all these disturbances to the material surface, are there any remaining contaminants that could prevent the stainless steel's chromium layer from forming naturally over the entire surface? The last thing a fabricator wants is an angry customer complaining about rusted or contaminated parts. Here is where proper cleaning and traceability come into play.

Electrochemical cleaning can help remove contaminants to ensure proper passivation (see **Figure 6**), but when should this cleaning take place? That depends on the application. If fabricators do clean stainless steel to promote complete passivation, they usually do so immediately after welding. Not doing so would mean that the finishing media could pick up surface contaminants from the workpiece and spread them elsewhere. For some critical applications, though, a fabricator might choose to insert additional cleaning steps—and perhaps even test for proper passivation before the stainless leaves the factory floor (see **Figure 7**).

Say a fabricator welds a critical stainless steel component for the nuclear industry. An expert gas tungsten arc welder lays down a perfect-looking stack-of-dimes seam. But again, this is a critical application. An employee in the finishing department uses a brush connected to an electrochemical cleaning system to clean the weld surface. He then uses a nonwoven abrasive and finishing cloth to feather the weld toes and bring everything to a uniform brush finish. Then comes a final brush with the electrochemical cleaning system. After sitting for a day or two, the parts are tested for proper passivation with a hand-held testing device. The results, documented and saved with the job, show that the part was fully passivated before it left the plant.

Avoid Expensive Rework

Grinding, finishing, and cleaning for passivation on stainless all usually occur far downstream in most fabrication plants. In fact, they're usually performed not long before jobs ship out the door.

A piece that isn't finished properly creates some of the most expensive scrap and rework there is, so it makes sense for fabricators to take another look at their grinding and finishing departments. Improvements in grinding and finishing can help relieve major bottlenecks, improve quality, eliminate headaches, and, most important, improve customer satisfaction. ***FAB***

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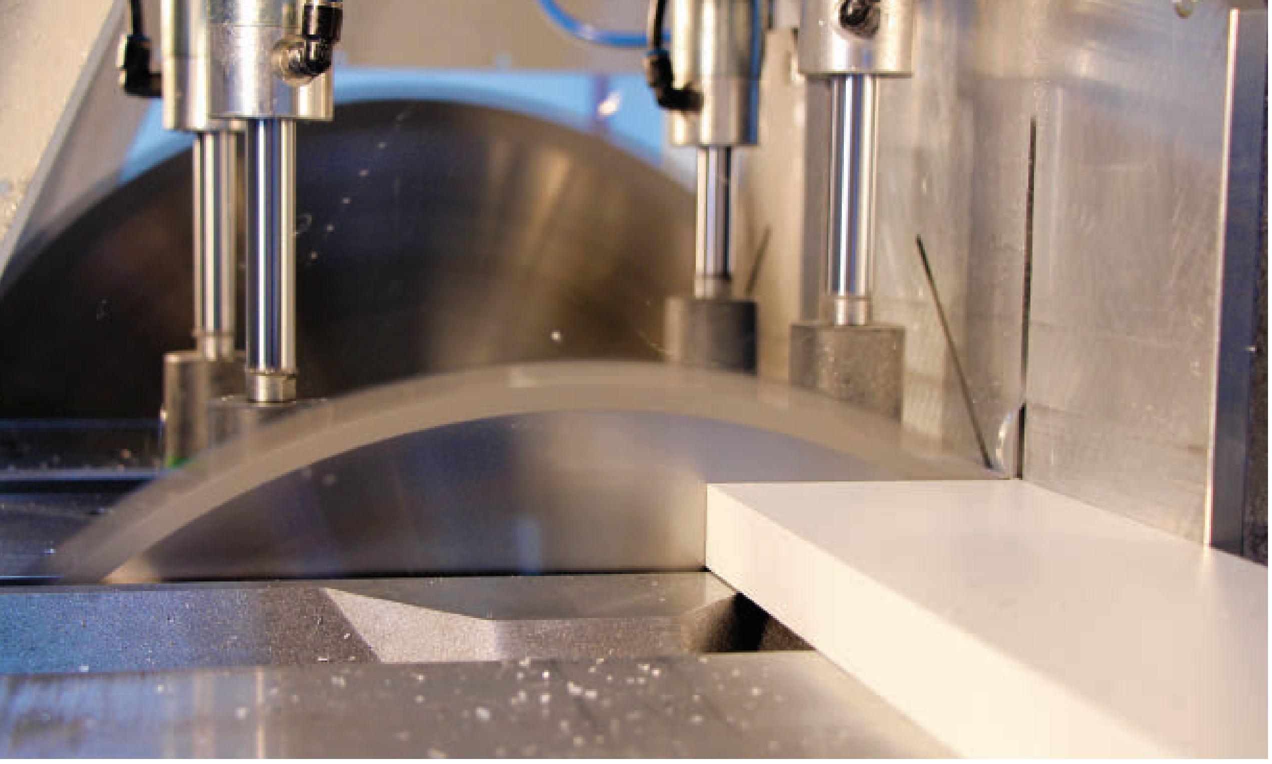

Fabricated Products Group, a manufacturer of architectural assemblies and components, relies on saws to cut material to length before it undergoes further fabricating and machining processes.

A fabricator's take on improving saw operations

Machine maintenance, training, and best practices keep the saw and operator safe

By Russell Enzenbacher

The sawing operation is important in some parts of the fabrication world because it is usually the first step in nearly all projects. Whether they are using a compound miter saw, a radial arm saw, or a table saw, most shops turn to the saw because it is the easiest way to bring material to the desired length and typically the most efficient way to cut material.

At Fabricated Products Group, we cut primarily aluminum from ⅛ to 2 in. thick. Circular saws are used most often, but band saws also are used for the occasional job. The horizontal band saw is used mostly to cut steel. The vertical saw is used for custom cuts and ripping material down to a specific size for those hot jobs.

With saws playing such an important role in a fabricating shop, the saw operators and maintenance team have to take steps to ensure the equipment is in pristine shape. If a saw is not functioning properly, the operator is at risk of injury. Malfunctioning saws also can produce undesired results, such as material being cut to the wrong length or out of square. As a result, the material becomes unusable or possibly scrap metal, and the operator must rework the project, which can be costly.

Maintain the Machine

If a fab shop wants to improve its sawing operations, it can approach the task from multiple angles. One is through maintenance. A well-maintained saw is safe and efficient. A maintenance schedule usually is provided by the manufacturer. The monthly, weekly, or even daily maintenance schedules should be followed per the manufacturer's recommendations to ensure proper saw performance and extend the life of the saw blades.

Fabricated Products Group has its operators perform the daily maintenance chores. Before using the saw, the operator checks the oil, the blade sharpness, and the blade's squareness to the workpiece. The operator also checks to see if the saw is set up correctly with the right saw blade. Although most of the cutting jobs involve aluminum and saw operators can use the same blades for most of those jobs, they might need to change out the blade for a specialty job, such as one on which a thicker kerf is required. Monthly maintenance tasks are usually shared by operators and maintenance personnel.

Keeping a saw clean is crucial for proper saw maintenance. Over time, resins from oil and wax lubricants build up on the saw blade's teeth. (If blade lubricant isn't used, the metal can build up on the teeth and negatively affect cutting performance.) The resin effectively coats the edges, making the blade act as though it is dull. This leads to an increase in friction and heat, making cutting more difficult and resulting in cut edges that are not as clean as they could be.

While it may seem counterintuitive, a dull blade is more dangerous than a sharp blade because it requires more force to make the cut. As an operator is trying to force the dull blade into the metal, his hand is more likely to slip off the handle because of the increased force being applied. Blades that cut at maximum efficiency also reduce the strain on a saw's motor.

Dull blades also can lead to quality issues. A dull blade tends to wander during the cut, not producing a straight edge like a clean blade does.

It is also important to properly lubricate the saw's moving components per the manufacturer's specifications. After each use, it is beneficial to lubricate blades with paste wax or lubricant. Lubricant can be rubbed on with a rag and left on the blade. Paste wax, however, should be wiped off after soaking into the blade for approximately 10 minutes. Both wax and lubricant assist in keeping rust off a saw blade. Removing the drive belt and motor from the back of the saw on some models, such as table saws, can dramatically improve access to the saw's interior for cleaning and lubrication.

The Proper Training

When staff members are properly trained on how to use a saw, the machine works safely and efficiently, producing strong results. For larger and more complex saws, such as those with digital readouts for positioning, dual cutting heads, and automatic feeds, the manufacturer usually offers training with the saw purchase, plus additional training to new employees at a cost. Trade schools also provide a great foundation for basic saw operation.

However, most training is on the job with a senior fabricator with experience on the saw. Learning from industry veterans can help prevent injuries with employees new to the machine. It also can improve efficiency. For example, an experienced operator can recognize when improper cutting speeds are being used on a particular type or thickness of metal.

Learning from established co-workers encourages the staff to utilize best practices learned over the years. Less experienced saw operators also get to see how their more experienced counterparts deal with unexpected challenges, such as delaying a job because the saw blade lacks the proper amount of lubrication. They learn not only how to run the equipment, but also when not to run the equipment.

Best Practices

When using a saw, an operator needs to have the proper personal protective equipment (PPE). It is important for the employee to wear safety glasses with side shields or full-face shields to protect the eyes and the face and a leather apron to protect the body. It is ideal to avoid wearing loose-fitting clothing and gloves while operating a saw as they can get caught during the cutting process.

It is best to operate the blade at speeds recommended by the manufacturer. Anything outside of those parameters can lead to unexpected and potentially dangerous results. It also is recommended to use only the accessories designed for that specific saw and application. Doing otherwise could damage the saw.

Two operators wear safety glasses, form-fitting gloves, and ear protection before engaging a saw.

Any adjustments should be secure before making a cut. These adjustments should be made only when the power is off and the machine is idle. It also is a safe practice to turn off the saw and place the material to be cut against the stop gauge when taking measurements. These steps are recommended not only for the health and safety of the operator, but also to protect the functionality and life of the machine and blades.

It is also helpful to optimize a cut list. This ensures the saw operator is getting the most out of the materials on hand and can cut everything on the list. At Fabricated Products Group, the project manager provides the cut list, which helps to ensure that enough of the right material is present for the job. The operator checks the cut list and proceeds in running the jobs in the most logical way. For example, if many small pieces are cut out of one large piece of raw material, the operator might not have enough material to cut a long piece on the cut list. In this scenario, it typically works best to go in the order of largest to smallest on the cut list.

No matter how precise the operator tries to be, discrepancies can sneak in during a project. When this occurs, parts need to be fitted into the job as the project moves along.

Used correctly, a cut list can be helpful in layout, confirming key dimensions, and estimating material needs. It also can indicate the order of construction and serve as a record of the build should the project need to be replicated, although that is rare in the custom fabrication industry.

An operator always needs to make certain the saw blade being used is suitable for the type of material to be cut as well as the type of cut to be made. Thinner blades that have more teeth are better-suited for making scroll cuts and tight turns, and they are best used with thinner material. Wider blades with fewer teeth are good for making rough cuts and cutting thicker material.

It is helpful to make sure the saw blade has been set to the proper tension before using it and that it is checked periodically and the tension readjusted whenever needed. Spotting damage to the blade before cutting commences can avoid real trouble, which means the operator should look for bent sections in the saw blade, broken teeth, or other damage. Our saw operators check saw blades at least once a shift. If the quality of a cut starts to deteriorate, the operator stops the equipment and checks the blade again, making any changes that might be necessary to improve the cutting action.

Maintenance, best practices, and training can boost a fabricator's saw operation, leading to time and money savings on the front end of a project. They also protect the health and safety of those operating the machine, which is even more important than the machine's output. ***FAB***

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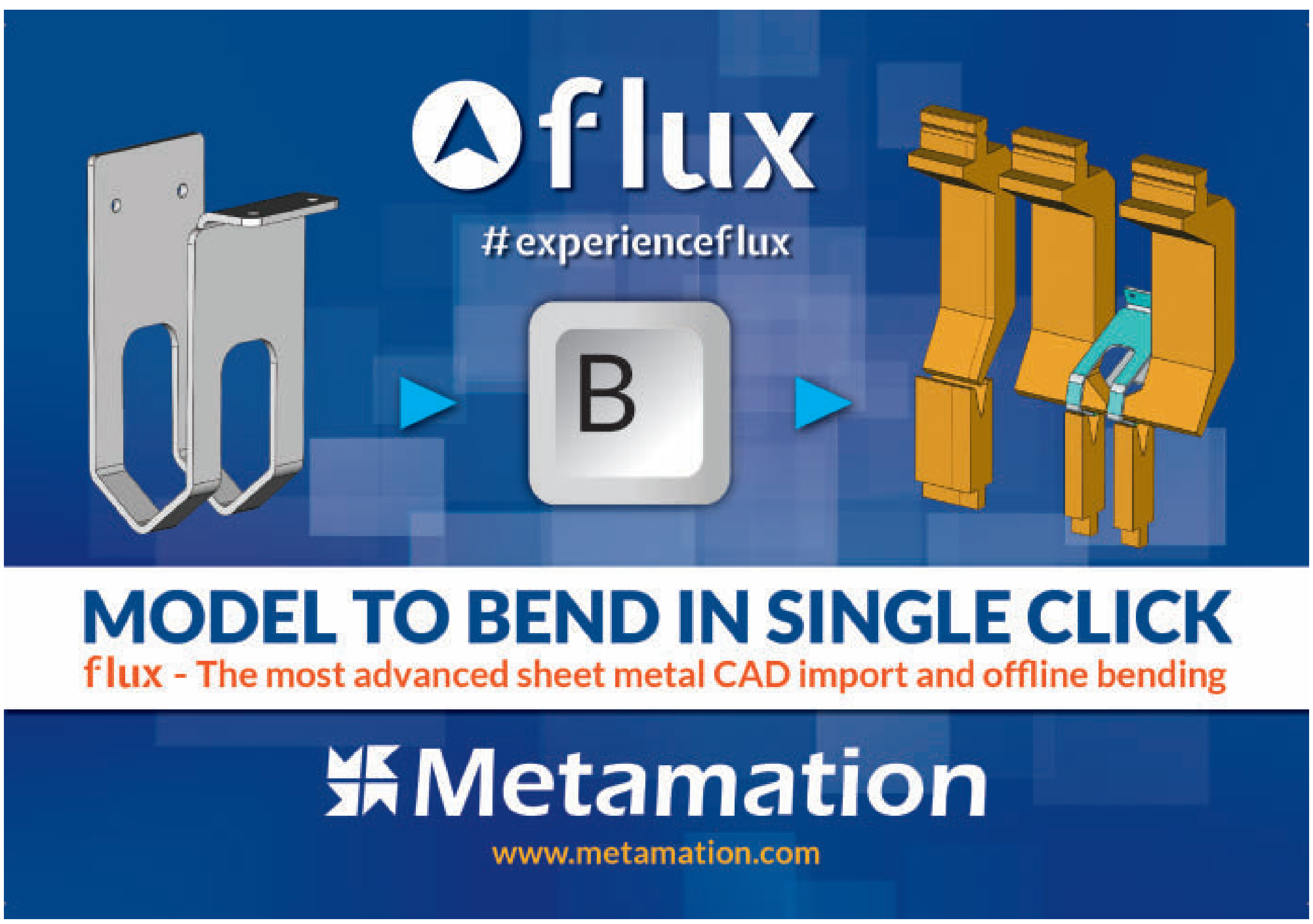


Why revenue diversity pays off

Heating equipment manufacturer delves deep into contract fabrication

By Tim Heston

In 2013 John Seefeldt, CEO of Electro Industries in Monticello, Minn., arrived at one of his daughter's school orchestra concerts. In the lobby he saw a fellow orchestra dad who was an engineer at a small business that made the trash compactors seen in airport terminals and shopping malls. The company had just received an order for 1,000 trash compactors, and he had no idea how his employer was going to build them all.

Seefeldt smiled. "I asked him, 'When are you going to come up to our plant? We can show you how we can build them for you.' And we've been building them ever since."

Electro Industries is a manufacturing hybrid. Most of the company's revenue comes from residential and commercial electric heat products such as electric boilers, makeup air units, and plenum heaters. Of course, most have highly seasonal demand, so for years the plant has been filling capacity during the slow periods with contract work.

That said, Electro Industries' story isn't just about a product-line manufacturer selling its excess fabrication capacity. It's delving into contract manufacturing, focusing not on *this* part or *that* subassembly, but on the entire product, especially if it entails sheet metal, electrical components, and microprocessor controls.

Yet because the company is small—it employs about 30 people—and because its principal heating products still make up the majority of its revenue, it's not looking to scale up its contract manufacturing into a massive operation. It can't deliver millions, but it can, say, fulfill a PO for 1,000 trash compactors: the "happy medium" between prototyping and mass-market, high-volume production—a niche not unlike its bread-and-butter product lines.

History of Product Development

To open the door to more contract work, Electro Industries now is working toward an ISO 9001 certification. Seefeldt chuckled. "I have to admit, I thought this ISO thing was a lot more difficult, but as it turns out, we're already doing the things we need to do to become certified. We already have the quality control procedures we've developed to improve our products over the years. We just need to make it official and formalize an auditing process."

Like many fabricators, Electro Industries can punch, bend, weld, powder-coat, and assemble parts. But unlike many operations, it can also build its own through-hole circuit boards—not the surface-mount circuit boards found in most mass-produced consumer electronics, but instead the ones suited for the simpler electronics found in many products. And many of those products happen to use a lot of sheet metal.

"Through-hole circuit boards is an old technology," Seefeldt said, "but it's still very practical for simple control boards with capacitors and relays. Compared to surface-mounted boards, a through-hole board is much more economical. There's still a big market for it."

The company also has a lathe and vertical machining center that machines metal as well as plastic, usually adapting off-the-shelf plastic enclosures with cutouts and other features for its heating products.

Seefeldt's father, Bill Seefeldt, founded Electro Industries in 1974. It started small, making one product for one customer: a makeup air heater for large agricultural facilities. Over the years he dreamed up new products and designed every piece of the assembly, from the sheet metal enclosure to the electrical relays and circuit board layouts.

One of the company's most innovative solutions is an air-to-water heat pump, which applies forced-air heat pump technology to water for radiant in-floor heating and other applications. "You're taking a 100% efficient electric boiler, which we've been making since the 1980s, and you can throw an air-source heat pump on similar boilers, and your efficiency goes up to between 200% and 250%, even in northern climates," Seefeldt explained. "Essentially, you can heat your house for two and a half times less money."

No Stovepipes

Such ideas are the engines that drive the manufacturing economy, but they have plenty of curves to navigate, many of them created by the competitive marketplace and the fickle consumer. That said, many curves don't come from market uncertainties (though COVID-19 has created plenty of those) but from inefficiencies across supply chains and the

CEO John Seefeldt is part of Electro Industries' second generation of family ownership. His father, Bill Seefeldt, founded the company in 1974.

companies within them, most stemming from the age-old practice of throwing work "over the wall" to the next silo or stovepipe.

An engineer throws a drawing over the wall to a fabricator, who sees that it can't really be manufactured. So the fabricator might suggest changes or perhaps just "throw it over the wall" again with a no-quote. Even worse, an assembler on the floor might struggle to assemble a certain wiring harness or insert certain hardware. But he's in his stovepipe, so he stays quiet as the rework and customer returns pile up.

"We try to avoid silos," Seefeldt said. "We just open up the communication. Our engineers and plant personnel talk. Let's have a conversation and see what we can do."

Company engineers talk with plant supervisors, welders, and others on the front line. "When we design something, we try to make sure we're doing it right from the beginning," Seefeldt said. And because so many processes are in-house, including circuit board design and assembly, a lot of manufacturing and assembly intelligence goes into the design from the get-go.

Of course, nobody's perfect. "We've had times where engineers didn't think things through and didn't communicate their ideas to production, and by the time it got to the production floor for the prototype, we find something doesn't fit," Seefeldt said. "So we go back to CAD, draw it up a little differently, hand it to our head programmer in the sheet metal department, and try again. We try to avoid those mistakes, but it sometimes happens. But the great thing is we can make changes quickly, usually within a day or two. The turnaround is very quick."

Flow and Inventory Management

In October Plant Manager Dave Hayes will celebrate 34 years at Electro Industries, and during that time he's worn nearly every hat one can at the place. He began as an electronic technician, hand soldering through-hole circuit boards. Now he manages material flow through circuit board fabrication, sheet metal fabrication, machining, and final assembly.

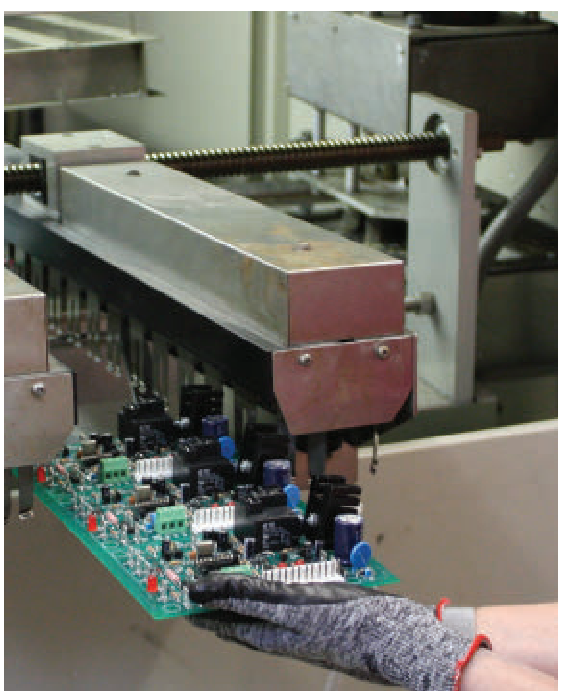
The company keeps about two weeks' worth of raw stock inventory for standard sheet metal grades

Plant Manager Dave Hayes has worked at Electro Industries for 34 years.

and thicknesses, mainly between 10- and 26-ga. carbon steel, much of it galvanneal. Sheets flow through one of two turret punch presses that have a range of punch and form tools. Many workpieces emerge with some combination of louvers, knockouts, flanges, extrusions, and embosses.

Work then flows to the welding department, which employs welders certified to the ASME code

Attaining a diverse revenue mix is a subtle science in metal fabrication. In the custom or contract fabrication world, it's about customer stability. How healthy are a fab shop's customers, and how easy would it be for them to jump to a competing supplier?



Electro Industries has an unusual mix of capabilities, including sheet metal fabrication, circuit board and electronics manufacturing, machining, and powder coating.

(a necessity if you're welding boilers). The department also has a two-station welding robot that spends most of its time welding four-sided boiler assemblies. The sheet metal then moves on to powder coating.

Circuit board fabrication requires a bit more lead time and so has a larger inventory buffer. Between three and four weeks' worth of completed circuit boards are usually on hand.

The company has invested in a wave soldering machine, but many of the solder joints are still applied by hand. The boards also need to be masked before they undergo a varnishing process, which protects the electronics from high-moisture environments.

Regardless, circuit board manufacturing isn't the constraint; it's the component supply chain, which extends to Asia—an area that's difficult to avoid for any electronics manufacturer. "You can get caught with extended lead times on a minor part," Hayes explained, "and it can end up holding up everything," adding that supply chain issues are the primary reason for the large inventory buffer.

Circuit boards, wire harnesses, machined plastic enclosures, and sheet metal subassemblies all meet in kits in final assembly. Assembled units are tested before they are packed and shipped.

Market Dynamics

Demand for heating products usually starts picking up in the fall and winter, for obvious reasons. During normal years Electro Industries builds ahead to meet the expected demand peak. "But of course, we aren't building ahead this year, because we don't know where this economy is going to go," Seefeldt said.

He added that while orders have slumped during the COVID economy, they at least haven't fallen off a cliff. April was very tough, as it was for many manufacturers, but orders began picking up in May and June. "In fact, we had a very good June, relatively speaking, though of course they were still down about 15% from last year."

Demand for the company's electric heating products usually rises and falls with the price of oil and gas, including natural gas and propane. "Back in 2014, when propane was crazy-high for a few months, we had an incredibly great year," Seefeldt said.

As gas and heating oil become more expensive, electric heat becomes more attractive. Considering the economy and the current price of oil, one would think demand for electric heat would plummet. But over the years the company has seen demand for electric heating products decouple from the price of oil, both because of regulations as well as Electro's evolving product offering.

Especially on the coasts, certain cities have regulations that encourage or require the use of electric heat. "We're setting up sales channels in those markets," Seefeldt said. "Engineers and contractors there say, 'I can't put in gas heat, so I need to put in electric.' Well, you can put in ours!"

The company also has makeup air units designed to put positive air pressure back into the house when, say, a new kitchen is installed with a 1,200-CFM hood over the stove. "In all states, code requires that you have a makeup air unit that puts positive tempered air pressure back into the house," Seefeldt said.

The company also offers those air-to-water systems that have efficiency levels that beat all heating alternatives no matter what the price of oil is. And it offers electric heating products designed to be used with dual-fuel programs, where a homeowner heats with gas during peak hours and electric during nonpeak hours (billed at a lower rate).

Long term Seefeldt said he sees demand for certain electric heating products increasing, though oil price will always have at least some effect on overall demand. "That said, we're still trying to diversify and not rely solely on heating products, which is why we're ramping up our OEM contracting."

Success hinges on product quality, efficiency, and delivery, of course, but the best operation in the world can suffer if customers stop buying. Refining that revenue mix, as Electro Industries continues to do, mitigates that risk. In these tumultuous times, that is a very good thing.

Refining the Revenue Mix

Attaining a diverse revenue mix is a subtle science in metal fabrication. In the custom or contract fabrication world, it's about customer stability. How healthy are a fab shop's customers, and how easy would it be for them to jump to a competing supplier? Deep integration (fabricating the entire product versus a tiny piece of it) makes it difficult for a customer to leave, as does an unusual mix of processes that perfectly fit the customer's needs—like, say, having both electronics (circuit boards, wiring harnesses) and plastics and metal manufacturing under one roof.

For product lines, it's about having demand driven by multiple factors such as the price of oil but also government regulations and the desire to save money on heating bills.

The COVID recession has revealed just how valuable revenue diversification is. As of mid-summer 2020, at least, some fabricators have reported being busier than ever thanks to being in the right markets, be it related to defense, warehousing (benefiting from the e-commerce boom), or other hot markets.

Success hinges on product quality, efficiency, and delivery, of course, but the best operation in the world can suffer if customers stop buying. Refining that revenue mix, as Electro Industries continues to do, mitigates that risk. In these tumultuous times, that is a very good thing. ***FAB***

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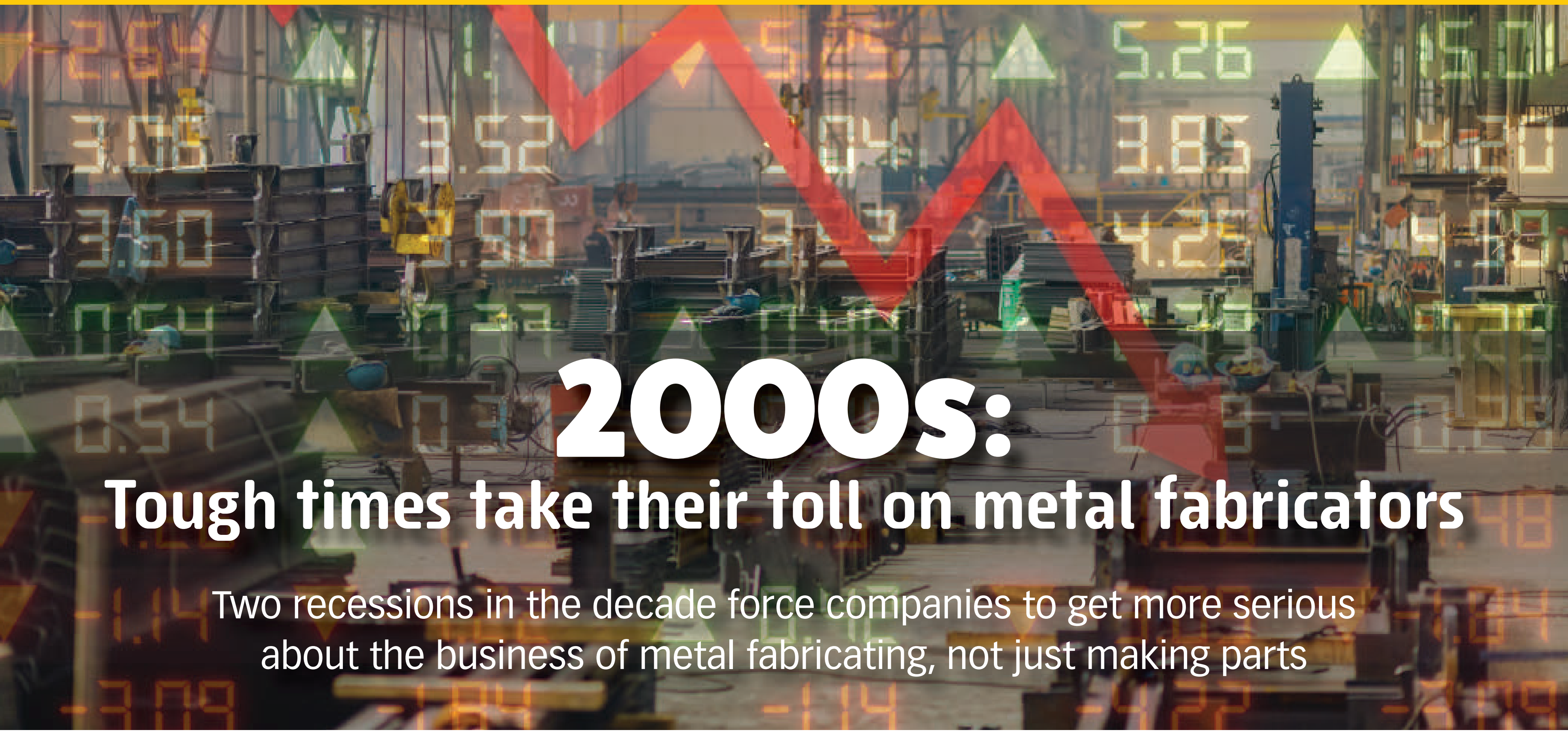
Electro Industries, www.electromn.com



2000s:
Tough times take their toll on metal fabricators

Two recessions in the decade force companies to get more serious about the business of metal fabricating, not just making parts

By Dan Davis

When a decade begins with the fear that the world was going to collapse because older computer systems weren't designed to accommodate the shift over to the year 2000 from 1999, you could argue that unjustified fear was setting the tone for the next 10 years. Looking back, that argument would be hard to refute.

If the 1990s were about metal fabricators taking a step into the world of laser cutting and computer processing ("1990s: Modern metal fabricating hits its stride," *The FABRICATOR*, July 2020, p. 79), the 2000s were about survival. The dot-com bust, 9/11, the offshoring of manufacturing to China, and the Great Recession put a lot of strain on the U.S. manufacturing base. In fact, many companies that survived the Y2K scare weren't able to make it through the decade. The reality of customers asking for better terms for reduced volumes of work proved to be a challenge that some shops couldn't overcome.

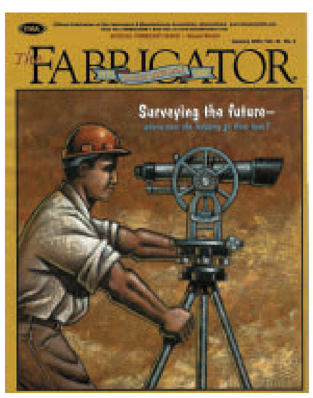
Having said that, lessons were learned in the 2000s. Like many in the metal fabricating industry, the survivors of the decade didn't get a formal degree, but they learned valuable lessons from the experience. The decade positioned them to make the most of what would be the longest economic expansion in U.S. history.

To get an idea of what was happening, let's take a look back at some of the highlights of the 2000s, as reflected in the pages of *The FABRICATOR*.

February 2001
The Human Touch

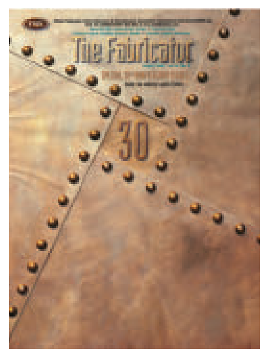
Even as more complex CNC equipment was being introduced to shop floors in the 2000s, people remained the heart of the manufacturing environment. Companies recognized the need for talented and flexible individuals who could float between different fabricating processes.

Begneaud Manufacturing in Lafayette, La., was one such fabricating company ("Company philosophy is based on a novel idea: common sense"). Don Begneaud, the company's owner, wanted his shop to mimic companies he had visited on vendor-sponsored tours of European metal fabricating companies. He particularly liked the way countries approached apprenticeship programs and hands-on training.



What awaited metal fabricators in 2001 and beyond? A lot of tough economic years, but the experiences made the surviving fab shops stronger for the economic expansion that would happen in the 2010s.

Taking that inspiration, Begneaud developed the position of a "flexo" at his company. The flexo position called for the individual to work wherever they were needed. That meant sweeping, moving material to another station, or helping more experienced equipment operators on a job. During this tenure, the flexo was trained on machines, and when a certain number of hours had been reached, the student graduated to nonsupervised roles.



***The FABRICATOR* celebrated its 30th anniversary in 2001. (Yes, we might have jumped the gun a little bit celebrating the publication's 50th anniversary in 2020, but we wanted it to coincide with FMA's 50th anniversary.)**

April 2001
Cutting Gets Complicated

At one time in the life of a metal fabricator, choosing a cutting technology was not that big of a deal. If the company wasn't punching, it was probably relying on some sort of plasma cutting technology to cut parts for customers. By the 2000s, however, CO_2 laser cutting was emerging as a technology that could easily take on 0.50-in. plate.

In "Cutting your losses," Stephen St. Hilaire of Komatsu's Cutting Technologies Division provided an overview of where plasma cutting was and how it stacked up against other cutting methods. The comparisons definitely summarized not only where cutting technology was at that time, but where it may have been heading.

Of course, the feature ended with a solid piece of advice no matter what the era of metal fabricating: "It is recommended that you consult colleagues as well as manufacturers to get information on experiences they have had with these technologies."

December 2001
Focusing on the Team

At the time U.S.F. Fabrication Inc., Hialeah, Fla., had reduced its lead times from three weeks to three days. It also had not raised customer prices for its products since 1991. How did they do it? Company management pointed to its culture of listening to employees, training, and a commitment to just-in-time manufacturing.

Getting the right people in place helped this effort. "We ask a lot of questions during the multiple interviewing process," said General Manager David Owens. "We look for trends in the answers and try to weed out those who are more about 'I' than 'we.'"

In addition, all managers and supervisors received eight to 12 hours of leadership training every five weeks. This wasn't just sitting in a conference room and walking home with a printed-out version of the presentation. Each training workshop included mandatory homework with one-on-one homework reviews the next day.

January 2002
In Search of the Level 5 Press Brake Operator

You'll recognize Steve Benson's name from this publication's Bending Basics column. It's no wonder that this bending guru was offering his expertise back in the 2000s as well.

In a feature aimed at company management ("Are you getting what you paid for?"), Benson described what a top-of-the-line press brake operator, a "Level 5" as he called it, should be capable of.

"Level 5 is the most skilled level. Operators should have mastered all types of press brakes: up-acting, down-acting, mechanical, and hydraulic, as well as folding machines. They should be able to work on manual press brakes and use all three controller modes: depth, graphic, and angle.

"They should be able to do difficult flat-pattern layouts from customer prints and without the aid of a CAD/CAM system (including notching) and be familiar enough with related equipment to produce the part, whether using a single-station punch, numerically controlled punch, shear, or hardware machine. They should have a working knowledge of geometric tolerancing.

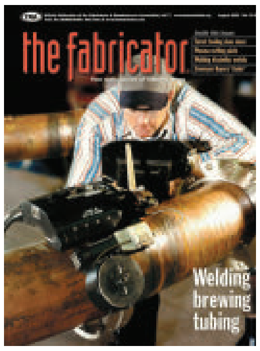
"At this level operators rarely make mistakes, can take a leading role in department operations, and supervise and train lower-level operators."

Benson estimated that the time line for an operator to reach this level of expertise was seven years.

February 2002
The Roller Coaster Ride of a Lifetime

Before Gerald Davis spent his time writing about 3D CAD modeling in *The FABRICATOR*, he wrote about job shop management. At the time he was president of DSM Manufacturing Co. in Colorado.

In a column called "Emotional thrills" he captured life in a job shop: "When you ride a roller coaster, you know that it is supposed to be fun and will last only a few minutes. The job shop you're working in isn't supposed to be anything like a roller coaster ride. Although it should be fun, it had better not



Got a story about fabricating brewery equipment? The staff of *The FABRICATOR* is always ready to respond.

have a foreseeable end. Even so, job shops experience many ups and downs. They key is to try to avoid the downs."

April 2002
The Rise of Manufacturing on Television

The rise of reality television is something that started in the 1980s, but reality manufacturing television really caught on in the early 2000s. "Junkyard Wars" on The Learning Channel (TLC) was one of the first.

By 2002 the show was in its sixth season. (It would last one more before being saved to the digital cloud in the sky.) The premise was simple: Two teams of three had to fabricate something, anything from a race car to a rocket, over a 10-hour period, and the two objects were later judged against field-specific criteria. The teams had access to any tool they might need, as well as an expert in a relevant field who could steer them in the right direction. The junkyard, in which the series was shot, was home to the parts that would ultimately become these Frankenstein fabrications.

The show originally aired in the U.K. under the name "Scraphead Challenge." The creators of the show actually shared a common desire with many involved in manufacturing in the U.S. According to the series' website, the point of "Junkyard Wars" was not the competition, but "to teach some science and get kids to think that engineering or something similar can be a fun thing to do with your life."

May 2002
Steel Tariffs: Sound Familiar?

In late March President George W. Bush enacted tariffs on various imported steel products, ranging from flat products like cold-rolled, plate, and coated sheet steel to circular welded tube products. Imports from the European Union, China, Taiwan, Japan, and South Korea were affected. Mexican and Canadian imports were exempted because of penalties the U.S. would face under the North American Free Trade Agreement.

In the early 2000s the tariffs coincided with a rise in steel prices. Steel-consuming companies were not very pleased.

"The president's decision made no mention of measures to help steel-using manufacturers waiting for the results of exclusion requests that are not yet resolved," said Lewis Leibowitz, counsel for the Consuming Industries Trade Action Coalition.

December 2002
Safety First

"20 years without a lost-workday accident" totally works as a headline, but the story also delivered some good tidbits on maintaining safe work environments. The writer interviewed five companies that had earned Safety Awards from the Fabricators & Manufacturers Association (FMA) for five years in a row. Here are some of the tips the writer shared:

- Create a company safety manual, but also include risk prevention tactics.
- Regular walk-around inspections are necessary.
- Create safety programs that reward safety consciousness, such as reporting unsafe working conditions or recommending a new, safer way to do something.
- Get management involvement in committees or leading meetings.
- Keep the shop clean.

"We're steel workers," said Sherrill Rogers, safety manager for B. Walter & Co., Wabash, Ind. "Steel is dirty. Steel is sharp. Steel is heavy. Steel is unforgiving. The equipment we use is power equipment. The minute people aren't paying attention, it's prime time for an accident."

Laser cutting technology became more widely adopted in the 2000s. High-powered CO_2 lasers meant that shops could use the machines to cut plate, which used to be the domain of plasma cutting machines.

February 2003
Productivity Improvements

The 1990s were a decade when fabricating companies adopted laser cutting technology at a rapid pace. The 2000s were a time when fabricators learned that they needed to keep up with the technology.

Hartzell Fan Inc., a custom industrial fan builder, was looking to replace its 8-year-old laser cutting machine at its Piqua, Ohio, plant. It purchased a Gemini 3015 from Amada with a load/unload pallet system, which paid immediate dividends. Not only did the machine take on all of the capacity of the old laser, it also took on work from the company's plasma cutting table. Company management suggested it was getting about four times more productivity with the new 4-kW laser cutting technology when compared to the older machine.

March 2003
Crawfish? Really?

This issue contained my first editorial as a member of *The FABRICATOR* staff. I wrote a column about how automated technology might work wonders for the crawfish processing industry, which was seeing real competition from cheaper crawfish imports from China. "Technology and adding value to a product lineup jump out at me as possible cures for intensified global competition," I wrote.

A reader wrote a letter a few months later just stating: "Crawfish?"

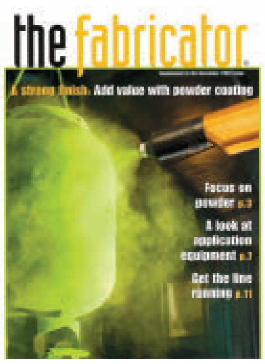
Maybe he was used to it being called "crayfish."

July 2003

The Incredible Case of Natural Gas

Has *The FABRICATOR* ever been more wrong than with the headline "Gas bills unlikely to decrease: Natural gas supply will not increase soon"? That was the thought at least in the early 2000s as industrial companies wrestled with rising energy costs and the inability to raise prices on a fickle customer base.

"Obviously, our electricity costs are influenced by natural gas supplies," said Jeff Uhlenberg, president of Donovan Heat Treating Co. Inc., at a National Association of Manufacturers press conference. "And because metal treating and a number of other sectors rely so heavily on natural gas as part of our manufacturing processes, we're being hit with a proverbial 'double whammy' as gas supplies become less dependable."



Recognizing the trend of fabricating companies taking on more processes in the metals value chain, *The FABRICATOR* put together a special section on powder coating in 2003.

At the time experts believed that manufacturers and others in the industrial sector used nearly 45% of the natural gas consumed in the U.S. It's amazing what the emergence of fracking and further development of the natural gas supply chain have done for energy costs in the U.S. It might be one of the most underrated reasons for domestic manufacturing remaining competitive against global competition.

September 2003

Reality Bites for Manufacturing

The recession that began in March 2001 and ended in November 2001 was unlike previous recessions in that U.S. consumers continued to spend money, according to William Strauss and Scott Walster of the Chicago Fed in the article "The disappearance of manufacturing?" Usually during tough economic times, consumer spending, which at the time represented two-thirds of the overall economy, retreats because workers lose jobs and confidence slips.

So if consumer spending remained strong, where did the economic weakness reside during the recession? Strauss and Walster singled out the manufacturing sector as a main area.

"Manufacturing output peaked to June 2000, 10 months before the overall economy went into a recession. The declines continued for 18 months until December 2001, with output declining by 7.6% over this time. In the 15 months since the output trough, manufacturing production has increased an anemic 1.1%. This recent weakness has clearly contributed to cutbacks in employment in the manufacturing sector," the authors wrote. The trend only reinforced what many know now: U.S. companies are learning to produce more with fewer people.

December 2003

Supporting Manufacturing Education

In an editorial *The FABRICATOR* announced its support for the FMA's push to offer scholarships to those interested in engineering, manufacturing technology, and welding.

"We have an interesting dichotomy in the U.S. today," said then FMA President and CEO Jerry Shankel. "According to government statistics, approximately 90% of the individuals 18 to 24 years old have graduated from high school, yet employers say they cannot find qualified workers. FMA, through its FMA Foundation [now known as the Nuts, Bolts & Thingamajigs Foundation], is trying to help this situation by providing scholarships to individuals interested in entering manufacturing at the engineer or technician level."

If you are interested in supporting today's students in pursuing a career in manufacturing, reach out to the NBT Foundation at www.nutsandboltsfoundation.org.

Beating the Global Competition

In the late 1990s Steven Southwell, president of Des Plaines, Ill.-based Nu-Way Industries, was told by a multinational customer that his part had to meet the "total cost of acquisition" achieved in China or purchase that same part from a Chinese supplier, inventory it, and incorporate it into the family of parts supplied by Nu-Way. He purchased the parts from China for a time, but soon got back to making them in the U.S. Automation allowed him to do that.

A case study covered how a lineup of Finn-Power (now known as Prima Power) fabricating technologies, including a flexible manufacturing system; a punch/shear combination with unloader, stacking system with buffer storage, and unloading robot; an inline automated bending cell; and a robotic press brake, helped Nu-Way become more productive and reduce the cost associated with making the parts for its multinational customer. Only four people were needed to run the system 24/7.

"This is where you need to be if you're going to compete against the low-labor-cost countries," Southwell said. "Because of increased productivity, I can make 10,000 of these parts in 24 hours. What is my revenue for that day compared to my previous output?"

As the pace of fabrication picked up in the 2000s, shops began to look more critically at their setup operations in the bending department.

His final piece of advice for other fabricators? "Automate the s**t out of everything you are doing!"

January 2004

Major Metal Fabricating Media Deal

It wasn't a deal that rocked Wall Street, but it was a major development in the trade journalism business serving the metal fabricating industry. In late 2003 the Society of Manufacturing Engineers' board of directors authorized the sale of its *Forming & Fabricating* magazine to FMA. *The FABRICATOR* became the undisputed No. 1 recognized source of industry coverage after the deal.

The SME and FMA relationship actually dates back to 1979 when both associations founded FABTECH. In the early 2000s the two organizations even worked on other events, such as a hydroforming conference that occurred in 2004.

February 2004

How Lasers Have Changed

In "Cutting through 5 myths about modern lasers," the author pointed out that it's a myth that high laser wattage is required to cut at competitive speeds. "In other words, higher wattage does not always equal higher productivity," he wrote.

That's pretty amazing considering today's march toward increased laser strength, but the point was very valid at the time. In most instances, lower-wattage machines then had higher beam quality than higher-wattage lasers. That meant that a 2,000-W laser that generated a high-quality and tightly focused beam could cut a wide range of materials faster than a 3,000-W laser of average beam quality. The laser of reduced power also would have been less expensive and less costly to operate than that 3,000-W laser.

Things have definitely changed since then. The march toward a 20-W laser cutting machine has already begun in 2020.

August 2004

Lean Manufacturing in the Job Shop

Even today some doubt that lean manufacturing can make a difference in a high-mix/low-volume environment. That general feeling was a lot more pervasive in the 2000s when people still associated the phrase with the Toyota Production System and high-volume manufacturers.

Some lean manufacturing consultants and fabricators who had implemented successful lean projects shared some advice with readers in the story "Lean on it":

• Get an outside point of view. A lean manufacturing expert can see opportunities for eliminating waste that someone who works in that same environment likely won't recognize.

• Invest in training. If employees understand the costs associated with their jobs and rework, they have a better understanding of what can be accomplished by eliminating waste. If those plans also are shown to increase company profit, employees can link lean manufacturing efforts to company prosperity.

• Provide a visualization of what's to be accomplished. A value stream map details the steps and indicates where value and nonvalue efforts take place. This map charts the course for changes and helps employees to see the dollars that are saved.

• Make a commitment to avoid layoffs. If a company embarks on a lean manufacturing journey, eliminates a job function, and lets go of an employee, that same company isn't going to get much employee involvement from the remaining staff. Eliminating waste allows for redeployment of human resources elsewhere. That's the only way to ensure employee buy-in over the long term.

• Consider an investment in technology. It's not always the answer, but when it makes sense, new fabricating technology usually makes a big impact.

November 2004

FABTECH and AWS Join Forces

For those that don't remember, the American Welding Society (AWS) used to have its own tradeshow—The Welding Show. In 2004 FMA, SME, and AWS decided to create one supershow.

"From the day I walked into the FMA in 1989, the industry has told me there are too many tradeshows," Mark Hoper, director of expositions, said. "And throughout the 1990s, the pool of exhibitors and attendees has gotten smaller for all tradeshows.

"We're trying to add value for exhibitors and attendees because usually they're able to go to only one event," he continued. "This will save the welding industry a lot of money."

For the record, the last SME- and FMA-sponsored FABTECH without AWS was in Cleveland in October 2004. The last AWS Welding Show was in Dallas in April 2005. The first combined event was in Chicago in 2005.

January 2005

The Journey Toward Press Brake Automation Continues

"Assessing the need for an automated press brake system" contained a multitude of bullet points to consider before purchasing a robotic press brake system, but one paragraph really stood out: "Automation may benefit your press brake operation, but unless you are already familiar with automation, it is not likely to be plug-and-play. There is a learning curve, and cultural changes may need to occur."

More than 15 years later, new automated press brake systems are as close to plug-and-play as they might get, but cultural issues remain. Does a fab shop know its processes well enough to drop in an automated system and have it run as effectively as it should? Technology marches forward, but the human element remains a consistent challenge for most fab shops.

> "From the day I walked into the FMA in 1989, the industry has told me there are too many tradeshows. And throughout the 1990s, the pool of exhibitors and attendees has gotten smaller for all tradeshows. We're trying to add value for exhibitors and attendees because usually they're able to go to only one event. This will save the welding industry a lot of money."
>
> —Mark Hoper, FMA, on the combining of FABTECH and the American Welding Society Welding Show in 2005

February 2005

***The FABRICATOR* profiled BTD Manufacturing, Detroit Lakes, Minn., for the first time in 2006. Twelve years later, the magazine honored the company with its Industry Award. By then it had grown its annual revenues to more than $200 million.**

Fabricating Technology Advances in Mexico

Even in the 2000s many viewed manufacturing operations in Mexico as simply a cost-savings move. The labor rates were less expensive when compared to the U.S., but delivery was less of a hassle when compared to having something made in China. Not too many companies at the time viewed Mexico as a strategic part of their overall manufacturing operations.

John Deere didn't see its operations in Mexico that way. Industrias John Deere (IJD), a Deere subsidiary, had spent the previous decade trying to establish a just-in-time manufacturing environment, and it was looking to make a major investment in laser cutting equipment to help push the further transformation of its Mexican operations. After several months of evaluating the technology from different machine tool vendors and checking customer references, IJD purchased TRUMPF's TCL 4030 CO_2 laser, which could cut material as thick as 0.75 in. and as thin as 0.125 in. The machine also had a working range of 162 by 83 by 5 in., which was large enough for the standard sheet size used in Mexico.

The laser cutting machine replaced separate shearing, plasma, oxyfuel, punching, and drilling operations. IJD management said that the laser technology helped it reduce labor and increase material usage, which was then between 80% and 85%. "The final quality of the part is the same, but it is a lot easier to achieve that quality with the laser," Ignacio Mondragon, an IJD mechanical engineer, said. "Before, to get the same finished part required a lot more operations and created a lot more scrap."

IJD ultimately purchased eight laser cutting machines for its facilities in Mexico. The company realized that cost-effective manufacturing processes make sense in any metal fabricating facility, no matter where it might be in the world.

July 2005

A Very Big Transition

BTD Manufacturing Inc., Detroit Lakes, Minn., was once Bismarck Tool and Die Co., a simple tool and die shop opened in 1979 in Bismarck, N.D. By 2005 the company had grown to become a contract manufacturer with $68 million in sales and more than 400 employees. "Beyond tool and die" featured one of the largest metal fabricating operations that *The FABRICATOR* had ever visited.

The company was in the early stages of really looking to crack open new markets with its newfound tube fabricating equipment. It had just spent more than $5 million on tube and bending equipment, such as a BLM 803D laser tube cutting system and two BLM tube benders. In particular the investments helped them to solidify contractual relations with companies in the recreation vehicle market.

Those investments and other company decisions proved to be good ones for BTD. Today it is a regular member of *The FABRICATOR*'s FAB 40 list with 2019 revenues of $242 million and 1,305 employees.

November 2005

Something You Don't See Every Day in Waterjet Cutting

Johnson Enterprises Inc., Val D'Amour, N.B., Canada, purchased a Byjet waterjet from Bystronic to fabricate debarking tools for the wood, pulp, and paper mills in Canada and New England. That wasn't so unusual, but the table's automated shuttle table was.

While common on a lot of laser cutting machines, the shuttle table, which allowed the machine to be loaded while it was also cutting, on a waterjet was not such a familiar sight. Company owners decided it was the right decision because it felt the table would be much more productive as business expanded. "The option is the most effective way to increase processing time," Operations Manager Joey Johnson said.

April 2006

A Visit to Jay Leno's Big Dog Garage

I got the chance to visit Jay Leno's Big Dog Garage in Burbank, Calif., thanks to some connections with the dealer that supplied the shop with a waterjet equipped with a KMT Streamline SL-V 50 Plus intensifier pump that generated a jet of water to 60,000 PSI. I spoke with Benard Juchli, who ran the garage and worked on most of the cars. He met Leno when Juchli owned a Jaguar repair shop and used to work on Leno's XK 120.

This kind of summed up the article: "So why does a garage need a waterjet? Because NAPA Auto Parts doesn't carry gaskets for a 1937 Fiat Topolino."

July 2006

OSHA Issues New Hexavalent Chromium Standard

In late February the Occupational Safety and Health Administration strengthened its existing standard that limited occupational exposure to hexavalent chromium [CR(VI)]. The new rule significantly reduced the permissible exposure limit (PEL) from 52 to 5 mg of Cr(VI) per cubic meter of air as an eight-hour time-weighted average. OSHA determined that the previous PEL for Cr(VI) posed a significant risk to workers' health.

Not all were happy with the decision. The original recommendation was to change the exposure limit to 1 mg/m^3 of air.

"OSHA's decision guarantees that many more workers will get lung cancer," said Michael Wright, the United Steelworkers union's director of health, safety, and environment.

August 2006

Concern Over Illegal Immigration

The vitriol about illegal immigration into the U.S. from the southern border was one of the main concerns of voters that helped to propel Donald J. Trump into the presidency in 2016. Readers of *The FABRICATOR* have been concerned about this for quite a while.

"A fence alone will not work," wrote Teresa Aschenbrenner of Temecula, Calif., in a letter featured in the magazine's Readers' Forum section. "If we want illegal immigrants to stop coming, we have to take away the incentive to do so. Employers who hire illegal immigrants should be fined as the current laws state. People who are in the U.S. illegally should not have access to services that U.S. taxpayers pay for.

"If we continue to allow this invasion, the U.S., as we know it, will change socially, economically, and politically—and not for the better."

April 2007

From Machine Shop to Fab Shop

Perhaps one of the underdiscussed trends of the last 25 years was the transition of machine shops and other types of manufacturers into fabricaters. In the 1990s Target Boring, Rockford, Ill., was looking to diversify its customer base and distance itself from the automotive machine, so it became Target Laser & Machining Inc. The company's new name reflected its new service: laser cutting.

The company started with a Mazak Optonics Super Turbo X510 Hi-PRO for 2-axis cutting. The machine was equipped with an automated load/unload cell for unattended operation. That proved a success and the shop ultimately added two more lasers, one of which was a SpaceGear, a multiaxis machine that gave it the capability to laser-cut features such as holes at various angles, bevels, and saddles.

Pleased with this new capability, the company decided it wanted to chase after high-volume work centered around tube fabrication. That led Target to purchase a FabriGear 4-kW tube cutting laser with bundle handler. It was the first company in the U.S. to have this type of machine.

Even then company officials knew they had to be able to produce quality parts cost-effectively and make delivery commitments. The world was growing smaller by the day.

"Right now we are unable to compete with China on a piece-per-piece basis," said Gary Reiter, Target's owner. "We have to create value for our customers through delivery, support, and service … The days of simply providing a part are waning."

As fabricators looked to automation to be more productive, even shops with waterjets considered the use of automated sheet load/unload systems.

July 2007

Best Feature Title Ever?

Kirsan Engineering Inc., Kenosha, Wis., created a new saw loader that relied on a lift truck, which kept its employees out of harm's way. *The FABRICATOR* was there to share the story. The headline? "Better safe than saw awry."

October 2007

Know Why You Are Automating

"Successul automation isn't automatic" covered the journey Fox Valley Metal-Tech, Green Bay, Wis., took to install a Mitsubishi River automated material processing system. Probably the best piece of advice to come out of the article was that the fabricator had a distinct reason to move toward material handling automation. It wasn't automating for automation's sake.

Fox Valley made the purchase of its first automated material handling system seven years earlier. That original investment in an MSCI automation system was made because the fabricator was losing money related to scrap generated by bad material transfer practices. A study of Fox Valley's operation revealed that moving certain materials with a lift truck, particularly stainless steel and aluminum, was causing scratches that resulted in rejected parts.

That system was soon upgraded to an MSCIII system with the River Navigation, which allowed the fabricator to leave behind the world of moving sheets and plate from wood pallets to metal skids. The automated system allowed the shop to load sheet metal directly into a storage tower, which then fed the laser cutting machines. The MSCIII also picked up the parts with suction and deposited them directly into laser loading bays, helping to minimize scratching.

March 2008

Virtually Welding

The FABRICATOR provided its first in-depth coverage of welding simulation tools, which now are much more prevalent in educational institutions and private companies. Back then, the technology was just being commercialized, so it was still being fine-tuned.

As one virtual welding technology user said at the time, "We assumed the proper way to weld was like a golf swing," meaning that his company thought that everyone was taught to weld the same way everywhere. But that's not necessarily the case with welding. Different applications have different needs.

Even though the tool might cost several times more than an average welding power source, educational institutions did see its potential. They didn't need to worry about constantly acquiring metal coupons for welding or dealing with scrap. Students who had never welded before might not be as intimidated when compared to handling a welding gun right off the bat. Liability concerns were reduced with this virtual technology.

Of course, the sources for the story indicated that this was no substitute for real-world welding experience. They were right there, but they also knew that the technology could be used to test job applicants or to teach basic movements before moving to a live arc. In short, virtual welding has indeed made a positive impact on welding training.

April 2008

The Bold in Arches

It may not mean much to the rest of the world, but when McDonald's tore down its restaurant in the

River North neighborhood of downtown Chicago in the early 2000s, it was kind of a big deal. Thousands of Chicagoans knew the restaurant as the "Rock 'n' Roll McDonald's" because of its musical theme. The new restaurant had to be pretty special if local citizenry were to ever forgive the chain for removing a beloved fast-food joint.

The new restaurant was supposed to be a remembrance of its past with a nod to the future. Its most eye-catching feature was a pair of parabolic arches that stand 60 ft. high. The arches were constructed from 20- by 12-in. tubes by Chicago Metal Rolled Products, and the story was covered in "Curving out a niche."

"We had never rolled these tubes into a parabola before," Chicago Metal Rolled Products' George Wendt said. "We found that we could do these pretty well; that there was minimal distortion; that we could do them fast. It was a little bit of a risky project, but something that gave us more confidence that we could go on and tackle other difficult projects and compete with anyone on how quickly we can do this."

May 2008

Fabricating: The Real Deal

Senior Editor Tim Heston has his byline all over this magazine every month, but if you don't read his Biz Talk column, you are doing yourself a disfavor. He understands the metal fabricating business and has come to appreciate its place in the overall U.S. economy.

One of his best columns ("Real companies, real products, real customer service") addressed his admiration for the tangible nature of metal fabricating, with its parts and components being made for paying customers, as opposed to the hard-to-understand world of mortgage-backed securities, which ultimately brought down the economy earlier in the decade. In short, building an investment business off bundled loans made to people who only years previously would have never qualified for a bank loan was a good idea?

Heston quoted Michael Greenberger, who served on the U.S. Commodity Futures Trading Commission in the late 1990s: "Should we have an economy based on whether people make good or bad bets, or should we have an economy where people build companies, create manufacturing interests, and make it more productive? We are rewarding people for sitting at their computers and punching in bets. That's not the way this economy is going to be built.

"India and China, with their focus on science and industry, and building real businesses, are going to eat our lunch unless the American public wakes up and puts an end to an economy that praises and makes heroes out of speculators."

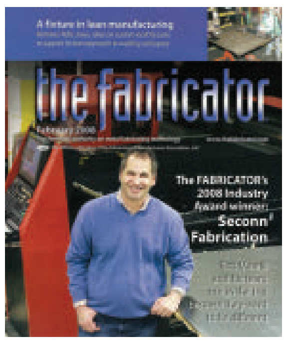
November 2008

A Fresh Approach to Rocket Fabrication

If you have been paying attention recently, you know that SpaceX's first human-rated spaceship just completed a 64-day test flight to the International Space Station. The company has long made it known that it was going to come at space travel from a fresh angle, but readers of *The FABRICATOR* knew that already.

In 2008 the publication profiled SpaceX. The opening paragraph gave you an idea of just how different this organization was going to be when compared to NASA: "Aerospace executive Chris Thompson, who reports directly to his company's CEO [Elon Musk], knows all about the retractable-pin friction stir welding sysem on the floor. He directly oversees it and has operated it himself."

Work back then was focused on the Falcon 9, which helped to pave the way for the Dragon. Today work is focused on getting man back to the moon and perhaps Mars.



In 2008 *The FABRICATOR* gave its first Industry Award to Seconn Fabrication, Waterford, Conn. The publication provided an update on the company in its January 2020 issue ("Refocus and renew," p. 68).

January 2009

Energy-efficient Bending

The FABRICATOR revisited electric and hybrid press brake technology and learned that it was beginning to garner more interest from metal fabricators, who were becoming more aware of the reduced costs of running the devices. Of course, the electric brakes didn't need any hydraulic oil, but even the electric-hydraulic brakes required only a third to half of the oil of conventional hydraulic brakes.

Fabricators increasingly are adopting these efficient press brakes as their main bending workhorses. Considering that these units hardly draw any power when sitting idle, you can understand why that makes the shop owner and company's accountant smile a bit more than when they were running all hydraulically powered machines.

February 2009

Rewarding Everyone in the Shop

Tim Heston profiled E&E Metal Fab in "Sustaining success in a downturn" and found a company that was on track to boost its sales revenue in the midst of an economic downturn. The Lebanon, Pa.-based shop was on track to hit $4.5 million in 2008, three times more than it made in its first year in business, which started with the company's founding in November 2003.

The company's founder, Willie Erb, said he had worked in companies where infighting and politics were common. He wanted his shop to be different.

"We all experienced the sad disappointments, the lies, and now we experience truth, fun, and excitement," he said. "Nothing was for us. It was all for them. We wanted something that was for us, from the entry-level person to the president of the company. It's all for us."

Profit-sharing reinforced this approach. It also should be noted that Erb said he never really had any trouble finding new employees. They found his company.

September 2009

The Digital Revolution Hits Structural Fab

Structural steel fabrication requires a group effort to be successful. You've got architects, general contractors, government officials, the structural steel fab shop, and erectors, just to name a few. Imagine trying to keep all of these parties on the same page without the use of digital tools. Well, phone calls and paper documents used to be the main tools in this communication loop, and that still remains the case for some older companies. But not for A. Zahner Co., Kansas City, Mo.

In a profile, the company revealed itself to be an aggressive adopter of new technologies, from 3D modeling to a new ERP system. Company management viewed it as a way to eliminate waste from the supply chain.

Verbiage on the company website summed it up nicely: "Over the last decade, the design, engineering, and construction industries have been working to integrate digital technology into the process of construction. Like a growing leak in the dike of ingrained conventions, the integration of digital technology is dissolving the barriers that slow down the building process. Companies that do not embrace this technology will be overwhelmed by the shift that is occurring."

December 2009

Tiny Living

Shows about tiny houses could be found all over cable television only a year ago. *The FABRICATOR* was on the trend more than a decade ago.

Contributing Editor Eric Lundin had a Back Page feature on CI Weld 'N' Fab, Vancouver, B.C., Canada, which was fabricating homes out of shipping containers. How small were the homes? Just over 300 sq. ft.

That's enough on that subject. ***FAB***

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Stop scheduling and start prioritizing

How to deal with constant change in production

By Mark Lilly

Most North American manufacturers make custom products, not standard widgets, and their high-product-mix production environments are extraordinarily complex. A shop might manage hundreds, perhaps thousands of jobs at any one time.

Each job has at least several operations, and some might be sent for outside processing like heat treating or plating. Some might be subassemblies, with parts ("children") being fabricated and then assembled to a "parent" subassembly, which in turn is assembled to another parent, and so on.

The children might be for a single job or shared across many parents that need them at different times. Managing these dependencies is no small task, and most companies have at least one person, sometimes a few, whose sole job is to manage the due dates and dependencies of all these subassemblies so their respective parents have a chance to be delivered on time. While juggling all this information, planners try their best to figure out, among all tasks across all work centers and departments, what truly is most important.

Meanwhile, sales and customer service continually and frantically ask production where orders are and how they're progressing. Will an order be delivered on time? If not, when will it be finished, and when will it arrive at the customer's receiving dock?

Many operations use finite scheduling methods developed in the 1970s and '80s. Whether used separately or as part of enterprise resource planning (ERP) software, finite scheduling uses capacity-loading algorithms to schedule the operations of jobs in a forward or backward direction.

Both forward and backward scheduling have their challenges. For instance, forward-scheduling releases work too soon, flooding the floor with too many jobs, causing excess work-in-process (WIP), bottlenecks, and confusion about what to work on next. The problem with backward scheduling, on the other hand, is that you're telling the planning tool, "OK, let's plan to finish the last operation of every job … the day it's due." Anyone who's spent time in a production environment knows that, to put it politely, "stuff happens." Tooling and machines break down, key employees don't show up, and material gets lost. In this environment, planning to complete the last operation of every job the day it's due is a recipe for disaster. It's no surprise then that, rather than relying on software algorithms, many end up scheduling manually on whiteboards or spreadsheets.

An Alternative Approach

Have you heard this one? *"How do you make God laugh? Tell him your plans!"* This couldn't be more true than on a manufacturing shop floor. Change is constant, which is why the traditional approach to production scheduling—set all your data and parameters, run a program, which creates a plan (the "schedule"), and then attempt to execute that plan in the shop—is fraught with frustration. As soon as the program comes up with a plan, something changes that makes the plan obsolete.

Instead of creating a plan based on a capacity-loading program (forward, backward, finite, infinite scheduling), what if a shop adopted a method that focuses on a real-time priority list that, if followed, would speed the flow of work through the shop? George Plossl, one of the "fathers of MRP" back in the 1960s and 1970s, felt so strongly about improving flow that he made it the foundation of his first law of manufacturing: "All benefits [in a manufacturing company] will be directly related to the speed of flow of information and materials."

What does "all benefits" mean, exactly? It means better on-time delivery, shorter lead times (leading to more sales and a better reputation in the market), less WIP (and less money tied up in inventory), and faster turns on the speed of production (greater throughput) and inventory. To achieve these benefits, an operation can apply three principles in conjunction with one another.

Principle No. 1: Acknowledge and Anticipate Variability

Say you're using finite-capacity backward scheduling, which means that the last operation of every work order is scheduled to finish the day the job is due. That's just asking for trouble. Hoping each operation gets done in perfect sequence is just a bad idea. Again, stuff happens. An operation might have a contention between manufacturing steps or experience tool or machine breakdowns. Perhaps the material doesn't show up when promised. Shops need to acknowledge variability, even anticipate it. Each job needs some time protection to buffer the due date, and assigning the right time buffer protects your due date commitment.

Production Execution Workstation

Prod Seq #	Threat Level	WO# Name	Buffer Remaining
1	1.700	Part FAB-20001 Make to Order	58%
2	1.600	Part FAB-30001 Make to Stock	62%
3	1.500	Part FAB-40001 Make to Order	75%
4	1.250	Part FAB-50001 Make to Stock	100%
5	1.000	Part FAB 60001 Make to Order	100%
6	1.000	Part FAB-70001 Make to Order	100%

FIGURE 1
A priority list at each workstation shows operators what to work on next. Orders in red are in the most danger of being late.

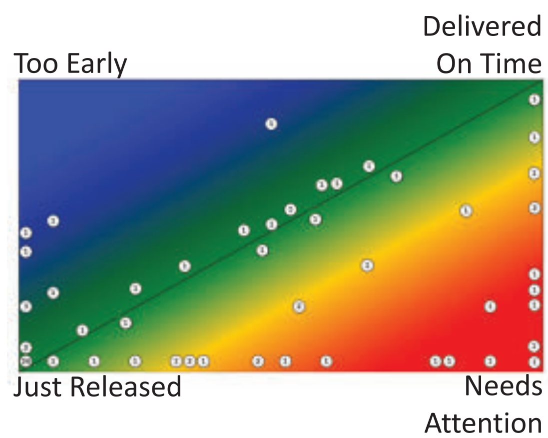

FIGURE 2
Instead of focusing on what is "on schedule" and what isn't, a planner can monitor which jobs are in danger of being late. The more jobs that are in the green, the better. Jobs in red need attention, while jobs in the blue were released too early, creating excess WIP.

Principle No. 2 Manage WIP Volume

In many high-product-mix operations, no one really knows the right time to start a job. Without knowing this, and often with the intent of trying to keep everyone busy, planners release orders to production as soon as possible. This leads to several significant problems.

First, it increases inventory. Because planners don't know when a job must start, they fear starting jobs too late, so material is purchased and brought in early—sometimes way too early—unnecessarily tying up capital and restricting cash flow.

Of course, releasing orders as soon as possible seems intuitive. After all, the sooner a work order is released on the shop floor, the sooner a finished order will come out the other side, right? Well … no.

Google "Little's law," and you'll see the mathematics from a concept called *queue theory.* Little's law states that the more items (people, cars, work orders) enter a system—anything from a highway, a grocery store, an amusement park, or a manufacturing shop floor—the longer those items *will be* in the system.

Say you drive up the on-ramp to a four-lane highway and hit the brakes. It's bumper-to-bumper as far as you can see. You now know you're going to be on that stretch of highway for a long time. Similarly, say you want to ride five rides at an amusement park. To ride those rides will take you a lot longer during spring break (pre-COVID-19) than if you went the third week of September when everyone's back in school.

The same holds true on a manufacturing shop floor. The more jobs you release to production, the longer any one of those jobs will be in production. The neat part about Little's law is that the inverse holds true: The *fewer jobs* you send out to the floor, the *faster* they will flow through all the manufacturing steps.

Principle No. 3: Use the Right Priority

Prioritizing jobs via due date seems to make sense, but in a high-mix environment it's not that simple. Just because a job has a longer lead time doesn't mean it's in less danger of being late. A job due in two months might be in greater danger of being late than other jobs due in a week, especially if the long-lead-time job involves complex routings, lengthy processing times, and multiple steps requiring outside processing. Prioritizing based on due date would have you working on the jobs due earlier, putting those complex jobs due later in even greater danger of being late.

If a due date isn't effective for setting priorities, what is? This is where *relative priority* enters the equation. Relative priority focuses on what production is trying to maximize: on-time delivery. It's about focusing on what's most in danger of being late regardless of when it's due.

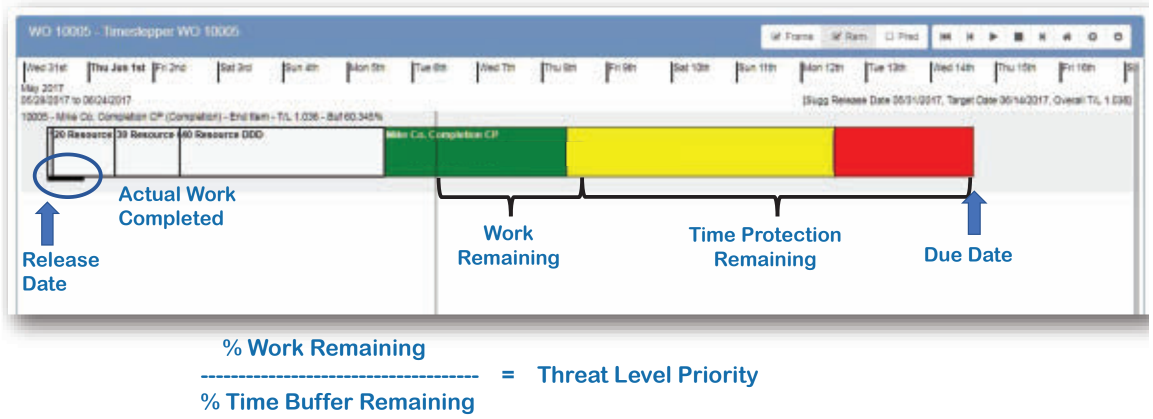

FIGURE 3

This custom execution plan for an order accounts for the inevitable variability of high-product-mix production. If the "work remaining" time shrinks faster than the time buffer, the threat of being late remains low. The plan also establishes the work release date (on the left edge). Work released any sooner would create excessive WIP. According to Little's law, the more WIP you have, the greater your lead time.

Prioritizing jobs via due date seems to make sense, but in a high-mix environment it's not that simple. Just because a job has a longer lead time doesn't mean it's in less danger of being late.

Such a system works off a ticking clock "eating away" at a time buffer, with priorities recalculated based on employees clocking in and out of jobs as well as other task-completion reporting. When operators see the job priority list, they know that the job at the top is most in danger of being late. The job that can least afford to wait gets worked on next.

Putting These Principles to Work

Operators don't need a schedule to know which task to work on next. They just need to know which job is most in danger of being late (see **Figure 1**). Similarly, planners need not constantly update an ever-changing "schedule," but instead can focus on the lateness threat level of all the orders in the shop (see **Figure 2**).

How do planners develop such a priority list? Here's where an alternative approach to software comes into play. It doesn't rely on capacity-loading algorithms based on backward, forward, infinite, or finite scheduling, but instead uses simulation and predictive analytics.

The goal is to predict the start and finish time and date of every operation in every work order. The prediction is based primarily on each order's danger of being late—that is, each order's *threat-level priority*, calculated by dividing the work that remains by the remaining time buffer. The more consistent an operation becomes, the shorter that time buffer can be. But again, production planning in high-mix manufacturing must anticipate variability, so the time buffer will never go away completely.

All this is incorporated into a *custom execution plan*, as shown in **Figure 3**. The left edge of the plan shows the correct time to start a job—not too late, not too early—and serves as the "need date" for any raw materials and manufactured components.

The planning method simulates production employees selecting the top order from the priority list, then "walks it out" into the future based upon the availability of machines, people, and (if needed) material. This produces a Gantt chart that looks like a schedule, but it's not. Again, operators don't need a schedule. They just need a priority list that shows them what to work on next.

That priority list comes from a plan created through software analytics that incorporates threat-level priorities (that is, an order's danger of being late), with the aim of delivering orders on time as often as possible. What does "as often as possible" look like? That's where capacity planning comes into play based on the actual way employees execute orders in the shop.

Predictive analytics—which, drawing from historical data, gets better over time—show detailed or aggregate predicted wait times by operation, job, or work center. Such analytics allow a company to run alternative game plans and production scenarios. *When could I promise this quote if it turns into an order? How much overall lateness will be reduced if I work overtime this Saturday in my bottleneck department?*

Promises Kept

The varying threat levels reveal where and how severe the bottlenecks will be. Viewing this information, an account manager can determine when he can deliver a specific work order to his client. And he doesn't just guess or rely on a shop's standard four-to six-week lead time. He instead promises a delivery date that takes into consideration all the other jobs on the floor, now and in the future.

Put another way, that promised delivery date factors in the uncertainty of high-product-mix production. It acknowledges and anticipates the planned and "unplannable" variability that production personnel deal with every day. ***FAB***

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Miller Metal Fabrication's TRUMPF 10-kW TruLaser 5040 has added new laser cutting capacity for the fab shop.

Miller Metal Fabrication

keeps trying new things

Fabricator finds that embracing change is the key to continuous improvement

By Dan Davis

Growing up on a farm, Martin W. Miller learned that if you needed to improve a situation, you were responsible for improving it.

The classic example is fixing a key piece of equipment, like a combine. If the combine is not running and it needs to be ready for harvesting, the farmer better get to work on the repairs. Waiting on a mechanic from the local equipment dealer is a gamble, because everyone wants their tractors and combines worked on prior to harvest. There is no excuse for not having a running combine, so the farmer has to be skilled enough to make it happen.

Miller had that type of creative mind, according to his son Martin Miller III, and it helped him to come up with new ways to do things. For example, when a local major food manufacturer needed machinery to help automate pretzel-making, the company reached out to Miller, who built them a pretzel-twisting machine. That was the beginning of a new business, but a few years later Miller recognized that not everyone needed a pretzel-twisting machine. As a matter of fact, a lot of his customers required his services only when a new piece of machinery was needed. That didn't leave a whole lot of opportunity to grow the business.

Realizing he was good at fabricating things, Miller decided to focus on his talent and not on an end product. He built the parts and assemblies that others didn't want to build. With the purchase of CNC plasma cutting and punching technology, Miller Metal Fabrication was born in the mid-1980s.

Laser cutting technology, however, changed the trajectory of the business in the mid-2000s. Miller had always been interested in finding new ways of doing things, and laser cutting was too big of a technological change to ignore.

A New Pace of Manufacturing

"We had started looking through *The FABRICATOR* at the time and saw some of the advertising for the TRUMPF lasers. So we had discussions back and forth between us," said Miller III, referring to his dad, his two brothers in the business, David and Paul, and Dave Morris, the company's vice president, who is now semiretired. "So in 2006 we bought our first laser machine and that kind of changed our world as far as production manufacturing."

That one piece of equipment changed the dynamic of the shop floor, as Miller Metal could now produce 2D blanks faster than it ever could before. It was up to the rest of the shop to catch up.

In a way that same dynamic exists today. Miller Metal has five TRUMPF laser cutting machines, including an 8-kW TruLaser 5030 fiber laser purchased in 2016 and a 10-kW 5040 TruLaser 5040 with a 6-ft. 8-in. by 13-ft. 4-in. table and automated material loading/unloading. To keep up with the blanks coming off the lasers, the shop has 13 press brakes, six of which are TRUMPF TruBend models. Laser cutting and press brake forming are done over three shifts.

In the spirit of trying to find a new way of doing things, Miller III said the company started offline programming of the press brakes about 18 months ago. What began as an effort to find more efficiency in the bending department also delivered another benefit.

"For the most part with the offline programming, our bend repeatability and holding of tolerances has gotten probably 40% to 50% better over the past several months," Miller III said. "It takes us a little more time in the office, and we've added more office people. So it's a bit of a balance."

Not Afraid to Adjust After an Adjustment

The focus on finding efficiencies not only on the shop floor but also the front office is nothing new for Miller Metal. It worked with a consultant from the Delaware Manufacturing Extension Partnership in 2007, and the recommendations really "shook us up a bit," Miller III said.

At that time the front office was organized like in most other companies, with one person being responsible for one activity. The head of purchasing handled all raw material acquisitions. All quoting went through the lead estimator. The lean consultant had other ideas, however.

The consultant recommended that a "project manager" be the one point of contact for all things related to a job. That project manager handled the quote, purchasing of material, and even design, which meant that a lot of people were sent off to learn SolidWorks. The theory was sound in that one person would have all of the answers about that one job. Reality showed that it was an extreme change that had its bumps when it came to execution.

"It was an extreme pendulum swing over that way," Miller III said.

The benefits became evident almost right from the start. Project managers didn't need to rely on the quoting department to turn around estimates for an antsy client or on the purchasing department to expedite a material order for a hot job. They also could hand-hold those hot jobs as they worked their way through the shop. The buck always stopped with those project managers, which made communication a bit easier.

Unfortunately, the process wasn't the most efficient way to approach all of those support activities to metal fabricating. For instance, one project manager might order a sheet of 0.25-in. hot-rolled steel, and another one might call up the service center for five sheets of the same material. A few hours later, two different trucks would pull up, waiting to be unloaded. Also, finding individuals with adequate design skills to really maximize that project manager role was difficult.

After several months of this arrangement, Miller Metal knew it needed to come back somewhat. "We kind of went back to our roots a bit," Miller III said.

The company set up a design department to help out with 3D modeling for quoting and work instructions. A purchasing manager was hired, and all material requisitions came through him. But the role was tweaked in a nontraditional way, according to Miller III, because the purchasing manager also nests all the jobs. He can see the demand, bundle similar types of jobs with similar deadlines, and maximize the material usage. He also has help from others, who handle the creation of CAM programming for the laser cutting and punching machines.

"It's a little different than before, but works better for us now," Miller III said.

This willingness to invest in new technology and shake up internal processes has proven to be a recipe for success over the years, Miller III said. The company actually grew during the Great Recession and survived 2016 when tariffs went into effect, increasing material costs. Even now in the midst of the COVID-19 pandemic, the company has remained busy, making the most of Gov. John Carney's proclamation of metal manufacturing businesses as being "essential" in the fight against the virus. In fact, the metal fabricator proved to be a valuable partner in a major effort to build ventilators during the early days of the COVID-19 outbreak on the East Coast.

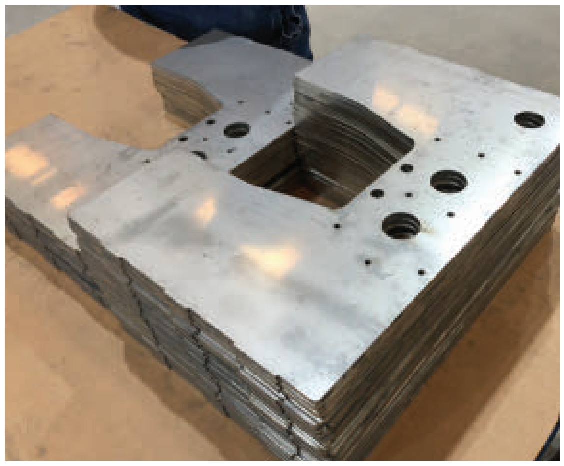
A Race to the Finish

All eyes were on New York City in March as the metropolitan area was the first major epicenter of the COVID-19 crisis in the U.S. In addition to personal protective equipment, city officials and medical professionals also sent out a call for ventilators. In those early days, many who were admitted into the hospital with the virus struggled mightily with breathing, and the lack of access to an inventory of ventilators worried everyone.

Spurred on by news coming from Italy and the call for manufacturing help, some New York City engineers from firms like NewLab and 10XBeta got to work and developed a design for a "bridge" ventilator, also called an automatic resuscitator. It's a streamlined ventilator that is designed to help less critically ill patients breathe. It also happens to cost about a tenth of a standard ventilator, which starts at around $30,000. After receiving expedited approval from the Food and Drug Administration, product designers reached out to local manufacturing contacts and found Boyce Technologies, a local manufacturer of safety and security equipment for the city's mass transit system. Boyce Technologies then found Miller Metal to help with the red-hot manufacturing effort.

Miller Metal was charged with making chassis components for the ventilator. Laser cutting the blanks would be no problem given the shop's equipment. Finishing the parts coming off the laser cutting machines, however, was going to be a challenge. The fabricator had a single-head grinding machine, but that was primarily used to put a grain on metal surfaces. Grinding off the microburrs that are often left on fiber laser-cut parts and rounding edges of the stainless steel parts to meet medical standards

The FINISHLINE metal finishing machine proved to be a useful tool when it came to turning around laser-cut stainless steel parts that needed to have microburrs removed and edges rounded for a ventilator application.


These parts are an example of jobs sent through the new metal finishing machine.

was going to have to be done manually, which was going to take more time than Miller Metal had.

"We had three days to order 200 sheets of stainless steel and have the parts cut, deburred, and bent," Miller III said. "Even with 20 people sanding it, you're not going to get the job done in two days. You're probably going to need a week."

Fortunately, around the same time, the company was entertaining the thought of investing in an automated finishing system. The fab shop had been in contact with its equipment dealer, Mid Atlantic Machinery, about its FINISHLINE machine, but it wasn't exactly ready to make the investment—at least until the ventilator job came along.

That led Miller Metal to ask for a test to see just how fast and effective the finishing equipment would be. In early May Mid Atlantic Machinery delivered the machine, which has a 43-in.-wide working window, and set it up between the newest laser cutting machines.

"As soon as the machine was installed, we were running parts in production," said John Rutkiewicz, Mid Atlantic's FINISHLINE specialist.

The 11- to 14-ga. stainless steel parts were about 14 in. wide by 18 to 20 in. long. An operator fed the first one through and proceeded to feed another 1,099 parts through the machine. In 105 minutes, all of the parts were deburred and had rounded edges. Miller III said that if the process had been done manually, it probably would have taken a 10-person crew a full shift to match the results of the automated finishing machine.

"I don't know if we would have bought the machine without that demonstration, but we were glad to see it in action. It was kind of the pushing-off point for that machine," Miller III said. The fabricator also used the machine to deburr and edge-round some 0.25-in. stainless steel base plates.

Rutkiewicz said the finishing machine has four heads that can handle not only deburring and edge rounding, but also oxide removal on edges for better paint adhesion, deslagging of plasma-cut parts, and graining of metal surfaces. Because Miller Metal was more interested in accentuating the deburring and edge rounding, the machine was staged with an abrasive belt (65 to 70 Shore hardness) for deburring, then a brush for edge rounding, then another brush, and finally a softer abrasive brush (35 Shore hardness) for a specified grain. The ventilator parts needed to be run on only one side, so they didn't need to be flipped and fed through the machine again.

Kevin Kilgallen, Mid Atlantic Machinery president and the first sales representative to introduce the TRUMPF laser technology to Miller Metal back in the 2000s, said he knew the machine would make an instant impact at the metal fabricating company, but he also believes that the machine will have an additional impact down the road as the deburring process is now streamlined. In particular, he pointed to the machine's automatic thickness adjustment, where a sensor determines the material thickness and moves the belts and brushes to deliver specified results. That and the machine's CNCs, which can store up to 250 finishing recipes, promise to help even less experienced employees get up to speed on the machine in a few days.

Miller III said the finishing equipment enabled the company to meet its obligations to deliver the ventilator parts in its three-day time frame and it's hoping to find similar time savings on other projects because the bottleneck of manual deburring has been removed. Additionally, he said he was intrigued by the polishing and graining capabilities, some he called "a science to its own."

Room to Grow

The automated finishing machine is not the only piece of equipment that Miller Metal has added recently. It installed Peddinghaus' Ocean Avenger single-spindle drill line this summer. The equipment will be useful with the company's structural steel work, which never dominates fabricating activities at the company, but never really completely disappears either.

Miller III said that kind of sums up Miller Metal nowadays. People come to the company because they know that it's a one-stop shop for their fabricating needs, which also may include machining and welding.

Remarkably, all of this metal fabricating activity is taking place in a 35,000-sq.-ft. facility. "Our poor shipping department is almost out the door," Miller III said. The shipping department lost some of its space to the new drill line.

Another change is coming in 2021 when Miller Metal moves into a new, 60,000-sq.-ft. facility just down the road. It'll have more elbow room to try new things and make necessary adjustments along the way. It's not the smoothest way to run a manufacturing business, but no one really gets into the trade to take it easy. Whether it's a harvest or a delivery date, the job has to get done, no matter what it takes. ***FAB***

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Miller Metal Fabrication, www.millermetal.com

Mid Atlantic Machinery, www.midatlanticmachinery.com

TRUMPF, www.trumpf.com

Model	Machine Configuration: Bridge	Machine Configuration: Cantilever	Machine Configuration: Gantry	Machine Configuration: Hybrid	Machine Configuration: Robotic	Machine Configuration: Rotary	Machine Configuration: Other	Number of Controlled Axes (Max.)	Work Area Travel (Max.) Without Repositioning: X Axis (in.)	Without Repositioning: Y Axis (in.)	Without Repositioning: Z Axis (in.)	Without Repositioning: Laser Head Rotation (Degrees)	Without Repositioning: Laser Head Tilt (±Degrees)	With Repositioning: X Axis (in.)	With Repositioning: Y Axis (in.)	Resonator Type	Power (kW)	Accuracy and Repeatability (±in.) Without Repositioning: Accuracy	Without Repositioning: Repeatability	With Repositioning: Accuracy	With Repositioning: Repeatability	Maximum Positioning Speed (IPM): X Axis	Y Axis	Simultaneous	Workpiece Specifications Max. Thickness (in.) With Max.-Power Resonator: Mild Steel	Stainless Steel	Aluminum	Max. Weight (lbs.)
3D FAB LIGHT INC., Oakland, CA																												
FabLight		✔				✔		5	50	25	1.7	0	0	50	25	Fiber	4.5	.002	.0005	.002	.0005	1,200	1,200	1,200	.188	.188	.125	16
AMADA AMERICA INC., Buena Park, CA																												
LC3015C2 (Theta)		✔						6	120	60	20	370	135			CO2, Axial Flow	4					3,150	3,150	4,455	.625	.312	.250	2,000
BLM GROUP USA CORP., Novi, MI																												
Lasertube LT5 Fiber						✔	✔	5	256	6	6	360				IPG Fiber	1.0	.004	.001						.1875	.120	.100	215
Lasertube LT Fiber						✔	✔	6	334	6	6	360				IPG Fiber	2.0	.004	.001						.250	.160	.160	300
Lasertube LT722						✔	✔	6	335	6	6	360				CO_2 Diffusion-cooled	2.5	.004	.001						.375	.180	.160	300
Lasertube LT8.10						✔	✔	13	8	8	9.5	360	45			IPG Fiber	3.0	.004	.001						.500	.375	.375	750
Lasertube LT8						✔	✔	13	335	8	8	360	45			CO_2 Diffusion-cooled	3.5	.004	.001						.625	.375	.300	750
Lasertube LT14 LT24						✔	✔	15+	700	14/24	14/24	360	45			CO_2 Diffusion-cooled	3.5	.008	.002						.625	.375	.375	1,000
LT-FREE					✔			5	116	37	29	Robot-dependent	Robot-dependent			IPG Fiber	3.0	Robot-dependent	Robot-dependent			Robot-dependent	Robot-dependent	Robot-dependent				
BOSCHERT USA, Butler, WI																												
Boschert Fiber Laser 3015				✔				3	118	59	10					Fiber	4	.002	.001	.002	.001			3,937	.6	.47	.4	
Boschert Fiber Laser 4020				✔				3	157	78	10					Fiber	4	.002	.001	.002	.001			3,937	.6	.47	.4	
HK LASER & SYSTEMS, Bartlett, IL																												
TL6015						✔	✔	4	303	6	6	360				CO2, Diffusion-cooled	2	.004	.001			4,724	1,574		.25	.20	.16	300
KOIKE ARONSON INC., Arcade, NY																												
Lasertex Z-Series	✔							6	240	2,400	14					Fanuc	4, 6							1,000	.75, 1	.50, .625	.375, .50	
KOMATSU AMERICA INDUSTRIES (FORMERLY NTC AMERICA CORP.—NTC LASER), Novi, MI																												
TLM 408	✔					✔		6	98	51	28	200	180			CO_2, Axial Flow	6	.001	.0002			1,575	1,575	1,575	.750	.625	.375	4,400
TLM 610	✔					✔		6	122	75	35	200	180			CO_2, Axial Flow	6	.001	.0002			1,378	1,378	1,378	.750	.625	.375	4,400
TLH 510 w/Rotary Table		✔				✔		6	120	61	24	720	135			Solid State, Fiber	3	.001	.0005			3,937	3,937	3,937	.750	.750	.500	1,700
LVD STRIPPIT, Akron, NY																												
TL 2665-FL		✔				✔		11	6	6	6					Fiber	2	.003	.001	.004	.0015	5,000	1,000	1,000	.3	.25	.19	400
TL 2450-FL		✔				✔		11		6	4					Fiber	1	.003	.001	.004	.0015	5,000	2,000	2,000	.25	.19	.16	190
MAZAK OPTONICS CORP., Elgin, IL																												
FG-220 DDL							✔	11	312		8.6 (dia.)	360	135			Direct Diode	4	.0020/20	.0004			3,937	1,417		1	.750	.625	728
3D Fabri Gear 220 III							✔	11	312		8.6 (dia.)	360	135			Fast Axial Flow	4	.0020/20	.0004			3,937	1,417		1	.5	.375	728
3D Fabri Gear 400 III							✔	11	312		16 (dia.)	360	135			Fast Axial Flow	4	.0020/20	.0004			1,181	945		1	.5	.375	1,036
Space Gear U44-2D/3D/Rotary			✔					6	50	50	13.38	360	135			Fast Axial Flow	4	.0020/20	.0002			945	945		1	.5	.375	695
Space Gear MK II 48 2D/3D/Rotary				✔				6	96	48	11.81	360	135			Fast Axial Flow	4	.0020/20	.0002			945	945		1	.5	.375	1,388
Space Gear MK II 510 2D/3D/Rotary				✔				6	120	60	11.81	360	135			Fast Axial Flow	4	.0020/20	.0002			945	945		1	.5	.375	2,050

Model	Machine Configuration: Bridge	Cantilever	Gantry	Hybrid	Robotic	Rotary	Other	Number of Controlled Axes (Max.)	Work Area Travel (Max.) Without Repositioning: X Axis (in.)	Y Axis (in.)	Z Axis (in.)	Laser Head Rotation (Degrees)	Laser Head Tilt (±Degrees)	With Repositioning: X Axis (in.)	Y Axis (in.)	Resonator Type	Power (kW)	Accuracy and Repeatability (±in.) Without Repositioning: Accuracy	Repeatability	With Repositioning: Accuracy	Repeatability	Maximum Positioning Speed (IPM): X Axis	Y Axis	Simultaneous	Workpiece Specifications, Max. Thickness (in.) With Max.-Power Resonator: Mild Steel	Stainless Steel	Aluminum	Max. Weight (lbs.)
MOTOMAN INC., Miamisburg, OH																												
HP20D					✔	✔		6	50	120	105	360	180	50	120				.002			750	750	750	.5	.35	.1	
MC2000					✔	✔		6			175	360	180					.1	.07									
MC MACHINERY SYSTEMS—MITSUBISHI LASER, Elk Grove Village, IL																												
1515VZ10				✔				7	59.8	59.8	33.4	360	180			CO_2, Transverse Flow	2,3	.0019/20	0.0006			1,772	1,772	1,772	.50	0.187	0.187	1,543
3122VZ10				✔				7	122	86.6	33.4	360	180			CO_2, Transverse Flow	2,3	.0019/20	0.0006			1,378	1,378	1,378	.50	.187	.187	4,400
1515VZ20				✔				7	35.2	35.2	21.6	360	135			CO_2, Transverse Flow	2,4	.0019/20	0.0006			1,772	1,772	1,772	.75	.25	.25	1,543
3122VZ20				✔				7	98.4	62.9	21.6	360	135			CO_2, Transverse Flow	2,4	.0019/20	0.0006			1,378	1,378	1,378	.75	.25	.25	4,400
LMZ-V			✔					6	Any	161	7.8					CO_2, Transverse Flow	2,4,6	.0019/20	0.004			944	944	944	1	.75	.50	N/A
PRIMA POWER LASERDYNE, Champlin, MN																												
LASERDYNE 606D Dual Laser Processing Machine	✔							14	24	24	24	900	300			Fiber	20	.0008	.0004			2,000	2,000	2,800	.6	.25	.18	3,300
LASERDYNE 795XS		✔						7	40	40	40	900	300	Inf.	Inf.	Fiber	20	.0008	.0004			800	800	1,100	.6	.25	.18	3,300
LASERDYNE 795XL		✔						7	80	40	40	900	300	Inf.	Inf.	Fiber	20	.0008	.0004			800	800	1,100	.6	.25	.18	3,300
LASERDYNE 795XLZ		✔						7	80	40	72	900	300	Inf.	Inf.	Fiber	20	.0008	.0004			800	800	1,100	.6	.25	.18	3,300
LASERDYNE 430BD				✔				6	23	16	20	900	300			Fiber	20	.00025	.00025			600	600	840	.6	.25	.18	250
LASERDYNE 430 VERSA				✔				6	23	16	20	900	300			Fiber	3	.00025	.00025			600	600	840	.13	.08	.05	250
TRUMPF INC., Farmington, CT																												
TruLaser Tube 5000								5	255	6.7	6.7	360	45			TruFlow	2.0, 2.7, 3.2	.008	.002			3,937	2,632	4,591	.4	.2	.2	390
TruLaser Tube 5000 Fiber								5	255	6.7	6.7	360	45			TruDisk	2, 3	.008	.002			6,693	2,362	7,098	.4	.2	.24	390
TruLaser Tube 7000								5	255	10	10	360	45			TruFlow	2, 2.7, 3.2	.008	.002			6,693	2,362	7,098	.5	.24	.2	900
TruLaser Tube 7000 Fiber								5	255	10	10	360	45			TruDisk	4	.008	.002			6,693	2,362	7,098	.5	.24	.24	900
TruLaser Cell 3000								4+1	31.5	23.6	15.7		135			TruDisk TruPulse TruDiode TruFiber TruMicro	8	.0005				1,968	1,968	3,346	.75	.47	.75	660
TruLaser Cell 5030								5	120	60	28	Inf.	135	120	60	TruDisk	2, 3	.003/.001			.003/.001	2362	2,362	3,340	.75	.3	.25	1,100
TruLaser Cell 7006								6	26	60/80	30/40	Inf.	135	26	60/80	TruDisk TruFlow	6	.003	.001	.003	.001	3,937	3,937	6,811	.8	.35	.25	2,200
TruLaser Cell 7020								6	80	60/80	30	Inf.	135	80	60/80	TruDisk TruFlow	6	.003	.001	.003	.001	3,930	3,930	6,810	.8	.35	.25	2,200
TruLaser Cell 7040								6	160	60/80	30	Inf.	135	160	60/80	TruDisk TruFlow	6	.003	.001	.003	.001	3,930	3,930	6,810	.6	.35	.25	2,200
TruLaser Cell 8030								6	120	50	24	Inf.	135	120	50	TruDisk	4	.003	.001	.003	.001	3,937	3,937	6,811	.75	.625	.5	660

Model	Operators	Punch				Shear							Notcher				Brake	Automatic Positioning Table		
		U.S. Tons	Std. Dia. (in.)	Max. Dia. (in.)	Throat Depth (in.)	Shear Blade Length (in.)	Angle, 90 deg.	Angle, 45 deg.	Channel	Flat Bar	Rod, Round	Rod, Square	Pipe, Sch. 40 (in.)	Angle, 90 deg.	Rectangle	Vee	Rated in U.S. Tons	S–Standard O–Opt. N–Not Offered	X Travel (in.)	Y Travel (in.)
BALEIGH INDUSTRIAL INC., Manitowoc, WI																				
SW-443	Single	44	.75	1.5	6.88	13.87	3 x 3 x .25			7.87 x .5	1.125	1 x 1								
SW-95	Dual	95	1.062 x 8.75	2 x .5	16	16.125	5.125 x 5.125 x .5			16 x .75	1.375	1.75	4		2 x 3.5 x .5	5.75 x 5.75 x .375	95			
SW-132	Dual	132	1.125 x 1.062	2 x .625	16	18.3	6 x 6 x .6			18.1 x .75	1.75	1.75	4		2 x 3.5 x .5	5.75 x 5.75 x .5	132			
SW-501	Single	50	.875	1.625	6	10.25	3 x 3 x .25			10 x .375	1.125	1	2		2 x 3.5 x .281	3.5 x 3.5 x .312	50			
SW-62	Single	62	1.125	1.625	8	14.125	4 x 4 x .375			13.50 x .625	1.5	1.5	2.5		2 x 3.5 x .312	3.5 x 3.5 x .312	62			
COMEQ INC., White Marsh, MD																				
GEKA HY-DRACROP 55S/SD	Dual	60	1¼	6	10/20	12	4 x 4 x ½	3 x 3 x 5/16	5	12 x ⅝	1 9/16	1 9/16	6	⅜	⅜			O	240	20
GEKA HY-DRACROP 80S/SD	Dual	88	1¼	6	12/20	18	5 x 5 x 1/12	3 x 3 x 5/16	5	24 x ⅝	1¾	1¾	6	15/32	15/32			O	240	20
GEKA HY-DRACROP 110S/SD	Dual	120	1¼	6	12/24	24	6 x 6 x ½	3 x 3 x 5/16	6	24 x ⅝	2	2	6	½	½			O	240	24
GEKA HY-DRACROP 165S/SD	Dual	185	1 9/16	6	20/30	30	8 x 8 x ¾	3 x 3 x 5/16	7	30 x ¾	2⅜	2⅜	6	⅝	⅝			O	240	30
GEKA HY-DRACROP 220S	Dual	240	1 9/16	6	15/20	30	8 x 8 x ¾	3 x 3 x 5/16	7	30 x ¾ 20 x 1	2⅜	2⅜	6	⅝	⅝			O	240	20
GEKA BEN-DICROP 50	Single	55	1¼	6	7	14	3 x 3 x 5/16			14 x ⅜	1⅜	1¼	6	⅜	⅜	½	55	N		
GEKA BENDICROP 60S/SD	Dual	66	1¼	6	10/20	14	5 x 5 x ⅜			14 x ⅜	2	2	6	4		⅜	66	O	240	20
GEKA BENDICROP 85S/SD	Dual	94	1¼	6	12/20	18	5 x 5 x ⅜			18 x ⅝	2	1½	6	5		½	94	O	240	20
GEKA MI-CROCROP	Single	40	1 1/16	4	6¾	14	3 x 3 x 5/16			13¾ x ¼	Opt.	Opt.	6	2½	2 x 1⅜			N		
GEKA MINI-CROP	Single	50	1¼	4	6⅞	11	3 x 3 x 5/16		Opt.	3 x 3 x 5/16	Opt.	Opt.	6	2½	2 x 1½			N		
DURMA, Lake Orion, MI																				
IW 45	1	50	1	4	6	11.8	3 x 3 x .3125	2 x 2 x .25	4	.50	1	.75		2 x .25	1.375 x 2	2 x .25	50	N		
IW 55	2	60	1.375	4	9.8	12	4.7 x .375	2.75 x .275	4.7	.75	1.375	1.375		.375	1.65 x 3.5	.25 x 3.74	60		Opt. ional	
IW 80	2	88	1.375	4	11.8	18.7	5 x .500	2.75 x .275	5		.75	2		.50	2 x 3.5	2 x .50	88	O		
IW 110	2	121	1.375	5	24	24	6 x .50	2.75 x 2.75	5.5	.75	2	2		2 x .50	2 x 3.5	5 x .25	121		Opt. ional	
IW 165	2	180	1.375	5	24	30	8 x .70	2.75 x .275	7.8	1.18	2.25	2.25		.625	2.25 x 4	5 x .375	180		Opt. ional	
FERRIC MACHINERY INC., Cambridge, ON Canada																				
Ferric HIW-40	1	40	.3125 x 1.5	.625 x .75	6.875	.25 x 13.75	3.25 x .3125	2 x .25	3 x 1.5	8 x .5	.8125	1	2.5				40	N		
Ferric HIW-45	1	45	.3125 x 1.50	.625 x .875	6.875	.50 x 12	4 x .375	2.75 x .250	3.250 x 1.750	8 x .625	.1875	.8125	2.50 Opt..	2.375 Opt..	1.375 x 3	2.375 Opt..	45	N		
Ferric HIW-60	1	60	.4375 x 1.50	.625 x 1.125	8.625	.625 x 12	5 x .50	3.1875 x .3125	4 x 2	8 x .750	1.750	1.375	2.50 Opt..	2.375 Opt..	1.750 x 3.50	2.375 Opt..	60	N		
Ferric HIW-60DC	2	60	.3125 x 2.250	.625 x 1.1875	12	.375 x 14.750	5 x .50	2.750 x .375	5 x 2.50	9 x .750	1.750	1.750	2.50 Opt..	2.375 Opt..	1.750 x 3.50	2.375 Opt..	60	O		
Ferric HIW-80	2	80	.375 x 2.250	.750 x 1.125	12	.625 x 17.750	6 x .50	2.750 x .375	5 x 2.50	12 x .750	1.750	1.750	2.50 Opt..	2.375 Opt..	1.625 x 3.50	2.375 Opt..	80	O		
Ferric HIW-100	2	100	.50 x 2.250	1 x 1.0625	14	.625 x 18.875	6 x .625	3 x .375	6.375 x 3.50	15 x .750	2	2	2.50 Opt..	2.750 Opt..	2 x 4	2.750 Opt..	100	O		
Ferric HIW-125	2	125	.625 x 2.250	1 x 1.50	14	.625 x 23.625	6 x .750	3 x .375	8 x 4	15 x 1	2.125	2.125	2.50 Opt..	3.125 Opt..	2.375 x 4	3.125 Opt..	125	O		
Ferric HIW-140	2	140	.6875 x 2.250	1 x 1.250	14	.750 x 23.625	6 x .750	3 x .375	8 x 4	16 x 1	2.125	2.125	2.50 Opt..	3.125	2.375 x 4	3.125 Opt..	140	O		
GEKA/COMEQ INC., White Marsh, MD																				
GEKA Bendi-crop 60 S	2	65	1.5	4	10	14	5 x 5 x .375		Opt.	14 x .5625			2	4	3.5 x 1.625 x .375	4 x 4 x .375	6 x .375	N		
GEKA Hydracrop 110 SD	2	120	1.5	4	24	24	6 x 6 x .50	3 x 3 x .3125	4 (6 Opt..)	24 x .625 16 x .75 12 x 1	2	2	2	5 x .5	3.5 x 2 x .625	5 x 5 x .625		O	40 (220 Opt..)	20
GEKA Bendi-crop 60 SD	2	65	1.5	4	20	14	5 x 5 x .375		Opt..	14 x .5625			2	4	3.5 x 1.625 x .375	4 x 4 x .375	6 x .375	O	40 (220 Opt..)	16

Model	Operators	Punch				Shear							Notcher				Brake	Automatic Positioning Table		
		U.S. Tons	Std. Dia. (in.)	Max. Dia. (in.)	Throat Depth (in.)	Shear Blade Length (in.)	Angle, 90 deg.	Angle, 45 deg.	Channel	Flat Bar	Rod, Round	Rod, Square	Pipe, Sch. 40 (in.)	Angle, 90 deg.	Rectangle	Vee	Rated in U.S. Tons	S–Standard O–Opt. N–Not Offered	X Travel (in.)	Y Travel (in.)
GEKA Bendicrop 85 S	2	95	1.5	4	12	18	5 x 5 x .5		Opt.	18 x .75	1.75	1.5	2	5 x .5	3.5 x 2 x .5	5 x 5 x .5	8 x .5	N		
GEKA Bendicrop 85 SD	2	95	1.5	4 x .25	20	18	5 x 5 x .50		Opt.	18 x .75	1.75	1.5	2	5 x .5	3.5 x 2 x .5	5 x 5 x .5	8 x .5	O	40 (220 Opt..)	16
GEKA Hydracrop 55 S	2	60	1.5	4	10	12	4 x 4 x .5	3 x 3 x .3125	4	12 x .63 8 x .75	1.5625	1.5625 x 1.5625	2	4 x 4 x .375	3.5 x 1.625 x .375	4 x 4 x .375		N		
GEKA Hydracrop 55 SD	2	60	1.5	4	20	12	4 x 4 x .50	3 x 3 x .3125	4	12 x .63 8 x .75	1.5625	1.5625	2	4	3.5 x 1.625 x .375	4 x 4		O	40 (220 Opt..)	16
GEKA Hydracrop 80 S	2	90	1.5 x .625	4	10	18	5 x 5 x .50	3 x 3 x .3125	4 (6 Opt..)	18 x .63 12 x .75	1.75	1.75	2	5 x .50	3.5 x 2 x .5	5 x 5 x .5	22 x .25	N		
GEKA Hydracrop 80 SD	2	90	1.5	4	20	18	5 x 5 x .5	3 x 3 x .3125	4 (6 Opt..)	18 x .625 or 12 x .75	1.75	1.75	2	5 x .50	3.5 x 2 x .50	5 x 5.5		O	40 (220 Opt..)	16
GEKA Hydracrop 110 S	2	120	1.5	4	12	24	6 x 6 x .50	3 x 3 x .3125	4 (6 Opt.)	24 x .63 16 x .75 12 x 1	2	2	2	5 x .50	3.5 x 2 x .625	5 x 5 x .625		N		
HILALSAN MACHINERY LTD., Konya, Turkey																				
HKM 45	1	50	1	4	7	12	4 x 4 x .50	3 x 3 x .25	3	12 x .625	1	1			1.375 x 3 x .375		50	N		
HKM 65	2	70	1	4	12	15	4 x 4 x .50	3 x .25	4.75	14.75 x .25	1	1			3.50 x 1.25		70	N		
HKM 85	2	90	1.25	4.25	14	19	6 x 6 x .50	3 x .50	6.25	19 x .50	2	2			4 x 2 x .50		90	N		
HKM 115	2	125	1.35	2.25	14	24	6 x 6 x .50	3 x .50	8	24 x .50	2	2			4 x 2.50 x .50		125	N		
HKM 175	2	190	1.5	2.25	25	24	8 x 8 x .75	3 x .50	12	24 x .75	2.50	2			4 x 2.50 x .75		190	N		
KAAST MACHINE TOOLS INC., Aldan, PA																				
PS 45	1	50	1	4	7	12	4 x 4 x ½	3 x 3 x ¼	3	12 x ⅝	1	1			1⅜ x 3 x ⅜		50	N		
PS 65 DP	1	70	1	4	12	15	4 x 4 x .50	3 x .25	4.75	14.75 x .50	1.75	1.75	4	4	3.50 x 1.25	4	70	O	240	31
PS 85 DP	1	90	1.25	4.25	14	19	6 x 6 x .50	3 x .50	6.25	19 x .50	2	2	4	4	4 x 2 x .50	4	90	O	240	31
PS 115 DP	1	125	1.25	2.25	14	24	6 x 6 x .50	3 x .50	8	24 x .50	2	2	4	4	4 x 2.50 x .50	6	125	O	240	31
PS 175 DP	1	190	1.50	2.25	2.25	24	8 x 8 x .75	3 x .50	12	24 x .75	2.50	2	4	4	4 x 2.50 x .75	6	190	O	240	31
PEDDINGHAUS CORP., Bradley, IL																				
PeddiMax No. 1	1	140	Standard	1.5	20	20	6 x .50	4 x .50	8	20 x .75	2/1	2/ 1.8125	2 (Opt..)	3.5 x .375	Standard	Opt.ional		O	40	16
PeddiWorker No. 1	1	100	Standard	1.25	10	16.75	5 x .375	5 x .50	6	16 x .75	1.5625/ .75	1.5625/ 1	2 (Opt..)	3 x .375	Standard	Opt.ional		N		
PeddiCat No. 1	1	55	Standard	1.25	8	14.5	4 x .25	4 x .25	4	14 x .50	1.25/ .75	1.1875/ .75	2 Opt. ional	3 x .375	Standard	Opt..	4 x 4	N		
PIRANHA-A DIVISION OF MEGAFAB, Rockford, IL																				
P50	1	50	1.125	3	5	13	3.50 x 3.50 x .3125			.750 x 6.250 x 13	1.375	1	2	3	2.250 x 3 x .250	3	50	N		
P65	1	65	1.125	5	8	15	5 x 5 x .375		Opt..	.750 x 10.625 x 15	1.500	1	2	4	2.750 x 4 x .250	4	65	N		
P90	1	90	1.5625	5	10	18	5 x 5 x .500		Opt..	1 x 8.50 x 18	2	1.375	2	5	3.50 x 5 x .375	5	90	N		
P110	1	110	1.5625	5	12	20.5	6 x 6 x .625		Opt.,	1 x 12.50 x 20	2	1.375	2	6	4 x 6 x .375	6	110	N		
P140	1	140	1.5625	5	12	20.5	6 x 6 x .625			1 x 14.50 x 20	2	1.375	2	6	4 x 6 x .375	6	140	N		
PII88	2	88	1.5625	5	9	24	5 x 5 x .375		Opt..	.750 x 8.25 x 24	1.50	1	2	5	2.75 x 4 x .250	4	88	N		
PII140	2	140	1.5625	5	20.5	20.5	6 x 6 x .625		Opt..	1 x 14.50 x 20	2	1.375	2	6	4 x 6 x .375	6	140	N		
SAHINLER METAL MAKINA, Bursa, Turkey																				
HKM 40	1	40		1.5	6.9	14	3.15 x .31	2 x 4												
HKM 45	1	45		3.9	6.9	12.4	3.9 x .39	2.76 x .24			1.18	1 x 1								
HKM 60	1	60		4.33	8.66	12.5	4.72 x .47	3.15 x .31			1.57	1.38 x 1.38								
SCOTCHMAN INDUSTRIES INC., Philip, SD																				
50514-EC	1	50	1	2.25	6	14	4 x 4 x .375	2 x 2 x .375		14	.25-1	.25 x .75	.75-2	6 x 6 x .125	3.5 x 3 x .3125	3 x 3 x .25	30	O		
5014-ET	1	50	1	2.25	4	14	4 x 4 x .375	2 x 2 x .375		.5 x 8	.25-1	.25 -.75	.75-2	3 x 3 x .25	2.5 x 3 x .3125	6 x 6 x .125	25	O		

Model	Operators	Punch				Shear							Notcher				Brake	Automatic Positioning Table		
		U.S. Tons	Std. Dia. (in.)	Max. Dia. (in.)	Throat Depth (in.)	Shear Blade Length (in.)	Angle, 90 deg.	Angle, 45 deg.	Channel	Flat Bar	Rod, Round	Rod, Square	Pipe, Sch. 40 (in.)	Angle, 90 deg.	Rectangle	Vee	Rated in U.S. Tons	S–Standard O–Opt. N–Not Offered	X Travel (in.)	Y Travel (in.)
6509-24M	1	65	1	4	9	24	5 x 5 x .5	4 x 4 x .5	2-5	.5 x 12	.25-1.25	.25-1	.75-2	2 x 2.5 x .375	2 x 2.5 x .375	6 x 6 x .3125	40	O		
DO70/110-24M	2	70	1	4	6	24	6 x 6 x .5	3 x 3 x .375	2-6	.5 x 14	.25 - 1.25	.25 x 1	.75-2	6 x 6 x .3125	3 x 4 x .5	3 x 3 x .375	65	O		
9012-24M	1	90	1	4	12	24	6 x 6 x .5	3 x 3 x .375	2-6	.5 x 16	.25-1.25	.25 x 1	.75-2	2 x 2.5 x .375	2 x 2.5 x .375	6 x 6 x .3125	50	O		
DO8514-20M	2	85	1	4	14	20	6 x 6 x .5	4 x 4 x .5	2- 6	1 x 16	.5 - 1.5	1.5	.75-2	3 x 3 x .5	3 x 4 x .5	6 x 6 x .3125	85	O		
DO95/140-24M	2	95	1	4	9	24	6 x 6 x .5	3 x 3 x .375	2-6	.5 x 16	.25-1.25	.5 to 2	.75-2		3 x 4 x .5	3 x 3 x .375	80	O		
12012-24M	1	120	1	4	12	24	6 x 6 x .50	4 x 4 x .50	2-6	1 x 12	1.125	1	2		2 x 2.50 x .375	6 x 6 x .375	83	O		
DO120/200-24M	2	120	1	4	12	24	6 x 6 x .5	3 x 3 x .375	2-6	.25 x 24	.25-1.25	.25-1	.75-2	6 x 6 x .3125	3 x 5.75 x .5	3 x 3 x .5	75	O		
DO150/240-24M	2	150	1	4	12	24	6 x 6 x .5	3 x 3 x .375	2-6	.75 x 24	.25-1.25	.25 x 1	.75-2	6 x 6 x .3125	3 x 5.75 x .5	3 x 3 x .5	90	O		
SUNRISE/TRILOGY MACHINERY INC., Belcamp, MD																				
Sunrise K-Series IW-50K	1	50	1.5	4	6.5	12	3	3	3	12 x .375	1	1	2	3	2 x 3.5 x .25	3.5	50	N		
Sunrise K-Series IW-66K	1	66	1.5	4	8	14	4x4x.3125		4	14x.625	1.5	1.5	2	3	2.5 x 3.5 x .3125	3.5	66	N		
Sunrise Dual-Cylinder IW-66	2	66	2	8	12-20	14	5 x 5 x .50	2.5 x 2.5 x .3125	5	14 x .5625 or 10 x .75	1.5	1.5	4	4	2 x 3.5 x .375	4	66	O	240	16
Sunrise Dual-Cylinder IW-88	2	88	2	12-20	1	18	6 x 6 x .50	3 x 3 x .375	6	18 x .5625 or 12 x .875	1.75	1.75	4	4	2 x 3.5 x .50	4	88	O	240	16
Sunrise Dual-Cylinder IW-110	2	110	2	8	12-20	24	6 x 6 x .50	3 x 3 x .375	6	24 x .625 or 16 x .75	1.75	1.75	4	4	2.5 x 3.5 x .50	6	110	O	240	16
Sunrise Dual-Cylinder IW-185SD	2	185	2	8	20	30	8 x 8 x .75	3 x 3 x .375	8	30 x .75 or 24 x 1	2.25	2.25	4	4	2.5 x 3.5 x .625	6	185	O	240	16
Sunrise Punching Machine PM-38-220	1	38-220	2	8	12-30												38-220	O	240	26
Sunrise Dual-Cylinder IW-135	2	135	2	8	12 or 20	24	6 x 6 x .6875	3 x 3 x .375	7	24 x .6875	2	2	4	4	2.5 x 3.5 x .50	4 x 4 x .50	135	O	240	16
TRILOGY MACHINERY INC., Belcamp, MD																				
SUNRISE ALS - Automatic Angle System	1	135	1.5	1.5	N/A		6 x 6											S	480	6
SUNRISE APS Automatic Punch/Shear System	1	220	1.5	4	20	20				20 x 1								S	480	20
SUNRISE IW-66KB Integrated Press Brake	1	66	1.5	4	8	14	4 x 4 x .375		3	14x.625	1.5	1.5	2	4	2.5 x 3.5 x .3125	3.5	66	N		
SUNRISE Dual-Cylinder IW-66S/SD	2	66	2	8	12-20	14	5 x 5 x .50	2.5 x 2.5 x .3125	5	14 x .5625 10 x .75	1.5	1.5	4	4	2 x 3.5 x .375	4	66	O	50 Auto. 240 Semi	16
SUNRISE Dual-Cylinder IW-88 S/SD	2	88	2	8	12-20	18	6 x 6 x .50	3 x 3 x .375	6	18 x .5625 12 x .875	1.75	1.75	4	4	2 x 3.5 x .50	4	88	O	50 Auto. 240 Semi	16
SUNRISE Dual-Cylinder IW-110 S/SD	2	110	2	8	12-20	24	6 x 6 x .50	3 x 3 x .375	6	24 x .625 or 16 x .75	1.75	1.75	4	4	2.5 x 3.5 x .50	6	110	O	50 Auto. 240 Semi	16
SUNRISE Dual-Cylinder IW-185SD	2	185	2	8	20	30	8 x 8 x .75	3 x 3 x .375	8	30 x .75 24 x 1	2.25	2.25	4	4	2.5 x 3.5 x .625	6	185	O	50 Auto. 240 Semi	16
SUNRISE Punching Machine PM	1	38-220	2	8	12-30						Opt..	Opt..	4	Opt..	Opt..	Opt.. 6 x 6	38-220	O	50 Auto. 240 Semi	26
SUNRISE K-Series IW-50k	1	50	1.5	4	6.5	12	3	3	3	12 x .375	1	1	2	3	2 x 3.5 x .25	3.5	50	N		
SUNRISE K-Series IW-66K	1	66	1.5	4	8	14	4 x 4 x .3125		4	14 x .625	1.5	1.5	2	3	2.5 x 3.5 x .3125	3.5	66	N		

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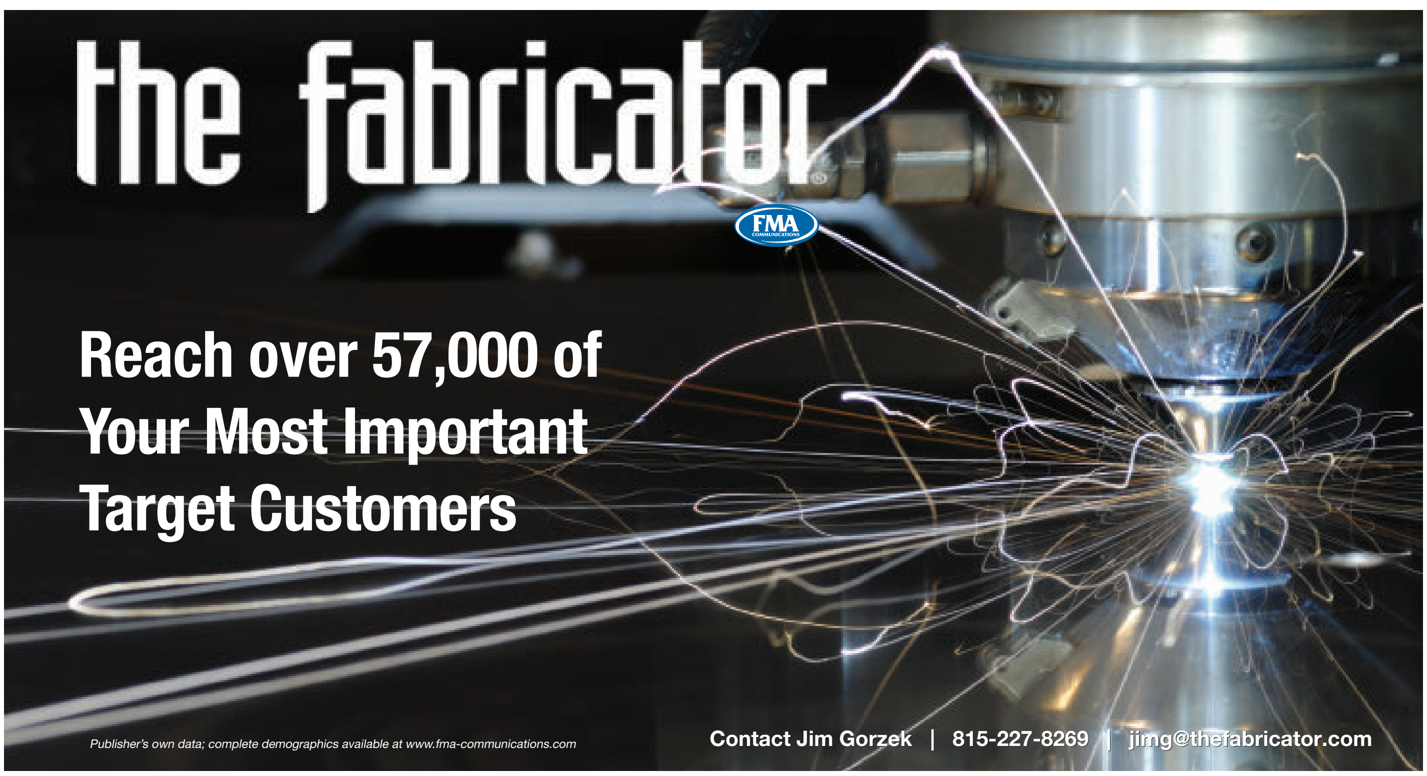

Read more from Dan Davis at
www.thefabricator.com/author/dan-davis

Farm living helps artist discover the welding torch

A desire to help with fence repair leads to a new career

By Dan Davis

In the metal fabricating business, you meet a lot of people who honed their skills while working on a farm. After all, when something breaks, like a tractor bucket, you just can't run down to the Dollar General and buy a replacement. You have to make the repair yourself.

Then it shouldn't be too much of a surprise that others might pick up fabricating skills after they have moved to a farm. That's how it happened for Sarah Stork, who was born and spent a majority of her childhood in Fountain Valley, Calif., until her family moved to Austin, Texas, as she was entering high school. Today she lives on a 14-acre farm with her husband, 19-year-old daughter, 13-year-old son, cows, pigs, dogs, and cats. But those welding skills also led her to a more creative place, somewhere many fabricators don't bother to explore. As a result, she's developed a career as a welding sculpture artist while still keeping her code welding skills sharp.

"I was inspired by my husband, who drives water wells for a living. He and his workers do a lot of welding back in the shop, repairing trailers and equipment," Stork said. "When we moved onto our property in 2012, we needed to cut some pipe fencing to keep the cows from wandering off. I wanted to be helpful and pick up welding."

Welding artist Sarah Stork works on kelp for a sea turtle sculpture. ***Photos courtesy of Melania Tyler.***

This goose sculpture is another example of Stork's skills in bringing animal figures to life.

That led her to start taking classes at Austin Community College (ACC) in 2013, where she ultimately earned her associate degree in welding technology three years later. While there, she learned about the different welding and cutting processes, as well as the codes and standard required to work as an ironworker or in a structural fabrication shop. In 2015 an ACC welding instructor asked her to be part of the school's team at the state SkillsUSA competition, a student competition centered around skills used in the trades or technical occupations.

The instructor originally invited her to be a part of the fabrication team, but the other two male students on the team "laughed at me," Stork said. The instructor then suggested that she try her hand at making a sculpture.

"From that point forward I became more focused on artistic metalworking than on structural fabrication," Stork said.

That first year she used her oxywelding and gas metal arc welding skills to create a lifelike Texas longhorn bull. (No one was confusing this metal bull with a steer, Stork joked.) The effort caught the interest of the judges, who awarded Stork first place in the welding sculpture competition. Only months later Stork's longhorn won second place at the national SkillsUSA competition.

In 2016 Stork created a sculpture of a tarpon and won first place at the national competition. This artistic path was paying off.

"Welding has given me a lot of confidence in my skills," she said. "I really get a kick out of it when people see my work and they don't put two and two together that I'm the artist. It's been really rewarding."

She continued to create sculptures of other animals, such as stingrays and turtles. In fact, she is currently working on a commissioned piece for a turtle that will join another turtle she fabricated and was later purchased by an admirer of her work. She also recently completed "Angela," a human form with butterfly wings, one of her most challenging pieces that took more than six months to finish. Stork said forming the metal to match a person's organic shape is time-consuming and a lot harder than just laying down a bunch of metal and then grinding it off. She sees herself doing more of this type of work as she looks to expand her studio that sits on her farm.

As she continues on her creative journey, Stork keeps up with her welding skills in more traditional ways, such as repairing trailers or making a barbecue pit. She even got around to finishing that pipe fence in the middle of a Texas summer. Stork may have discovered another outlet for her metalworking abilities, but sometimes it's good just to keep those code welding skills sharp. ***FAB***

Sarah Stork Welding Art, www.instagram.com/sarah_stork_

The person who purchased this sea turtle sculpture is now commissioning Stork to create another turtle to join her original reptile.

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