SMART SOLUTIONS

Helping contractors save money and enhance productivity

WINTER 2021

With Daikin, Olson Plumbing and Heating Stands Up COVID-19 Care Facility in Record Time

Olson Plumbing and Heating partnered with Daikin Applied to retrofit a Colorado medical center to house patients recovering from COVID-19, moving from planning to project completion in just 30 days. In response to the rapid spread of the pandemic, St. Mary-Corwin Medical Center in Pueblo, CO, was redesigned to provide post-COVID-19, non-critical, isolated care, freeing up intensive care isolation units in other facilities. Daikin is a sponsor of MCAA's 2021 Virtual Education Conference.

Despite attempts to "flatten the curve" through travel, business and social restrictions, in spring 2020, Colorado officials knew they would need additional capacity and hospital beds

continued on page 8

Olson Plumbing and Heating installed eight Daikin Rebel rooftop units with gas heat and DX cooling to ensure that St. Mary-Corwin Medical Center was comfortable and healthy—a process completed in record time because of the cooperation among the manufacturer and contracting team.

Xcel Mechanical estimated saving as much as 40 percent in labor on some aspects of an aerospace laboratory renovation project by using NIBCO Press fittings and valves.

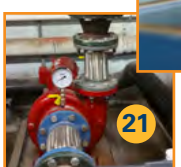
Xcel Mechanical's Labor Savings Rocket With NIBCO Press for Aerospace Remodel

Xcel Mechanical Systems estimated saving as much as 40 percent in labor on some aspects of an aerospace laboratory renovation project by using NIBCO® Press fittings and valves. Xcel, based in Gardena, CA, was hired to design and build the mechanical, plumbing, and process piping elements to expand and modernize an occupied research and development facility in southern California for one of the nation's largest aerospace firms. NIBCO INC. is a sponsor of MCAA's 2021 Virtual Education Conference.

"Leveraging press technology mitigates the inherent risks of working with open flame within an occupied space," said Jason Gordon, Xcel Mechanical's vice president of operations. "We

continued on page 10

WHAT'S INSIDE



MANUFACTURER / SUPPLIER COUNCIL
MCAA
Adding Value to Your Supply Chain

SMART SOLUTIONS

Helping contractors save money and enhance productivity

Smart Solutions showcases new technologies and promotes cost-saving and productivity-enhancing applications available from members of MCAA's Manufacturer/Supplier Council. *Smart Solutions* is published biannually for contractor members of MCAA and its subsidiaries.

All information in this newsletter was supplied by members of MCAA's Manufacturer/Supplier Council. MCAA is not responsible for any claims made regarding products or services mentioned.

Adrienne Breedlove
Director, Content

Jan Grillo
Director, Membership Engagement

Melissa Funyak
Executive Director, Executive & Conference Services

Dana Trevas
Consultant

1385 Piccard Drive
Rockville, MD 20850-4340
301-869-5800
Fax 301-990-9690
e-mail abreedlove@mcaa.org
www.mcaa.org

MANUFACTURER / SUPPLIER COUNCIL
MCAA
Adding Value to Your Supply Chain

Efficiency On Demand

In this issue of *Smart Solutions*, read how our manufacturer/supplier partners continue to provide what you need, when you need it. Olson Plumbing and Heating renovated a medical center to care for recovering COVID-19 patients in just 30 days—thanks in part to Daikin Applied factory workers going the extra mile. With Viega products, Nelson Stark Company overcame the challenges of repurposing a dilapidated factory into a mixed-use development. Saladino Mechanical won the bid for a college dorm renovation by specifying Uponor's PEX piping rather than more costly copper—saving themselves time and money during installation. Xcel Mechanical Systems estimated saving as much as 40 percent in labor on some aspects of an aerospace laboratory renovation project by using NIBCO® Press fittings and valves.

J.M. Brennan, Inc. used Zurn's new universal lavatory carrier for an upgrade of a health clinic's restrooms, saving time and materials. To expand a large biopharmaceutical company's COVID-19 vaccine research and production capacity, High Purity Systems, Inc. turned to Orbitalum welding systems (distributed with support from E.H. Wachs) to rapidly complete thousands of high-purity welds. With a tight construction timeline for a new assisted living facility, Brandt Companies relied on Reliance Worldwide Corporation HoldRite products to save time while meeting code requirements. Northern Ohio Plumbing Co., Inc.'s creative approach to mounting A. O. Smith tankless water heaters saved the contractor installation costs.

Tech Support

Contractors are continuing to learn how to put technology to work for them. Helm Group is combining leading technology like BIM 360 within Autodesk Construction Cloud™ with Lean construction principles to increase efficiency. Lexington Plumbing employed Lochinvar's exclusive SMART SYSTEM interface to simplify installation and operation of two new Lochinvar ARMOR water heaters. Ferguson's new virtual design and construction department became a pivotal partner to MMC Contractors on a major building project, identifying potential pitfalls and offering cost-effective solutions.

Upgrading from Excel to LaborChart for labor scheduling proved to be an ideal solution for Martin Mechanical Inc., streamlining communication and making life easier for the whole staff. Havtech and MacDonald-Miller Facility Solutions are using XOi technologies to set themselves apart in a highly competitive market. Thanks to Trimble SysQue MEP software, Renick Brothers is working smarter, streamlining and automating workflows.

Pro Tips

Also in this issue, our manufacturer/supplier partners offer hard-won, how-to advice to improve productivity. Raken shows how to maximize efficiency with digital tools, while Ridge Tool Company explains how to make sure you always have the right gear on hand. The pros at Milwaukee Valve Company describe selecting and installing check valves properly, and Aquatherm's experts offer tips on butt-fusing polypropylene piping. Dive deep into dezincification with Jomar Valve to learn more about alternatives to bronze valves.

Expand your horizons further by attending the first-ever MCAA 2021 Virtual Education Conference. Visit the virtual exhibits to connect with the event's sponsoring manufacturer/supplier members.

William Hughes

William Hughes, Chair

Nelson Stark Brings Abandoned Factory Back to Life With Viega Products

Putting Viega products to work allowed Nelson Stark Company to overcome the slew of challenges that came with repurposing a dilapidated factory into a mixed-use development. The contractor knew that Viega's flameless press technology was the clear choice for renovating the historic building safely and for installing piping much faster than other pipe-joining methods. Viega is a sponsor of MCAA's 2021 Virtual Education Conference.

A century ago, the Peters Cartridge Company in Kings Mills, OH, produced munitions for the U.S. military through the end of World War II. However, the factory was in shambles for years. It was designated as a Superfund site, abandoned and covered in graffiti, littered with feral cats, and running rampant with ghost stories.

Then, the Environmental Protection Agency cleaned up the area, and developers got excited about what could be. Business partners Kyle Hackbarth and Anthony Cook saw the potential and started up Cartridge Brewing. The upscale brewpub is now an anchor of the mixed-use redevelopment, which includes apartments, a banquet hall, and retail stores.

Nelson Stark employed Viega's ProPress and MegaPressG to get the old building into shape for the brewery. Because the building is on the National Register of Historic Places, developers could not simply scrape the building and start again. Contractors had to be extremely careful in the aging building. Flames from welding or soldering could have posed danger and risk. Viega's press technology was ideal.

Floors were opened to place underground plumbing for the kitchen and bathrooms. Drains were installed for the brew deck. Nelson Stark also piped overhead water mains and gas lines for the brewpub. They installed the lines for the kitchen equipment, furnaces, boiler, and two domestic water heaters.

For the natural gas lines, Nelson Stark used Viega MegaPressG across the board, from 1/2" to 4" fittings. It was the first project Nelson Stark did with the larger-diameter MegaPressG fittings.

"It saved a lot of time," said Russell Hill, plumbing superintendent with Nelson Stark, who has been on the project since day one. "Pressing gas instead of welding or cutting and threading—it's nice, and I really like that. Much faster." On average, contractors can realize from 60 percent up to 90 percent time savings over other pipe joining methods.

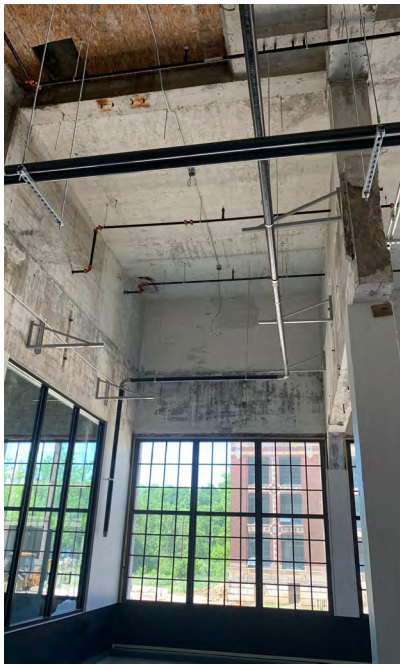
As with many renovation projects, the building posed challenges, such as getting onto the pitched concrete roof. The speed and simplicity of the Viega connections made installing the necessary plumbing on the roof simpler. And although much of the plumbing is hidden, the 3" and 4" gas main lines in the brew area and service corridor are exposed, so the pressed joints look clean and uniform.

"Viega is a quality product. It saves us time and labor," Hill noted. "We use it all the time."

For more information, visit www.viega.us.

MCAA thanks Viega for being a sponsor of MCAA's 2021 Virtual Education Conference.

Below: Contractors had to be particularly careful renovating a historic munitions factory, so Nelson Stark chose Viega press tools to avoid welding and soldering while also speeding up installation time.
Middle Because the brewpub design leaves some of the gas lines exposed, Nelson Stark appreciated that the Viega press products leave clean, uniform joints.
Right: Nelson Stark's Russell Hill, plumbing superintendent, and Jake Weisbrodt, second-year apprentice (first and second from left), saved time and money using Viega products to transform a dilapidated factory into a stylish new brewpub. Also pictured are Cartridge Brewing Co-Owner Kyle Hackbarth (third from left) and Steve Greis, job superintendent of Furlong Building, the general contractor on the project.



Saladino Mechanical Cuts Down Time, Costs With Uponor's PEX Products

Saladino Mechanical of Kansas City, MO, won the bid for a college dorm renovation by specifying Uponor's PEX piping rather than more costly copper—a move that saved the contractor time and money during installation. The dorm's new plumbing system is also more efficient, saving energy and conserving water. Uponor is a sponsor of MCAA's 2021 Virtual Education Conference.

Updates Needed

CollegeProwler.com, a university search site for students by students that ranks everything from parking, transportation, and housing to campus life, academics, and athletics, gave a very astute observation of Kansas University's Gertrude Sellards Pearson (GSP) Hall: "Great location, but needs renovation." The university heard the call loud and clear and set out to accomplish a year-long, $13-million renovation that included a complete interior demolition of the electrical, plumbing, and HVAC systems.

Built in 1955, the four-story, 109,000-square-foot building was initially plumbed with galvanized steel and then re-piped with copper in the late 1990s. When bids went out for the new renovation, all the plumbing bids with copper came in too high.

PEX Piping Prevails

Saladino decided to rebid the project with PEX—a flexible, durable, polymer piping product that has been gaining popularity in commercial plumbing projects over the past decade because of its extreme durability and cost-effectiveness. While PEX has a 40-year history in residential projects (in fact, it is installed in more new-home plumbing construction than copper and CPVC combined), builders have been slower to adopt the product for commercial projects because of concerns that a "plastic" product is not as durable as metal.

Saladino won the bid for a Kansas University dorm renovation by specifying Uponor's PEX piping rather than more costly copper, saving the company time and money throughout the construction process.

However, thanks to its corrosion resistance and extreme flexibility, PEX is more durable than metal, which can corrode, and it is faster and easier to install. Because PEX is not a traded commodity that fluctuates in price, like copper, contractors can bid a project with greater confidence.

Carl Bachner, foreman at Saladino, has been plumbing with PEX since 2003 and was very familiar with the product. He worked with Mark Baker of Uponor representative firm Specified Systems, Inc., to send the project through Uponor Construction Services for the design work. The bid came back right on target.

"I was first introduced to PEX back in 2003 when I was installing the plumbing system for an assisted living complex," said Bachner. "After that, I installed it in my own home, and I've never had a problem with it."

Cutting Down Costs

The GSP Hall re-pipe used nearly 12,000' of 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" Uponor AquaPEX® for the plumbing system, which included piping for 42 bathrooms, a laundry facility, and a large kitchen to accommodate more than 300 students.

The system also included Uponor's ProPEX® engineered polymer (EP) and lead-free brass fittings. Baker noted that using EP fittings also helped bring the costs down for the plumbing system.

"The EP product is helping us get a good leg up on the competition cost-wise compared to brass," said Baker. "In fact, up to 80 percent of the fittings we do now are EP."

The cold-expansion ProPEX fitting concept was also a big winner with Bachner and the other installers. The ProPEX connection uses an expansion tool to expand the flexible PEX pipe to insert a fitting. Then, as the PEX shrinks back to its original size, it creates a solid, strong connection around the fitting.

"The ProPEX fitting is nice because it doesn't restrict the flow like insert fittings do," remarked Bachner. "It keeps the same OD [outside diameter] like copper does."

Other Advantages Achieved

The new plumbing system included multiport tees in the bathrooms to supply water to the lavatories and showers. A

multiport tee is essentially one long tee with multiple outlets. This product reduces the number of required connections in a system for faster, easier installation while improving system performance by distributing water to fixtures in a single grouping.

This installation method, known as “logic” plumbing, also provides advantages for clustered or consecutive uses of hot water, saving on energy and water usage. Once hot water arrives at a multiport, it is readily available to all fixtures connected to it. Essentially, that multiport’s fixture grouping is “charged” with hot water.

Energy and water conservation were also a large part of the design process, which included several runs of preinsulated Uponor AquaPEX pipe to insulate the hot-water lines. The preinsulated piping product is available with insulation sizes from 1/2" up to 1-1/2" to help projects meet energy codes while offering installers a preinsulated product, which saves time.

The design also called for a unique application for the flush-valve water closets. The designers came up with a concept that used PEX along with prefabricated stubouts instead of traditional copper or another rigid piping product. This approach helped save on costs when compared with using only copper.

Because of its flexibility, PEX significantly dampens surge pressure and noise transmission when compared with copper. Surge pressure in PEX is 65 percent less than in copper, and noise transmission in copper is eight times higher than in PEX. For these reasons, using PEX for all the flush-valve water closets worked well. The project used prefabricated 18" by 6" stubouts of 1" copper that were rigidly supported behind the wall to transition from PEX to the flush valve.

Dan Pederson, plumber with Saladino, was part of the team that quickly and easily replaced a Kansas University dorm’s worn copper plumbing with 12,000’ of Uponor PEX piping with ProPEX engineered polymer and lead-free brass fittings.

After his experience with the GSP Hall re-pipe project, Bachner was very happy with the results. Not only did his installers work faster with flexible PEX compared with rigid copper, but using PEX helped his bottom line as well. With the stable pricing of cost-effective PEX and EP fittings, Saladino kept costs low and the project on budget.

For more information, visit www.uponor-usa.com.

MCAA thanks Uponor for being a sponsor of MCAA’s 2021 Virtual Education Conference.

MMC Contractors Avoids Conflicts, Coordinates Processes With Ferguson VDC

As MMC Contractors embarked on building a large central utility plant for a globally recognized corporation in the lower Midwest, Ferguson's new virtual design and construction (VDC) department became a pivotal partner, identifying potential pitfalls and offering cost-effective solutions for the job. Ferguson is a sponsor of MCAA's 2021 Virtual Education Conference.

The new plant presented challenges. The project had a tight schedule, in addition to a design-assist component using large-diameter HDPE to build manifolds for the cooling tower yard. Working with 48" HDPE is complicated, and several fittings require custom fabrication. Traditional design methods do not always apply. HDPE requires expensive, large-scale fusion equipment and expertise in build strategy.

To produce a viable and cost-effective solution for the piping manifolds, Ferguson presented their new VDC services as design-assist. With their new VDC department, Ferguson is meeting demands by providing MMC with drawings, HDPE manifold fabrication, and an integrated planned delivery to the jobsite.

MMC chose to work with Ferguson because they became an integral part of the team early in the project. Everyone, including preconstruction, project management, engineering, design, and field supervision, quickly realized the value of the VDC services when Ferguson pointed out design conflicts on the contract drawings. Ferguson presented coordinated shop drawings and a BIM model as their recommendation for the build. Additionally, they made calculated recommendations for upgrading pipe sizes and wall thickness because of industry availability of the product.

Using Ferguson's new VDC capacities helped MMC avoid potential problems at the planning stage of a large project, saving the contractor time and money.

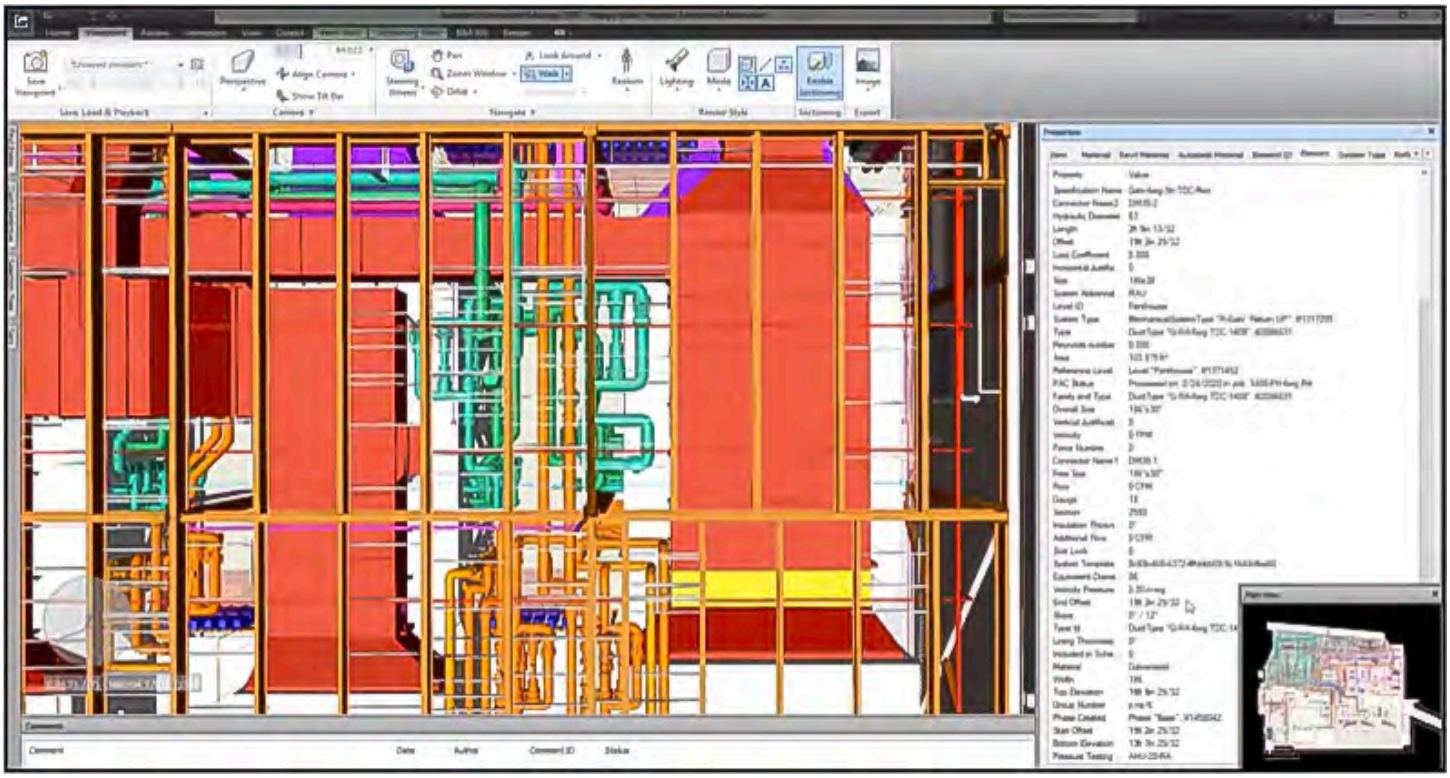
"Ferguson project management, VDC, and fabrication teams were pivotal in creating a successful build strategy and truly acting as trusted advisors and not just a supplier."

— Brent Townsend,
Operations Manager, MMC Contractors

Brent Townsend, MMC operations manager, said of Ferguson, "I'm very pleased with their commitment to partnership. As a design-build contractor, the investment in the time it takes to plan and collaborate can be staggering. Ferguson project management, VDC, and fabrication teams were pivotal in creating a successful build strategy and truly acting as trusted advisors and not just a supplier. Their VDC capabilities set them apart from their competition. It's reassuring to have a supplier that can partner at this level." The partnership between MMC Contractors and Ferguson created the best solution for the client while introducing the industry to Ferguson's new and expanded capabilities in VDC.

For more information, visit www.ferguson.com.

MCAA thanks Ferguson for being a sponsor of MCAA's 2021 Virtual Education Conference.



"Revit combined with SysQue empowers our detailers to create constructible models that are ready for fabrication—AutoCAD can't do that," said Dominick Florentine, director of virtual design and construction at Renick Brothers.

Renick Brothers Accelerates Project Delivery Using Trimble's SysQue Software

Dominick Florentine, director of virtual design and construction at Renick Brothers, was skeptical that Trimble SysQue MEP software would improve productivity, but since trying it out, he admitted, "I'm working smarter because of the features and functionality of the software." Trimble is a sponsor of MCAA's 2021 Virtual Education Conference.

Florentine explained, "I've been drawing in CAD for almost 20 years. A few years ago, the owner wanted to switch to Revit because he saw it as the future. I was not on board because I thought I could draw much faster in AutoCAD." With the transition to Revit pending, a Trimble SysQue representative encouraged Florentine to give it a try.

Today, Florentine is a believer. He noted, "While you can't draw superfast in Revit, the content it provides down the road saves so much time. Essentially, Revit powered by SysQue shapes a streamlined and automated workflow that isn't possible in AutoCAD. No matter the complexity, SysQue kicks in and turns simple data into intelligent content."

Because most of the models Renick creates are designed by the engineers in Revit, they have a lot of object intelligence at their fingertips. These are great starting points, and SysQue does the laborious tasks, such as breaking joints and adding connections.

"The goal is to work smarter, not necessarily faster," said Florentine. "Revit combined with SysQue empowers our detailers to create constructible models that are ready for fabrication—AutoCAD can't do that."

Florentine said his favorite thing about Revit is the scheduling tools. "It's beautiful," he said. "Everything I draw is 100-percent extractable, so I always have an accurate count within the schedule direct from the model. That's the way to accelerate project delivery with intelligence."

For more information and to request a personalized demo, visit mep.trimble.com.

MCAA thanks Trimble for being a sponsor of MCAA's 2021 Virtual Education Conference.

DAIKIN

continued from page 1

for COVID-19 care. Accordingly, state administrators, working with the Colorado Hospital Association and U.S. Army Corps of Engineers, developed a plan to repurpose several health care facilities.

The Rush to Reconfigure

Eight Daikin Rebel DPS units with gas heat and DX cooling were selected for their ability to run on factory controls and handle 100-percent outside air to serve neutral, make-up air to the fourth and fifth floors of the six-story medical facility. The two floors are pulled negative by 18 utility set exhaust fans. All the duct work was installed on the exterior of the building. The Rebel units also feature inverter compressors and electronically commutated motors to maximize energy efficiency.

While the Daikin Rebel units were an ideal solution for converting two floors of general recovery rooms into isolation rooms, the more critical challenge was delivery and installation speed. The virus growth models suggested that the Colorado health care system would be overburdened by early May—and building integrators LONG Building Technologies only learned about the St. Mary-Corwin project on April 11. When Daikin factory workers in Minnesota learned about the job and the dire need, they assured management they could get the system built and shipped in a matter of days.

"There was no way this project would have been completed without our partners. And Daikin more than stepped up to the plate."

—John Hill,
Construction Manager, Industrial Plumbing and Heating (part of Olson Plumbing and Heating)

"We knew from the first phone call that we needed to take on this time-challenging project. But we needed to do it with a team we could trust," said John Hill, construction manager at Industrial Plumbing and Heating, part of Olson Plumbing and Heating.

In just 30 days, a Colorado hospital was reconfigured to care for patients recovering from COVID-19, thanks to Daikin's ability to speed up the manufacturing process and Olson Plumbing and Heating's dedication to working nonstop to get the job done.

"There was no way this project would have been completed without our partners. And Daikin more than stepped up to the plate."

Gary Venable, president of Colorado Sheet Metal, agreed. "It was really amazing the way everybody came together as a team on this project," he said. "We started the design and planning process on Easter, and a week later, we started construction. We were working seven 12-hour days for three weeks to make this thing come together. Everybody put extra effort into meeting the schedule, from team delivery drivers to cranes being set on weekends. The engineers were on site the entire duration of the project, tweaking ducts and designs to meet codes and facility requirements," Venable said.

The entire project, from manufacturing to commissioning, was completed by May 10—approximately 30 days from plan to completion. It is typical in the industry for the bid and spec process of similar jobs to take up to six weeks.

A Breath of Fresh Air

The Daikin Rebel units have performed flawlessly and have been effective in balancing negative and positive air pressure to isolate the fourth and fifth floors of the facility. The integral gas heat system ensures a continuous supply of neutral air in colder months.

The rapid project completion is a testament to the dedication of Daikin factory workers in providing quality solutions that meet the needs of the customer. Yet, it is also a testament to the cooperation of Olson Plumbing and Heating and the rest of the contracting team.

For more information, visit www.daikin.com.

MCAA thanks the Daikin Group for being a sponsor of MCAA's 2021 Virtual Education Conference.

Zurn's EZ Lavatory Carrier has universal arms that can be adjusted in the field, as shown here, which simplified installation for J.M. Brennan's crew.

J.M. Brennan Saves Time, Materials With Zurn EZ Lavatory Carrier Upgrades

To upgrade four restrooms for PHC—Waterford Clinic, J.M. Brennan, Inc. installed Zurn's new universal lavatory carriers, saving time and material "without sacrificing support," said Justin Sherman, J.M. Brennan project manager. The Zurn Z1231EZ Universal Lavatory Carrier is designed to simplify installation. It includes arms that can be adjusted in the field, an independent bracket system that positions horizontally or vertically, and two foot-anchors per upright, instead of four—ultimately saving material, time, and tool wear. Zurn is a sponsor of MCAA's 2021 Virtual Education Conference.

J.M. Brennan saved time during installation with the Z1231EZ Universal Lavatory Carrier, which uses two foot-anchors per upright instead of four.

All of these features seemed like they would offer J.M. Brennan a leg up, but only execution would determine whether the carriers had the strength to hold up in the installation. The health care facility project included four carrier upgrades.

"We work with Zurn products often. Even though the carrier is new, we knew what to expect," said Sherman.

Sherman continued, "I was skeptical of the two anchors replacing the four, along with the fewer floor penetrations. But Zurn did the 250-pound load testing and if they back only two bolts, I'm fine with it."

For more information, visit www.zurn.com.

MCAA thanks Zurn for being a sponsor of MCAA's 2021 Virtual Education Conference.

NIBCO

continued from page 1

chose NIBCO Press for this job for multiple reasons, including safety, time and labor savings, and aesthetics," said Gordon, whose firm has been a preferred design-build mechanical contractor on the sprawling campus for more than two decades. "NIBCO is a proven brand name in our industry. That's important to us because the products we select are a reflection on our company."

After four carefully planned construction phases and three-and-a-half years of steady and precise work, the $8-million HVAC, plumbing, and piping elements of the estimated $50-million laboratory modernization project are nearing completion.

The total renovation project included remodeling existing laboratories located on the ground floor of a three-story, 1960s-era research and manufacturing facility. These laboratories must allow for constant redesign and reconfiguration to meet the specific requirements of each new contract award. The owner's primary goal was to convert the subdivided laboratory space into a large open floor plan, creating the opportunity to build out a modern, flexible, and scalable "factory of the future" that would maximize the total available 160,000 square feet of laboratory and manufacturing space and 57,000 square feet of office space.

The building was stripped down to concrete on all four sides, exposing what was left: columns, high ceilings, and slabs. The original building design included old stanchion supports with piping and electrical systems running up from the floor. To free up valuable floor space, the new design features steel overhead utility racks that now run 500–600' across the exposed ceiling for a nice, clean application. Major mechanical and plumbing systems were removed and redesigned to align with the new design.

Xcel Mechanical chose the NIBCO Press system to maximize efficiency and safety and minimize downtime for an aerospace laboratory renovation. Project team members, from left, are Wes Whittle, piping and plumbing superintendent; Foreman Shawn Gibson, pipefitter and welder; Vice President of Operations Jason Gordon; Foreman Ray Adams, plumber and pipefitter; Tim Brown, service technician; and Steve Prisk, CSHO, ASH, safety director.

"[Using the NIBCO Press], we saved a minimum of 30–40 percent on labor on some parts of this job, and significantly more on other parts."

—Jason Gordon,
Vice President of Operations,
Xcel Mechanical Systems

The Safety Factor

In this facility, the mains on the overhead utility distribution racks are sized from 2" down to 3/4". Separately, the HVAC system has chilled water and heating hot water lines measuring up to 4" in diameter. Some of those lines drop down from a chilled water system located on the roof that serves a newly installed air handler.

"Typically, we would use steel for those 4" lines," Gordon pointed out. "But since the piping ran down an existing shaft, there were safety concerns around welding or grooving the 4" steel. And then there was the weight factor and what would be required to run steel pipe down that shaft versus copper," he said.

"For these reasons, my foremen advocated for the additional material spend on copper. Obviously, the material cost is considerably more but we felt the safety benefits and labor savings would offset it," Gordon said. "We are a strong believer in getting perspective from our foremen. If they support the plan, believe in the products they are installing, and it makes sense financially, then it's a win-win."

Gordon said using NIBCO Press on the project also meant not having to go through the facility's hot work permitting process, which typically adds time to any project. "The customer liked that the NIBCO product removed a certain level of risk—and also the smell of soldering and flux—from an operational lab environment," Gordon noted. "So, in the end, our customer was happy. Our safety team was happy. And our field personnel were happy."

Astronomic Labor Savings

Gordon confirmed that NIBCO Press is easy to install, which helps reduce labor costs while keeping projects on schedule. "Material is material,

but labor is what makes or breaks a job," Gordon stated. The project's process piping system consists of three copper lines, one each for compressed air, nitrogen, and industrial vacuum systems. Each run is 400–500' long and includes multiple connection points.

Gordon said the press product made working in smaller areas and also making multiple connections overhead much easier from both a safety and labor efficiency perspective. "We fabricated a fair amount of material used in this job, but with a multitude of small overhead connection points located 6–12' apart along these lengthy runs, the copper press solution was key. We saved a minimum of 30–40 percent on labor on some parts of this job, and significantly more on other parts," he said.

Minimizing Downtime

Through the life of the project, the ongoing challenge was to build safely around the 100–200 employees who were working in the laboratory areas. The project's four-phase approach called for temporarily relocating employee teams into other parts of the facility while completing construction one section at a time. "Using NIBCO Press not only reduced labor time, but it shortened shutdown periods, allowing us to get the building back online sooner."

Looking Good

Although functionality and flexibility played an important role in modernizing this facility, creating a visually appealing space was also a consideration, Gordon said. "Aesthetically the NIBCO Press product is a good-looking product and a clean application overall," he said. "For nitrogen systems, we would typically purge and braze, and afterward the copper is oxidized. When we install press, the copper looks brand new. It's a good look."

As the project nears completion, Xcel Mechanical will continue to use NIBCO Press systems to maintain their reputation for high-quality workmanship.

For more information, visit www.NIBCO.com or contact Sally Boyer, manager of marketing communications, at boyers@nibco.com.

MCAA thanks NIBCO INC. for being a sponsor of MCAA's 2021 Virtual Education Conference.

Raken Outlines Three Ways to Maximize Efficiency During COVID-19

COVID-19 has changed the way we work—in construction and beyond. From implementing new safety protocols to navigating delays, contractors have more processes to learn and more variables to consider. Here are three ways you can use digital technology to maximize your efficiency during the pandemic.

1. Invest in Real-Time Production Tracking

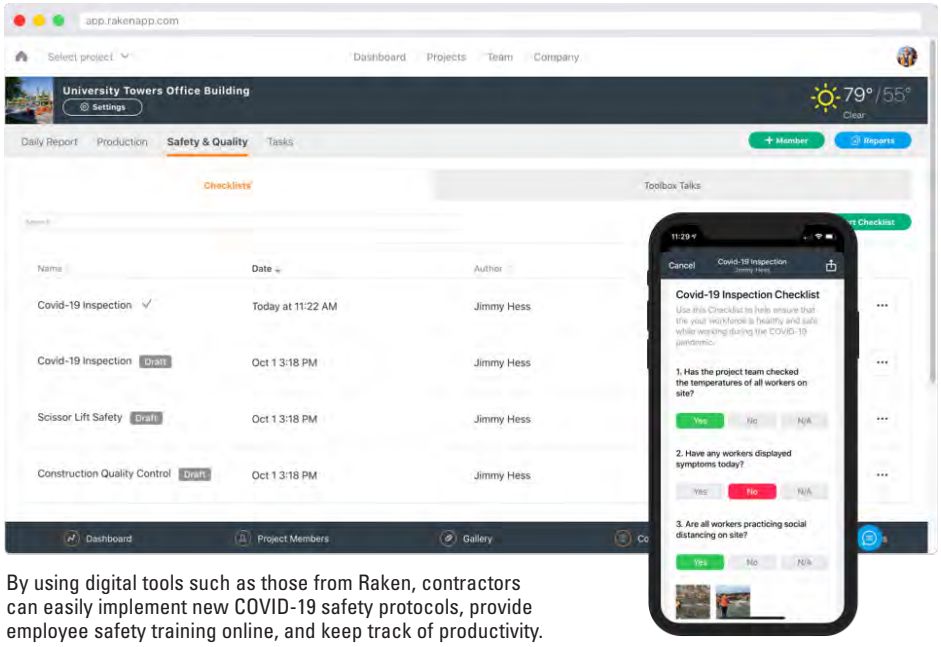
Safety guidelines that require social distancing and extra cleaning are affecting jobsite productivity everywhere. Tracking software makes it easier to know exactly when and how productivity is affected.

Invest in software that lets your teams quickly record materials, equipment, and time cards. By digitally documenting how much time and manpower a job takes, you will have real-time data that can help you make better, more profitable decisions for your projects. You will also have powerful evidence and protection in case of a dispute, all without manual entry and cross-checking.

2. Digitize Daily Reports

Comprehensive daily reports ensure that any delays or liabilities do not slip through the cracks. The more

continued on page 26



By using digital tools such as those from Raken, contractors can easily implement new COVID-19 safety protocols, provide employee safety training online, and keep track of productivity.

Northern Ohio Plumbing's Creativity Cuts Costs With Space-Saving Installation of A. O. Smith Tankless Units

Northern Ohio Plumbing Co., Inc.'s (NOP's) creative approach to mounting A. O. Smith tankless water heaters saved the contractor installation costs and saved floor space in the mechanical room. The water heaters themselves and the layout of the mechanical room promise to make maintenance a snap. The owners of the Holiday Inn-Cleveland Clinic, which opened in May, were inspired to use tankless water heaters because of the nearby Cleveland Clinic's interest in energy efficiency and sustainability. The 199,000-BTU A. O. Smith units deliver a uniform energy factor of 0.93 and, working together, provide more than enough hot water for the guests and staff of the hotel. Ultimately, NOP put in 29 wall-mounted A. O. Smith ATI 540H-N fully modulating condensing tankless water heaters.

"We've done a number of tankless installations in Ohio, but never anything of this scope," said Kevin Conyngham of LIBB Company, Inc., the manufacturer's representative responsible for coordinating the project.

Located adjacent to the world-renowned medical center, the new Holiday Inn-Cleveland Clinic is designed to serve the many people who visit or serve the sprawling clinic campus. The hotel does not experience the type of morning "rush hours" that most hotels do, during which guests demand significant quantities of hot water for showers or bathing from 6 a.m. to 8 a.m. Suppliers to the nearby clinic, visiting physicians, and family members of patients make up the bulk of the hotel's guests, and they tend to arrive and depart at all hours. The A. O. Smith units can meet their hot water needs throughout the day and night.

The 29 units are divided into two zones, Jim Roddy Jr., NOP president, explained. Eleven units supply 140° F hot water to the laundry and kitchen, while 18 units serve the 284 guest rooms with 110° F hot water. Not surprisingly, the laundry requires the most hot water, although the Mocé Café and Bar and the hotel's event facilities also demand ample quantities. The A. O. Smith tankless water heaters' modulating capability means the units can ramp up to meet peak demands while saving energy and costs for the owners.

The NOP team identified a number of creative approaches that saved space and reduced cost during the installation. The original specification called for installing the tankless units on a prefabricated rack system in the mechanical room. Instead, Ben Welton, NOP's foreman for this project, came up with a unique wall-mounted configuration that saved mechanical room floor space. He staggered the units to make the most of the available walls, which better accommodated the water heaters' piping and venting. "The finished job is nothing like the original drawings," Conyngham noted.

NOP also maximized the venting capabilities of the tankless units. The contractor installed one large plenum that branched into individual air intake pipes to supply the 29 water heaters with fresh air. This method required creating just one hole in the mechanical room's exterior wall. The units' exhaust vents are collected into a set of four large exhaust vents that exit the building through one wall. PVC water lines from each of the tankless water heaters lead to a series of risers; one pair of risers serves each guest floor.

The modulating capability of the A. O. Smith condensing tankless water heaters eliminated the need for a hot water storage tank normally used in a hotel application. Roddy said that NOP tested the system, running multiple showers on multiple floors at the same time, and the water heaters were able to keep up with the demand.

NOP came up with a unique wall-mounted installation of A. O. Smith tankless water heaters that cut down installation costs and also saved mechanical room floor space.

The A. O. Smith 199,000-BTU tankless units are rated to deliver a maximum flow rate of 10 gallons of hot water per minute. Even during Cleveland's cold winters, the water heaters can deliver a minimum of four gallons of hot water per minute or seven gallons of blended water, Conyngham pointed out.

"The nice part is the redundancy of the system. If one unit requires maintenance, you don't have to shut down the system, and the hotel will still have hot water," Welton noted.

For more information, visit www.aosmith.com.

HPS Shortens Welding Time With Orbitalum Systems From E.H. Wachs

High Purity Systems, Inc. (HPS) of Manassas, VA, relied on Orbitalum® high-purity tube cutting, facing, and orbital welding systems to meet the urgent infrastructure needs of a large biopharmaceutical company's COVID-19 vaccine research and production effort. The project called for thousands of high-purity welds, so HPS partnered with Orbitalum, based outside Chicago and distributed with support from E.H. Wachs.

HPS found that Orbitalum's OM 180 SmartWelder's standard Flow Force, a purge gas function, dramatically shortened welding cycles as they worked to rapidly expand infrastructure for COVID-19 vaccine research and production.

Productivity Boost

During fabrication, HPS combined Orbitalum's OM180 SmartWelder TIG orbital welding power supply and fully enclosed, water-cooled weld heads with the Orbitwin SW switching unit. The Orbitwin offers the flexibility to control two orbital welding heads with one power supply, alternately operating one while the other is being setup. This gave HPS a huge productivity increase, because two heads with two different-sized setups can be "couponed in" concurrently.

Doug Barefoot, HPS business development manager, explained, "Because you're not removing the head from the power supply, the previously assigned program is recalled automatically when the start key on the welding head is pushed. You're not changing any of your programs—you've already made your test welds and can switch from head to head and weld either the same size/wall thicknesses or two completely different OD [outer diameter] and wall thicknesses."

Another factor in HPS' drive for efficiency was Orbitalum's OM 180 SmartWelder's standard Flow Force, a purge gas function that uses computer-controlled, modifiable flow values to reduce argon usage and the prepurge time after the weld heads are closed. Barefoot commented, "We dramatically shortened our welding cycles by using the Flow Force function, which significantly decreases the waiting time the welder typically has when waiting for ID [inner diameter] oxygen levels to get within range. The Orbitalum cutting and welding equipment has worked great for our offsite fabrication and onsite installation needs."

Preparing for Vaccine Production

The ability of U.S. biopharmaceutical companies to react to changing manufacturing requirements is vital as the COVID-19 pandemic continues to spread throughout the United States. Many biopharmaceutical companies are building expanded infrastructure designed for rapid line redeployment, anticipating the need to increase manufacturing capability for COVID vaccines. HPS was awarded contracts for multiple, simultaneous projects by a large biopharmaceutical company with clear directives: the work must be done precisely, safely, and quickly; it must be minimally invasive; and it must meet specific project deadlines.

The scope of the project included modifications and additions to infrastructure and process piping systems at facilities designated by the U.S. Department of Health and Human Services (HHS) to provide advanced development and manufacturing of medical countermeasures to support the U.S. government's national security and public health emergency needs. Part of the scope included expanding a fill/finish facility to significantly increase manufacturing capacity, redundancy, and flexibility. HHS aims to align the designated facilities to produce medical countermeasures rapidly for public health emergencies, including COVID-19 vaccines.

Tips for Tough Projects

Barefoot offered his thoughts on achieving success on projects like these: "First, be sure to get long-lead items identified and ordered right away, even if it involves expedited fees or priority delivery costs. Second, prebuild parts of the project that are under your control while waiting for long-lead parts. Third, use the best tools available, use technology to your advantage."

Using Orbitalum tools like the industry-standard GF line of tube

continued on page 26

Aquatherm Outlines Steps to Success With Butt Fusing Polypropylene Piping

A properly performed butt fusion on polypropylene piping is a wonder of the modern world: two pieces of pipe (or a pipe and fitting) become one solid piece. The joint is as strong—if not stronger—than the pipe itself. There are no leak paths, and, when properly performed, the fused joint will remain leak-free throughout its 50-year-plus year lifespan.

Of course, the key here is "properly performed." Good technique and attention to detail will ensure a successful fusion, contributing to a leak-free installation.

According to Lance MacNevin, director of engineering for the Plastics Pipe Institute's Building & Construction Division, the butt-fusion procedure basically consists of heating the squared ends of two pipes (or a pipe and a fitting), holding them against a heated plate, removing the heat when the proper temperature is reached, bringing the ends together with a certain force, and allowing the joint to cool while maintaining the force.

There are seven essential steps when performing a butt-fusion joint using Aquatherm polypropylene pipe. The steps outlined here are the basis for creating both great piping systems and happy customers.

Step 1: Prep

Proper preparation and organization will help your heat fusions go smoothly.

- First, inspect the pipe itself. Do not use pipe that is damaged or gouged deeper than 10 percent of the pipe's wall thickness on the outside or 5 percent on the inside.
- Next, set up and inspect the fusion machine that you will be using. Follow all the machine manufacturer's instructions and perform any maintenance as needed.
- Inspect the facer device and ensure the blades are sharp, tight, and undamaged.
- Inspect and turn on the fusion iron. Make sure the iron is clean and set to 410° F ±18° F (210° C ±10° C). Verify that the iron is at the proper temperature prior to each fusion.

Step 2: Clean

Clean surfaces are essential. The pipe ends being fused must be clean and dry to ensure a good fusion. Clean the pipe ends, facer, and fusion iron to remove any dust, dirt, or other contaminants. Wipe the pipe ends, facer, and iron with a clean, dry, lint-free, nonsynthetic cloth and isopropyl alcohol, 91-percent concentration or higher.

Step 3: Clamp and Align

This step is crucial, as the clamps will hold the pipe as it is being fused, and an accurate alignment will ensure a consistent fusion "bead." Remember to watch your fingers whenever the fusion machine's carriage is in motion.

- Set the pipe and fittings into the clamps. Adjust the configuration as needed. Make sure to leave enough room for the facer (see step 4). Tighten the clamps and bring the pipe ends together.
- Check the alignment of the pipes by running your finger or the end of a pen across the gap. If one side is higher than the other, tighten down the higher side.

Step 4: Face the Pipe

The ends of the pipe or fittings must be faced to establish clean, parallel mating surfaces. Proper facing creates smooth and even surfaces for fusion. This step is performed using a device with a rotating cutter head.

- In step 3 you brought the pipe ends together to check their alignment. Now, separate the pipes, while keeping them locked into the fusion machine's carriage. Open the carriage set and lock in the facing tool. Run the facing tool and let it come up to full speed—do not start the facer if it is pinched between the pipe ends.
- Close the pipes on the facer and increase the pressure until the facer begins shaving off ribbons of polypropylene. Proper facing will produce 360-degree full-width strips on both sides of the facer. When you see two full revolutions of ribbon on both sides of the facer, open the carriage to separate the pipes from the facer, then switch off and remove the facer. (Do not turn off the facer while the carriage is still closed; this can leave nicks on the pipe face.)

Step 5: Adjustment and Bead-Up

- Close the carriage and check for gaps; reface or realign as needed. Reopen the carriage and wipe down the pipe faces with 91-percent isopropyl alcohol.
- Check the fusion machine manufacturer's information and set the drag pressure and full fusion pressure levels (controls vary by manufacturer). A temperature measuring device, or pyrometer, can be used to verify proper temperature of the heating tool face.
- Open the carriage and insert the heating iron. Close the pipes onto the heating iron under full fusion pressure to begin formation of the adjustment bead. The height of the bead will vary from 1 mm to 2.5 mm depending on the size and standard dimensional ratio (SDR) of the pipe.
- Carefully watch the bead during the adjustment phase and reduce the pressure once the bead reaches its required height. The height of the bead is important during the fusion, as too small a bead may lead to an improper connection, whereas too large a bead can create a flow

restriction and also may indicate a problem with fusion pressure.

Step 6: Heat

- Once the adjustment bead is complete, drop the system to drag pressure. If necessary to maintain contact, add up to 10 percent of machine pressure. The heating phase requires as little pressure as possible. Some machines lock in place, only requiring the drag pressure. Others require a slight positive pressure to keep them in place, but never more than drag plus 10 percent machine pressure. Excessive pressure during the heating phase can create an excessive bead and slight restriction in the pipe.
- Use a timer to monitor the proper heating time for the size and SDR of the pipes being fused.

Step 7: Fuse and Cool

- Open the carriage and remove the iron. Immediately bring the pipes together and ensure the machine achieves full fusion pressure within the pressure buildup time. If excessive force is used, melted material may be pushed out of the joint, resulting in contact with cold material, known as a "cold" joint. If too little force is used, insufficient welding of the joint can occur.
- Allow the connection to cool for the specified time for the size and SDR of the pipes being fused. Examine the bead. The final bead should look like one solid piece; a bad fusion will have a split bead with two distinct sides.
- Release the pressure and, once the pressure has been completely released, undo the clamps.
- Remove the fused pipes, or fused pipe and fitting, from the machine. It is ready to hang and to begin providing leak- and corrosion-free service for decades to come.

Conclusion

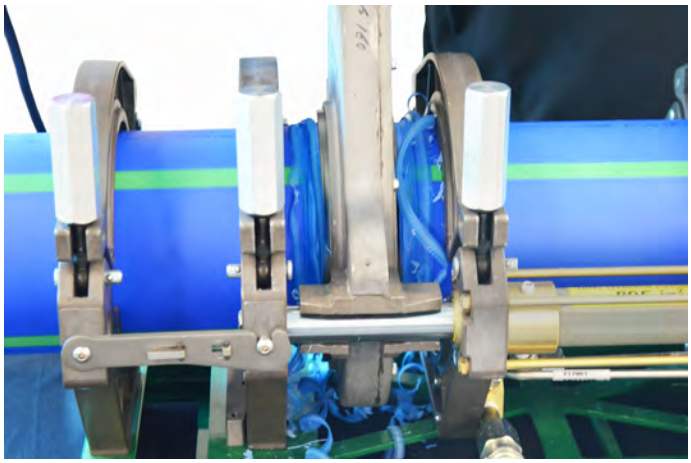
These steps give you an overview of making successful, long-lasting, leak-free butt fusions with polypropylene pipe. For a complete guide to working with polypropylene pipe, consult the Aquatherm North America Installer Manual, available at https://aquatherm.com/literature/installer-manual. Aquatherm also offers extensive training resources.

In addition, the manufacturers of the fusion equipment offer comprehensive information about their products. It is important to always follow the manufacturer's guidelines for both the pipe and fusion equipment when fusing polypropylene pipe and installing polypropylene piping systems.

For more information, visit aquatherm.com.

Preparing the fusion machine will help ensure that you can perform effective butt fusion of polypropylene piping, which creates leak-free joints.

Clamps hold the pipe as it is being fused, and an accurate alignment will ensure a consistent fusion bead, which is important for a good connection.



Proper facing creates smooth and even surfaces for fusion, a key factor in forming a strongly fused joint. Facing is complete when you see two full revolutions of ribbon on both sides of the facer.

Using BIM 360 within Autodesk Construction Cloud enables the Helm Group to coordinate and share data. As a result, these multitrade skids created in an offsite fabrication shop are so accurate, the contractor can install them onsite as soon as they are delivered.

Helm Group, Inc. Streamlines Work, Wins Jobs with Autodesk's BIM 360

Helm Group, Inc. (formerly Mechanical, Inc.) combines leading technology like BIM 360 within Autodesk Construction Cloud™ with Lean construction principles to implement new design, engineering, and construction methods. For example, by fabricating multitrade skids in an offsite fabrication shop, Helm Group increases collaboration and drives efficiencies to deliver highly complex projects while achieving certainty in cost, schedule, and quality. BIM 360 enables the coordination and data sharing that allows the fabrication to be so accurate that, once it arrives onsite, all that is necessary is to lift it into place and install it.

Known for their commitment to innovation, Helm Group has gained this reputation not by being on the cutting edge, but by remaining on the "bleeding edge." They are always trying out the latest technologies and approaches, looking for the most effective way to get the job done. Unfortunately, being on the bleeding edge has side effects.

"You try all the new things, and you can get fatigued by it," said Travis Voss, leader of innovation technology at Helm Group. "It's application fatigue."

"We wanted to pull back from all the heavy focus on trying each latest and greatest thing and look more holistically at what we were doing," said Voss. So Helm Group adopted BIM 360, which they use as a common data environment to unify and simplify data across the project lifecycle and improve communication and collaboration across teams.

With a strategic approach to developing its tech stack to specialize on large-scale industrial projects, here are eight ways that BIM 360 helps Helm Group win more work by achieving Lean workflows and simplifying and streamlining the digital exchange of information across project teams.

1. Puts Data Into the Hands of Everyone Who Needs It

BIM 360 is a one-stop shop where teams can get the latest project information. With connected data across the project lifecycle, teams spend less time looking for information and can collaborate and communicate

more effectively, reducing project risk and improving quality.

"We struggled with making sure our field personnel had the most up-to-date information in the palm of their hands," said Jeff Knoup, vice president of operations at Helm Group. "Before BIM 360, if you needed information, you would have to go to greater lengths. If you were on the third floor of a building, or the 20th floor, for instance, you might have to go all the way down to the job trailer, open up your laptop, get on the network, and look up the information you need. Now, we can access that information from anywhere on the jobsite."

Voss added, "BIM 360 is also a powerful tool for our virtual design and construction (VDC) department to use when we're doing design work for other companies. We can easily share models and documents between our team and partners within a platform that we are already comfortable using within our workflows, allowing our design work to fit into their processes seamlessly."

2. Appeals to Sophisticated Customers

Knoup pointed out that Helm Group likes to go after highly technical, industrial projects that many firms cannot handle. The buyers at these companies are sophisticated, and they expect similar sophistication from their partners.

"Owners want full visibility into the project to see what's getting done in a given day, how many linear feet of pipe you put up each day, how many pounds of ductwork, etc. Unless you have a technology solution to help you track and produce that information, the owners will pass you by," said Knoup.

Voss noted that using BIM 360's 3D modeling capability makes the bid process more effective. "We get into some of these bid meetings, and we show off," he said. "We not only traditionally showcase our work, but we share our designs via augmented reality/virtual reality (AR/VR) headsets while we're talking about data sharing. It appeals to those sophisticated owners."

3. Helps With Materials Tracking

In highly technical work such as in the biopharmaceutical industry, materials tracking is critical. "Every weld has to be documented," said Knoup. "All of the owner-supplied equipment has to be checked in against specs and fabricated into spools and assemblies before being brought to the jobsite."

Tracking the quantity and level of detail necessary on a highly technical project would be a very labor intensive, manual process without BIM 360. It facilitates the tracking of materials as they enter and leave the fabrication facility and while they are inspected and installed.

4. Makes Projects Leaner

"We use BIM 360 to integrate with other partners in our fabrication tracking," said Voss. "Part of Lean is eliminating waste, including wasted time. Integration eliminates trips back and forth to the trailer. It eliminates phone calls back to the office to ask questions. It eliminates confusion over versions."

Voss also said that Helm Group shares its centralized data hub and its VDC process in a third-party fabrication add-on, which helps push fabrication to the shop.

"It provides the shop foreman and the shop manager, as well as the field foreman and the field manager, what they're going to be receiving, so they can prepare for it. It gives them good insight so they can remotely comment and share their thoughts on what we're building in the shop, so they don't have to do any rework in the field," Voss explained.

5. Integrates with AR Applications to Make Walk-Throughs More Effective

Owners understandably like to walk through the space as it develops to see where their equipment will go, where their systems will be installed, and how the structure will support it. Some walk-throughs can be conducted via VR, but Knoup said the best use of the technology is using AR during a physical walk-through.

"We had one customer building a food processing plant, for which we did a bunch of the sheet metal and piping work and some platforms," said Voss. "We put AR glasses on and walked them around the space. They had previously spec'd out the work, but while walking through it with AR showing them how the space would be used, they discovered that their carts wouldn't fit under a certain platform and that other platforms weren't high enough for someone to be able to reach what they needed to work on. It seems like a small detail, but it saved them thousands of dollars because we could change the design based on what the customer really wanted before anything was installed."

Voss said Helm Group has countless similar examples, in which they discovered that other contractors installed things incorrectly or designs had failed to account for a real-world application. Discovering these things during walk-throughs substantially reduces rework and provides owners with peace of mind.

6. Improves Accountability

In addition to reducing rework, the AR technology integrated into BIM 360 creates a trail of accountability that saves money and ensures everyone is held responsible for their commitments.

"We had a situation where a space had been modeled, coordinated, and signed off on, but a plumber came in and

continued on page 27

Jomar Valve Explains the Corrosion-Resistant Properties of Heat-Treated Brass as Alternative to Bronze for Plumbing

For those considering open-loop copper plumbing systems, there may be a misconception that bronze valves are the only reliable option for dezincification resistance. However, changes in lead-free requirements as a result of the Safe Drinking Water Act have led to new, viable alternatives to bronze. Heat-treated, dezincification-resistant brass valves are becoming a popular specified product within the engineering community. When subjected to ISO 6509 testing, heat-treated, dezincification-resistant brass valves perform as well as bronze in fighting against corrosion.

What Is Dezincification?

Many forms of corrosion can occur in copper-based alloys. The most common in plumbing systems is dezincification. This process mainly exists in copper zinc alloys that contain more than 15 percent zinc. Dezincification selectively removes zinc from an alloy, leaving behind a porous and copper-rich structure with poor mechanical strength.

Additional environmental factors can also contribute to the acceleration of dezincification. These factors include water with high levels of oxygen and carbon dioxide, slow-moving (or stagnant) water, water with high chloride ion content, and water with high salt content above room temperature.

In some instances, design engineers and contractors are unaware of harsh, preexisting conditions prior to beginning work onsite. However, after completion of a piping system, a number of visual signs might indicate a higher likelihood of dezincification in common copper alloy valves. These indicators include mineral stains on the outer surface of a valve, water weeping from a valve body or stem seal, and the presence of a white deposit (zinc oxide) on the exterior of the valve. A narrowly written valve specification can help minimize these potential failures by simply calling for a proper corrosion-resistant, copper-based alloy.

How Can Brass Become Corrosion Resistant?

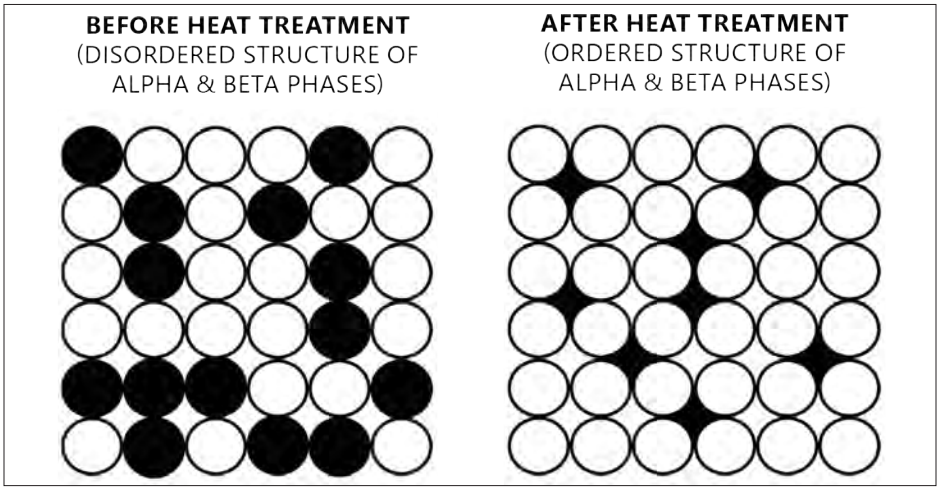
Two manufacturing methods can eliminate dezincification in copper-based brass alloys. The first method is to increase the copper content, which results in a reduction of zinc in the alloy. The second practice involves adding corrosion inhibitors to brass alloys. Only through a controlled-heating and slow-cooling annealing treatment can the second method create a stronger material with a realigned molecular structure. Brass alloys typically have two phases to their molecular structure. The first—alpha phase—is dezincification resistant; the second—beta phase—is dezincification susceptible. When brass alloys are enhanced to an all-alpha phase through heat treatment, they perform the same as bronze alloys when fighting dezincification.

The Solution: Heat-Treated Forged Brass

An example of a heat-treated alloy in the commercial plumbing industry is CW511L. This duplex brass is a lead-free brass alloy composed of both an alpha and beta phase. Alpha and beta phases correlate to the solubility between metals in brass alloys, resulting in different colors and structures in each phase. As a result of the temperature changes in heat treatment, elements within the alloy change their liquid and solid states, resulting in a restructured alloy composition.

The alpha and beta composition is resistant to cracking and is extremely malleable at high temperatures. The purpose of heat treatment is to transform alpha and beta phases into a predominately alpha phase (dezincification resistant). After heat treatment, the new composition structure's alpha-to-beta-phase ratio is less than one percent beta phase, resulting in a dezincification-resistant alloy. At this point, beta phase is now referred to as a residual beta phase, and the alloy structure is 99 percent in alpha phase. This restructuring leaves a brass alloy that is now truly dezincification resistant.

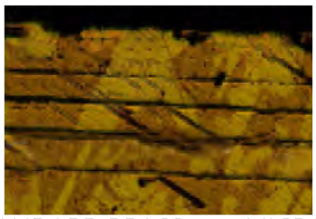
Figure 1 (below) shows the varying phase changes of CW511L during the heat treatment process. These changes are distinguishable by the color and shape of the crystals within the alloy. When the alloy completes



its heat treatment process, the color of the brass will appear more gold than bronze under a microscope. However, the valve body surface will appear bronze in color due to the oxidation of brass at 1,000° F (537.87° C).

When CW511L brass is heated to a temperature of 1,000° F (537.87° C), an all-alpha phase is achieved. This alpha state is maintained in the alloy by a slow-cooling, annealing process. The end result is optimal dezincification performance when tested to the ISO 6509 standard for determining dezincification depth of copper alloys with zinc exposed to fresh, saline, or drinking water. The method is intended for copper alloys with a mass fraction of more than 15-percent zinc. Third-party ISO 6509 testing explored dezincification susceptibility among copper-based alloys, including bronze and brass valves. This testing illustrated the difference in dezincification depths for each valve and corresponding alloy. It was determined that heat-treated CW511L brass showed a dezincification depth of zero microns, which was equivalent to the dezincification depths seen in bronze valves. The remaining non-heat-treated brass valves showed dezincification above 200 microns depth as illustrated in Figure 2 (below).

DEZINCIFICATION DEPTH TEST



STANDARD BRASS: 290 MICRON

CW511L: 0 MICRON

This level of dezincification is above the acceptable performance level based on the ISO standard, deeming the non-heat-treated brass valves as not truly dezincification resistant. The results of the test prove that not all brass materials are equal and that certain heat-treated brass alloys can perform as well as bronze when it comes to corrosion resistance.

Jomar Valve's white paper offers more detail on dezincification: https://www.jomarvalve.com/docs/lit-wp-crb.pdf

Consider Alternatives

Dezincification in plumbing systems is an ongoing battle, but bronze is not the only solution. New technologies, like Jomar Valve's heat-treated CW511L brass alloy, can act as a combatant to dezincification while providing an increased level of mechanical strength.

For more information, visit www.jomarvalve.com.

Lexington Plumbing Locks In Savings, Energy Efficiency With Lochinvar Systems

To provide an energy-efficient system for a Kansas county jail, Lexington Plumbing employed Lochinvar's exclusive SMART SYSTEM interface to simplify installation and operation of two new Lochinvar ARMOR water heaters. "We consistently recommend Lochinvar equipment because of their constant innovations and technologically advanced systems," said Don Lawhon of Lexington Plumbing.

Lawhon explained, "With the installation of the ARMOR units with their SMART SYSTEM control, the facility managers here at the county jail can now adjust the firing rate of these units as opposed to using the 100-percent firing rate on their old water heaters. The ARMOR units will fire at the rate needed to keep the water supply at the right temperature—and energy bills where they should be."

Kansas City-based Lexington Plumbing worked with Lochinvar to design an installation that would provide the utmost advancements in energy efficiency for the Wyandotte County Jail. With its ability to deliver thermal efficiencies as high as 98 percent and its turndown ratio of 5:1, the fully modulating ARMOR Condensing Water Heater was the ideal fit for the job.

The facility's original system was comprised of two 70-percent efficient water heaters tied into a vent that extended up through the building. The Lexington Plumbing team removed the old units and installed two 800,000 BTU per hour ARMOR models, stacked with two 500-gallon insulated storage tanks to provide maximum savings. With ARMOR's flexible venting options, the new units could be vented directly though the sidewall of the building.

Lochinvar's SMART SYSTEM interface provides complete control of the system's entire range of functions, offering full access to performance data and history. The SMART SYSTEM operating control also features a built-in cascading sequencer that allows the two ARMOR units to work together to fire as low as 10 percent of total maximum input and smoothly modulate up to 100 percent as demand increases, keeping operating costs to an absolute minimum.

Adding to the energy savings, the SMART SYSTEM's night setback feature can be preprogrammed to shut off or slow down when the jail is less occupied. In addition, SMART SYSTEM enables ARMOR to communicate seamlessly in real time with building management systems by using an onboard Modbus protocol.

The unique ARMOR design also protects against the harmful effects of lime scale buildup, which can cause a traditional water heater to fail in as little as two to five years and substantially increase operating costs. For example, just 1/4" of scale in the tank can increase operating costs by as much as 25 percent. Because ARMOR heats the water and then deposits it in an unfired storage tank, lime scale buildup does not impair the heat transfer efficiency.

Following the installation, facility managers were extremely pleased with the increase in efficiency delivered by the two ARMOR Condensing Water Heaters. "The facility management team at the Wyandotte County Jail was initially attracted to the fuel savings attributed to the Lochinvar units, and they haven't been disappointed," said Tom Axtell, president of Lexington Plumbing. "Having a highly efficient system is vital for a facility that uses this much hot water on a daily basis, and they will be able to pay back the cost for the new equipment in two-and-a-half to three years. Now that this project is completed, the facility personnel told us they wish they would have upgraded sooner."

For more information, visit lochinvar.com.

Left: Lexington Plumbing installed two new, efficient Lochinvar ARMOR water heaters to meet the high demands of the Wyandotte (Kansas) County Jail while keeping operating costs low.

Right: Using Lochinvar's exclusive SMART SYSTEM simplified Lexington Plumbing's installation of two new Lochinvar ARMOR water heaters for the Wyandotte County Jail in Kansas.

Milwaukee Valve Pros Explain How to Check Your Check Valves

Depending on the application, check valves can get a bad rap. They are blamed for problems such as water hammer, vibration, reverse flow, leakage, or component wear and damage—all of which are harmful to downstream systems. However, the real cause of these problems usually stems from poor sizing and inadequate selection of the check valve for the application.

Most check valves are selected on line size and the desire for the largest valve flow coefficient available. Swing checks require a minimum rate of flow for the valve to function. If the flow is not sufficient to hold the disc in a fully open and stable position, the disc and associated internal parts will be in a constant state of motion (wobble). Insufficient flow results in premature wear, noisy operation, and vibration.

The solution to this problem is selecting a line size that produces sufficient flow. A general rule of thumb for water systems is to maintain a minimum of 7.5 feet per second (ft/sec) flow rate. If the system struggles to maintain that flow rate, it is sometimes recommended that the line size be reduced.

In piping systems containing other types of fluids, the flow requirements vary with the specific gravity of the media. The following formula can be used to approximate the minimum flow rates.

$$\text{Flow}_{min}\ (\text{ft/sec}) = 60\ \sqrt{V}$$

V = specific volume of fluid (ft^3/lb)

Silent check valves such as the Milwaukee Valve 1400 (Wafer) and 1800 (Globe) have slightly different flow requirements. Spring-loaded silent check valves are designed to provide a cracking pressure of 0.5 psi and to fully open at a flow velocity of 4 ft/sec.

All check valves should be installed in a location that has smooth and laminar flow conditions. The following general rules exist for check valve installations:

Downstream of a reciprocating pump or other turbulence-inducing device (elbow, tee, etc.):

- Swing type: Locate the valve a minimum of 10–12 diameters downstream of the device.
- Silent type: Locate the valve a minimum of 4–5 diameters downstream of the device.

Pipe fittings, elbows, reductions, etc., downstream of the valve:

- Swing type: Locate the elbow a minimum of 5–7 diameters downstream of the valve.
- Silent type: Locate the elbow a minimum of 2–3 diameters downstream of the valve.

For more information, visit www.MilwaukeeValve.com.

These examples all show check valves that are installed too close to the pumps. In all three, reducers were installed between the pump and the check valve, suggesting that the check valves were likely oversized for these pumps.

Brandt Companies Meets Aggressive Project Deadlines With RWC's HoldRite

With just 25 months to construct a 12-story, two-building assisted living facility in Dallas, TX, Brandt Companies relied on the Reliance Worldwide Corporation (RWC) HoldRite products they have trusted for more than 15 years to save time while meeting code requirements. Brandt was commissioned to install firestop and plumbing systems. Project Superintendent Andrew Meshell and Project Manager Spencer Jackson chose HoldRite's engineered firestopping solutions and pipe support products.

HoldRite's new construction plumbing rough-in products helped Brandt reduce installation times while maintaining quality on the jobsite. HydroFlame Pro cast-in-place sleeves were the

Brandt used easy-to-install HoldRite products to meet the demanding construction deadlines for a new, 12-story, two building assisted living facility in Dallas. Here, Andrew Meshell, project superintendent, and Spencer Jackson, project manager, walk through the jobsite.

Insights from Ridge Tool Company on Stocking Your Truck With the Right Gear to Get the Job Done

With technology changing at a rapid pace, adding new tools to your truck can provide a quick productivity boost. Keep in mind that a tool's weight, size, overall portability, and versatility are critical when making purchases. When investing in a new tool, you will want to consider:

- Will it save time and space by incorporating multiple tools into one?
- How much space will it take up in your truck?
- Are ergonomics incorporated into the tool's design to minimize user fatigue?

For example, the RIDGID® RP-342 XL Press Tool boasts the widest range of applications of any press tool. It presses 1/2" to 4" copper, stainless steel and carbon steel pipe and 1/2" to 2" PEX pipe—in under 12 seconds and all with one tool. It is ergonomically designed and compatible with the full line of Standard 32kN Press Tool accessories, including the StrutSlayr™ Strut Shear Head, Press Snap™ Soil Pipe Cutter and all MegaPress jaws.

New tools can benefit productivity, but they are not the only way to maximize your time. Here are a few additional ideas to reclaim potentially wasted time.

RIDGID's RP 241 compact press tool connects to your phone via Bluetooth, so you can easily keep track of the battery life and cycle counts, avoiding unexpected maintenance on the jobsite.

natural choice for Meshell and Jackson for UL-listed firestop sleeves. Their telescoping functionality means they can easily fit into tight areas.

When it came to in-wall rough-in plumbing, the team secured pipes with HoldRite stout and copper brackets and clamps. Not only did they offer the right pipe support for the job, but they also locked the measurement down so the team did not have to worry about the under-slab rough-in being off when they came back later to install fixtures. The brackets gave the contractors peace of mind that the pipes were secured in the wall right where they needed to be.

Ultimately, Brandt installed more than 4,000 HydroFlame Pro sleeves, as well as HoldRite clamps and various other components, to meet the job requirements and the deadline. To them, HoldRite has always been—and continues to be—an innovative partner with solutions to get the job done efficiently without sacrificing quality.

"One of the best things you get out of the HoldRite products is they take a 30-minute job down to a 5-minute job."

— Andrew Meshell,
Project Superintendent,
Brandt Companies

Brandt continues to use HoldRite products because they are user-friendly and versatile, allowing the team to work quickly and use across a diverse range of applications. "One of the best things you get out of the HoldRite products is they take a 30-minute job down to a 5-minute job," Meshell said.

To Meshell, HydroFlame Pro sleeves are easy to install and can be used in a variety of installations. When working on the Dallas assisted living facility, his team only needed to bring one type of sleeve on the site to accommodate multiple jobs.

"Because of [HoldRite's] versatility, we're able to meet and beat the expectations from our customers to maintain a schedule," Jackson said. "I would say there's no comparison. This is the right product to use."

For more information, visit www.holdrite.com.

Assess and Restock Service Vehicles

Keep a standardized list of tools and products for each service vehicle. Make that list available to your team for regular reference to ensure routine items are stocked and at-the-ready. Refer to the list at the end of each day, and restock any needed items so that you are ready to go at the start of the next work day. Taking those few moments can improve productivity and minimize delays getting to a jobsite.

Prepare Your Crew for Upcoming Projects

Just as you make sure your service vehicles are stocked and ready to go, ensure your team is prepared for their day as well. Whether it is a quick meeting at the beginning of the day, a team email on who is doing what, or a group text with key project notes, sharing details of what is planned for the day can be beneficial in making sure team members know what is expected of them when they get to a jobsite.

Find Ways to Minimize Trips to the Service Vehicle

How many times have you just gotten started at a jobsite when you realize you left a key tool in your vehicle? Keeping standard tools and supplies—the ones you cannot live without—in a tool box or storage container that you bring into every job can minimize trips to your vehicle. Investing in tools that have minimal service downtime is another great way to up productivity. For example, the RIDGID RP 350 Press Tool has a brushless motor that eliminates the need for scheduled

continued on page 27

You can increase productivity by choosing tools that need little or no maintenance—such as the RIDGID RP 350 Press Tool, which has a brushless motor that eliminates the need for scheduled service.

Havtech, MacMiller Better Connect With Customers Through XOi Technologies

Havtech and MacDonald-Miller Facility Solutions (MacMiller) are among those MCAA members using XOi Technologies to capture facilities information that helps them improve service and better communicate with clients. In a highly competitive market, video documentation helps them get client approval quickly, demonstrate that work is completed, and bring technicians up to speed quickly before they go onsite to provide service.

Communicating the complexities of a service call to a customer can be extremely challenging. Video of a service call can explain a lot, but it can be difficult to email a large video file. XOi Technologies' holistic communication tool allows a service contractor to send a PDF to a facilities manager with an easily shareable link that provides documentation in the form of photos, videos, notes, and text narration of recommended and completed work. A link to a customized, cloud-based file that shows the entire service call provides unbeatable transparency.

"Capturing photo and video content of the opportunities our technicians find in the field has become extremely valuable to our customers. It is becoming an expectation in our marketplace."

—Rory Olson, Service Operations Manager, MacMiller

Sometimes a service call cannot be completed in a single visit. For example, repairs might require ordering specialized parts, which might threaten to exceed a customer's service and maintenance budget. Typically, there are many moving parts when completing and recommending work, and dealing with an offsite facilities manager can be an added challenge when trying to get additional work and orders approved. Attaching links with visual confirmation of necessary parts and service can be a huge help to expedite the decision-making and approval process.

Enhanced Credibility

Havtech, one of the mid-Atlantic's largest and most experienced providers of commercial HVAC equipment, building automation systems, field services, distribution, and energy solutions, uses XOi Technologies' platform to document jobsite conditions before, during, and after each visit, taking the guesswork out of what is really going on with facility equipment. Doing so allows their customers to make informed decisions and feel confident in their investment.

"XOi has given us a tool to increase credibility and just overwhelm people with communication," said Erik Hess, service operations leader of Havtech. "We've had times where customers called in and challenged the work performed. Havtech has the ability to provide the customer with an electronic link to watch the associated video."

Collaborative Communication

The wealth of information the XOi solution documents and provides ultimately makes the facilities manager's job easier, strengthening the relationship between customers and service providers. MacMiller, a leader in design, retrofit, and service capabilities in the Pacific Northwest, counting Nike, Boeing, and Microsoft among its clients, implemented the communication tool after company executives identified mobility and collaboration technology as two key growth drivers to ensure continued success and differentiate the organization.

"Capturing photo and video content of the opportunities our technicians find in the field has become extremely valuable to our customers. It is becoming an expectation in our marketplace," said Rory Olson, service operations manager of MacMiller. "XOi's platform provides a clean way to connect our customers with the solutions we provide. It has also become a useful training tool for mentoring and developing technicians."

Building a Data Library

Perhaps more important than the ability to show and tell are the data that the software captures. The solution creates a library of all the videos created for a customer, allowing the next service technician sent to that site to access the complete work history for the specific piece of equipment. This library of knowledge and data ultimately improves the contractor's quality control.

"XOi has given us a tool to increase credibility."

—Erik Hess, Service Operations Leader, Havtech

The data captured can be used to show energy consumption, based on instrument readings taken by technicians. The data can also be used to track the integrity of a unit over time, identifying whether the unit's performance is degrading. Such information can be paired with additional software to track the amount of money a client has spent on each piece of equipment, the number of service calls required, the type

of repairs needed, and whether the equipment requires callbacks. The combined information can be used to make the case for buying and installing a new piece of equipment rather than continuing to repair an old one.

XOi Technologies also enables users to construct a database of service videos, service manuals, wiring diagrams, and all kinds of the other information that a technician needs when he's in front of the equipment. No wonder that XOi Technologies CEO and cofounder Aaron Salow calls the cloud-based video platform "the future of service."

For more information, visit www.xoi.io.

Martin Mechanical Inc. Reimagines Labor Scheduling, Improves Efficiency With LaborChart

Upgrading from Excel to LaborChart for labor scheduling proved to be an ideal solution for Martin Mechanical Inc., streamlining communication and making life easier for the whole staff. With LaborChart, "all the information is in one place and it's easier to navigate. This helps everybody in our company," said Seth Rogers, project manager and manpower supervisor for the Kansas City, MO, contractor.

Workforce Worries

The day typically starts for Martin Mechanical Inc.'s field crews at 7 a.m., but Rogers' phone would often ring 15 minutes before the clock had officially started. He would spend his morning answering a flurry of emails and phone calls to make sure each of the ongoing projects was staffed properly. "Scheduling manpower sounds easy, but it isn't," Rogers said of the hours he would spend on his phone shifting personnel and coordinating teams in the field.

Martin Mechanical's labor force has a wide skill set with expertise in plumbing and pipefitting. The company employs 40 people in the field, split between divisions that work on new projects and technicians responding to service calls.

Like many small companies, Martin Mechanical relies on an administrative staff for labor scheduling. The challenge was that the administrative team did not always have field or industry experience, and they did not have an efficient way to find out details about the skills and equipment for the available pool of employees. Martin Mechanical needed a central place where schedulers could easily access the information relevant to assigning people in the field.

Better Scheduling

Martin Mechanical had been tracking projects in Excel, which made it difficult to communicate information about projects and people. LaborChart provided a cloud-based alternative that could be easily accessed by decision-makers. The digital platform provided key insights and a better window into labor scheduling.

"LaborChart makes so much sense. It makes my life easier. I'm not trying to chase anybody down with emails and phone calls."

—Seth Rogers, Project Manager and Manpower Supervisor, Martin Mechanical Inc.

"Excel isn't efficient for scheduling labor," Rogers said. "LaborChart made scheduling easy and functional."

By giving managers in the field and dispatchers in the office access to the dashboard, the entire team was able to work from the same information in real time. As a small staff without a dedicated labor person, Martin Mechanical was able to spread the duties across multiple people. Without making Rogers or another member of senior management the focus, the project dashboard empowered team members to work collectively on labor scheduling.

When Rogers gets project requests, he instantly has the answer for what he needs rather than having to hunt for information in Excel. What once took six phone calls or three emails is now available at the click of a button.

"LaborChart makes so much sense. It makes my life easier. I'm not trying to chase anybody down with emails and phone calls," Rogers said.

Rogers also relies on LaborChart for estimating projects. He can pull up historical data, track the current spend on a project, and understand the true cost of adding labor to the bottom line. "If you've got to move people at the start of a job, then you're in a hole before from the start. With LaborChart, we've got the right labor mix at the start of a project," Rogers noted.

For more information, visit www.laborchart.com.

RAKEN

continued from page 11

detailed your reports are, the faster you can spot any potential issues and address them.

Software lets you store all completed daily reports in one place on the cloud. That way, you can easily access your data whenever you need it. Plus, you can minimize physical contact by keeping everyone in the loop without having to be onsite.

Don't forget: The best software is easy to use in the field. After all, your crews will be the ones sending you the information you need. Give them a tool they can use as they walk the jobsite—so their focus is on the work, not on figuring out the new tech you provided.

3. Streamline Your Safety Training and Processes

Safety has always been a priority in construction, but now more so than ever. Now is the time to take all your safety training and documentation online. With online talks and safety checklists only a few taps away, your crews can stay informed of the latest safety protocols and the resources they need to stay compliant.

For even more visibility, consider options like digital sign-in sheets and bulk scheduling talks. Because everything is stored in one central place, you will not have to go digging for proof that you followed all safety requirements.

Keep your employees (and your business) safe. Proper, complete documentation is key during the pandemic. Maintain everyone's safety, health, and efficiency by developing your tech stack.

For more information, visit www.rakenapp.com.

HPS combined Orbitalum's OM180 SmartWelder TIG orbital welding power supply and fully enclosed, water-cooled weld heads with the Orbitwin SW switching unit, which offers the flexibility to control two orbital welding heads with one power supply, providing HPS a huge productivity increase.

E.H. WACHS

continued from page 13

saws and the RPG line of deburring and facing tools, HPS delivered the cost-effective cuts and perfect fit-ups required for ultra-high-purity welding applications. For projects that combine multiple challenges of precision, safety, strict deadlines, and jobsite health concerns—all while remaining profitable—Barefoot gave the following tips:

- Make certain you identify long-lead items early, and order them ASAP.
- Use the best equipment, and partner with proven suppliers that offer support.
- Use the best technologies available to meet project deadlines and efficiency targets.
- Fabricate everything offsite whenever possible.
- Avoid rework by ensuring that the information provided to the fabrication shop is accurate.
- Combine best-in-class technologies—for example, a TigerStop system with the Orbitalum cutting equipment—to save material waste and increase productivity.

HPS is bringing together the two key elements that will help defeat the COVID-19 virus: technology in the form of the best tools for the job and skilled craftsmen with the knowledge to use them. HPS, armed with Orbitalum high-purity equipment, is using both to do their part to help combat and ultimately defeat COVID-19.

For more information, visit www.ehwachs.com.

AUTODESK

continued from page 17

ignored the model, putting in plumbing where the ductwork was supposed to go, and then refused to take it down," said Voss.

Redesigning and recoordinating fabrication around the contractor's use of the space would have cost thousands of dollars. Helm Group's team used AR glasses to walk the construction manager and owner through the site and show them what the plumber had done and what a big deal it was. As a result, the contractor and owner held the plumber accountable, demanding that he rip out his plumbing and piping and put it back in its proper locations per the model. "They would not have had a feel for how big a deal this was if they couldn't put the glasses on," said Voss.

7. Easy to Use and Versatile for Critical Workflows

Autodesk and others' technology is critically valuable in helping Helm Group stay at the forefront of their industry. However, it can also be a stumbling block if it's not implemented thoughtfully.

"BIM 360 is a very versatile software," said Voss. "We knew it would give us all the communication with the field that we need, and that one dominant platform where everything would reside. But we can't just roll it out and expect folks to pick it up and learn it on their own. We have to develop a workflow and a training module to train people to the workflow."

Some software vendors, said Voss, treat the sale of the software like the last interaction necessary. But what they need is a partner who will help them implement the software to work the way they need it to work.

"That's been one of the benefits over the past two years of working with Autodesk," said Voss. "They've gone from software provider and reseller to a partner."

Knoup added, "There's so much functionality in software that it's important to figure out your workflow, how you want the software to interact with your workflows, and then have a partner that helps you build a training module to train your people specific to that workflow."

8. Makes Impossible Timelines Possible

"We take a very deliberate and patient approach to creating the tech stack the way we want it," said Voss. "And then we have to deploy it very rapidly." Sometimes, he continued, the timelines on technical projects would be physically impossible to meet if all of the labor and materials had to be on the jobsite. Everyone would have to be present and working simultaneously.

Fabrication takes enormous amounts of labor off the jobsite and into the fabrication facility's controlled environment. This enables vast amounts of work to be completed simultaneously and then assembled very quickly onsite. With BIM 360 for coordinating and sharing data, the fabricated materials are accurate and ready for installation.

Helm Group's strategic partnership with Autodesk showcases what is possible for industrial construction projects and maps a blueprint for faster, Leaner, more effective outcomes.

For more information, visit www.autodesk.com.

RIDGE TOOL

continued from page 23

service. There is no scrambling to find a new tool while the other is out for maintenance. This idea goes beyond tools and plumbing project supplies. Consider bringing the materials you need for invoicing into a home at the beginning of a job.

Maintain Your Tools

It sounds simple, but taking routine care of your tools can minimize downtime for tool repair. Many newer tools will alert you to upcoming service needs, allowing you to plan for maintenance, whether that means swapping in another tool or planning for projects that do not require a tool that is in the shop. For example, the RIDGID RP 240 and 241 compact press tools allow you to connect your tool through your phone using the RIDGID Link app to view cycle counts and battery life. Investing in some tools with diagnostics might make sense if unexpected maintenance or repairs are a regular pain point that delays your work. However, understanding how to properly use your tools and keeping them clean, charged and lubricated can keep them ready for the next project longer.

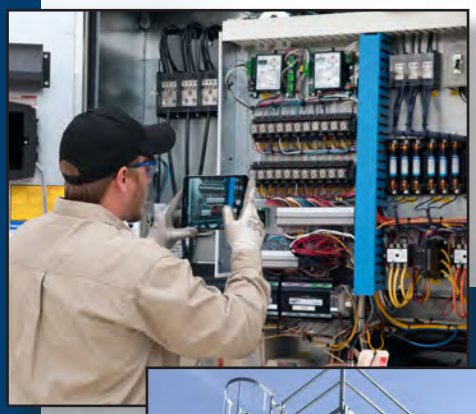
Whether enhanced productivity means heading home a little earlier at the end of the day or being able to take on a few more projects each year, these small changes can have a huge impact.

For more information, visit www.ridgid.com.

Interested in *MORE*

"SMART SOLUTIONS"?

Check out the Smart Solutions Case Studies area at mcaa.org, where you'll find additional articles that spotlight mechanical contractors who found their win-win. In partnership with members of MCAA's Manufacturer/Supplier Council, these contractors found innovative ways to meet their clients' needs by improving productivity, cutting costs and saving time on the job.



This section of our website also features tips and ideas on other ways you and your company can save money and enhance your productivity.

Find **Smart Solutions Case Studies** under the *Virtual Trade Show* menu at **www.mcaa.org**

MANUFACTURER / SUPPLIER COUNCIL
MCAA
Adding Value to Your Supply Chain