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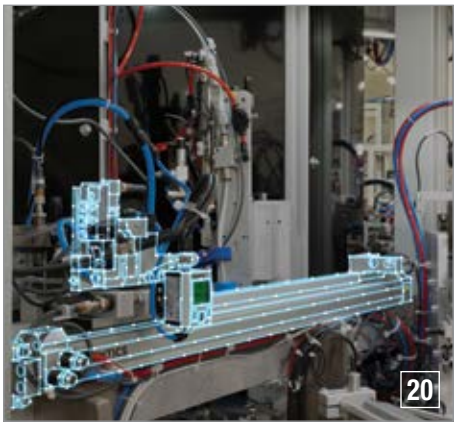

COLUMNS

COVER PHOTO: This month's cover depicts the use of smart pneumatics. Photo courtesy of Emerson.

FROM THE EDITOR

What does the Industrial Internet of Things (IIoT) mean to your plant? In this issue, we explore different applications of "IIoT Intelligence" in compressed air systems.

Quality, Safety and Reliability

The AZEK Company produces building materials at their Wilmington, Ohio plant. Industrial Air Centers and Airleader have sent us a case study detailing the new compressed air system able to reduce their annual electrical consumption by $91,000 per year and 1.4 million kWh. The 1,200+ horsepower multi-brand air compressor system is orchestrated by an IIoT air compressor management system, intelligently choosing which air compressors should run, while logging data from sensors, to provide maintenance and efficiency KPI's.

Thanks go to Stephen Parry, from Bay Controls, for sending us an automotive case study. This IIoT project details how they helped the firm maintain control and monitoring capabilities when adding a new 200 horsepower rotary screw air compressor to their system featuring six 1,000 horsepower centrifugal air compressors.

Productivity, Sustainability & Energy Conservation

Pneumatics provide the technology enabling modern plant automation. They also happen to be the location of most compressed air leaks and pressure drops, negatively impacting productivity and efficiency. Mark Densley (Emerson) and Justin Lesley (Motion Industries) have sent us an important article describing the smart pneumatics monitoring they are deploying with clients. We feel the adoption of this IIoT technology is so important, we have placed it on the magazine cover!

A major automotive company agreed to a long-term, outsourced, performance contract for a dry compressed air supply system. Kurt Metzler, from Universal Compressed Air, has provided us with the details of this new system, featuring centrifugal air compressors and heat-of-compression dryers, able to deliver expected net savings of $3.6 million over the next ten years. IIoT enabled the original system assessments, the on-going system performance and KPI tracking.

IIoT can be expressed by the use of cloud-based software to conduct compressed air system assessments. We are pleased to publish a chemical plant case study, sent to us from Slovenia by Rok Trelc, from CALMS Air.

Thank you for investing your time and efforts into ***Compressed Air Best Practices®***.

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COMPRESSED AIR SYSTEM INDUSTRY NEWS

Best Practices 2020 ONLINE EVENT! A Major Success

Held September 23-24, 2020, the Best Practices ONLINE EVENT! was a major success, drawing more than 1,700 attendees – while uniting technology and system assessment experts with manufacturing/process industry leaders working to reduce energy and water consumption, while lowering operating costs and their carbon footprint.

Produced by the publisher of Compressed Air Best Practices® Magazine, the two-day online event took the level of excitement for methods and technologies used in compressed air system optimization to a new level, said Rod Smith, Show Producer and Publisher of Best Practices Magazines.

"We're thrilled at the turnout for this unique, one-time event and the level of enthusiasm shown by presenters and those who engaged in discussion and participated in live sessions," Smith said. "Judging by the number of participants and the engaging dialogue throughout the event, the industry's passion for continued progress toward optimization of compressed air systems – and all the benefits that come with it – is stronger than ever."

Steve Briscoe, President, Compressed Air Challenge

Stephen Coppinger, P.E., Vice President of Engineering Services, CalPortland

The Best Practices ONLINE EVENT! featured live keynote presentations, as well as a live discussion forum for monitoring and fixing compressed air leaks. Additionally, it included hours of pre-recorded sessions featuring leading industry experts from around the world who addressed a host of best practices for compressed air system optimization. All presentations and sessions can be downloaded for free at www.airbestpractices.com/magazine/webinars.

Keynote presenters at this year's online event included Chad Larrabee, Education Committee Chair of The Compressed Air & Gas Institute (CAGI); Thomas A. Pagliuco, Executive Director of Global Energy Engineering for AbbVie; Stephen Coppinger, P.E., Vice President of Engineering Services from CalPortland; and Steve Briscoe, President of the Compressed Air Challenge. The forum featured industry leaders, including Leslie Marshall, General Mills; Ron Marshall, Marshall Compressed Air Consulting; Jon Jensen, SMC; and Neil Mehltretter, Kaeser Compressors.

Pre-recorded sessions covered a host of topics focused on compressed air technology fundamentals and maintenance and system energy and cooling water conservation.

Chad Larrabee, Education Committee Chair, The Compressed Air & Gas Institute

Thomas A. Pagliuco, Executive Director of Global Energy Engineering, AbbVie

About Best Practices EXPO & Conference

The Best Practices EXPO & Conference is an event devoted exclusively to optimizing on-site utilities powering modern plant automation. The in-person Best Practices EXPO & Conference is slated for November 2-4, 2021, in Chicago. Now entering its fourth year, the event hosts more than 100 exhibitors and a multi-track conference program featuring industry experts willing to share "Best Practices" who have profitably deployed energy and water conservation measures. For more information and to register for the 2021 event, please visit www.cabpexpo.com.

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COMPRESSED AIR SYSTEM INDUSTRY NEWS

MAT Industries Acquires Certain Assets of Campbell Hausfeld

MAT Industries, LLC, a subsidiary of MAT Holdings, Inc., announced that it has acquired certain assets of Campbell Hausfeld, a manufacturer of consumer, industrial and commercial grade air compressors and associated pneumatic air tools and accessories.

"This is a perfect acquisition for MAT as Campbell Hausfeld complements our air compressor business," said Steve Wang, Chairman and CEO of MAT Holdings, Inc. "We are excited to bring the Campbell Hausfeld brand and product line into the MAT family. The acquisition complements our existing portfolio of product lines in addition to adding geographic presence that will enable us to serve our customers as a one source provider for all their air compressor and pneumatic air tools and accessories needs."

About MAT Holdings, Inc. and MAT Industries, LLC

MAT Holdings, Inc. based in Long Grove, IL. Founded in 1984, MAT Holdings, Inc. is a privately held $1.9 billion multi-national company with manufacturing operations, distribution centers and sourcing offices worldwide in the automotive, fencing, hardware, and power equipment sectors. Headquartered in Long Grove, Illinois, we have over 40 factories on three continents, including 2.1 million square feet of U.S. distribution and manufacturing space. We provide our customers with a full range of services including U.S. and overseas engineering, quality assurance, logistics and distribution support, strategic warehousing, bi-lingual sourcing, product development, and marketing. MAT is a family of companies and products providing employment opportunities with more than 14,000 employees in 12 countries. To learn more about MAT Holdings, Inc., visit www.matholdingsinc.com.

Atlas Copco Acquires Perceptron

Atlas Copco and Perceptron have entered into an agreement for Atlas Copco to acquire Perceptron, a leading supplier of automated metrology solutions, for USD 7.00 per share. The company is headquartered in the United States and listed on the NASDAQ stock exchange in New York.

"Flexible automation and in-line quality control on the production line are two strong trends where we want to support our customers in their transition towards digital manufacturing", said Henrik Elmin, Business Area President Industrial Technique. "Through Perceptron's position in automated metrology and robot guidance, together with the recent acquisition of ISRA VISION, we are creating a strong offering in machine vision solutions and extending the Smart Factory Automation business segment."

Perceptron has approximately 300 employees and is headquartered in Plymouth, Michigan, USA. In the fiscal year 2020 Perceptron had revenues of MSEK 569 (MUSD 62.3). Atlas Copco will pay USD 7.00 per share, corresponding to an enterprise value of MSEK 573 (MUSD 62.7), including MSEK 57 (MUSD 6.2) of assumed net cash on hand. The total purchase price will be MSEK 630 (MUSD 68.9). The offer represents a premium of 66% to Perceptron's 30-day average closing share price of USD 4.22 up to September 25, 2020, the last trading day prior to this announcement.

"The acquisition of Perceptron will enable us to increase our customers' productivity through best-in-class quality control and an increased automation level", said Henrik Elmin. "Perceptron has almost 40 years of experience as a leading global provider of 3D automated measurement solutions. There are several identified synergies in sales, operations, service and technology development from Perceptron joining the Machine Vision Solutions division."

The transaction will be completed by way of a negotiated statutory merger. It has been approved by the Boards of Directors of both companies. Additionally, Perceptron's largest shareholder, affiliates of Harbert Management Corporation, has signed a Voting and Support Agreement in favor of the proposed transaction. Subject to majority approval by Perceptron shareholders, customary closing conditions and regulatory approvals, the transaction is expected to close in the fourth quarter of 2020.

The acquisition is an all-cash transaction utilizing Atlas Copco's existing own funds. Perceptron will become part of Atlas Copco's newly created division Machine Vision Solutions within the Industrial Technique business area.

About Atlas Copco Group

Atlas Copco Group Great ideas accelerate innovation. At Atlas Copco we have been turning industrial ideas into business-critical benefits since 1873. By listening to our customers and knowing their needs, we deliver value and innovate with the future in mind. Atlas Copco is based in Stockholm, Sweden with customers in more than 180 countries and about 39 000 employees at year-end. Revenues of BSEK 104/BEUR 10 in 2019. For more information, visit www.atlascopco.com.

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COMPRESSED AIR SYSTEM INDUSTRY NEWS

Schulz Opens New Office in the United States

Schulz of America, a subsidiary of Schulz Compressores, headquartered in Joinville (Brazil), has just changed its address in the United States. The new office is in a large and modern 30,000 square foot space in the city of Acworth, part of the metropolitan area of Atlanta (Georgia).

Strategically located nearby major centers in the United States and the largest international airport in the world, the new branch aims to expand Schulz's market share in North America, seeking not only to boost sales, but to expand its product portfolio as well.

"Expectations with the new and expanded physical space are great and we hope to better serve the American market and thereby increase our market share, strengthening the Schulz brand even more," said Fábio Juliano Rosa, Export manager.

With modern architecture and state-of-the-art equipment, the company invested around $2.5 million to build the new branch. The new space has an administrative area, training rooms, parking and a product storage area twice the size of the previous warehouse. "We understand that the North American market has great potential and expanding the operation is essential for us to explore this market," said Rosa.

Operations at Schulz of America started in 1999, with the opening of the branch in Acworth, and since then the company has offered the American market a full line of pumps, oil-lubricated and oil-free air compressors, rotary-screw compressors, scroll compressors, compressed air dryers, as well as filters and spare parts.

About Schulz Compressores

Schulz Compressores is the largest manufacturer of air compressors in Latin America. It is a Brazilian company located in Santa Catarina state, headquartered in the city of Joinville, and recognized as one of the most comprehensive air compressor plants in the world. The company offers the residential, professional and industrial market a full product line for generation, treatment and storage of compressed air. In addition to reciprocating piston, diaphragm and rotary-screw compressors from 5 to 250 hp, it provides refrigeration and adsorption compressed air dryers, power and coalescent filters, condensate separators, pneumatic tools, power tools and accessories for residential, professional and industrial applications. For more information, visit www.schulzamerica.com.

Energy Department's Better Plants Partners Save $8.2 Billion

The U.S. Department of Energy (DOE) announced that Better Buildings, Better Plants partners have cumulatively saved more than $8 billion in energy costs and 1.7 quadrillion British thermal units (BTUs).

More than 235 organizations now partner with DOE through Better Plants. This year, DOE welcomed 20 new partners to the program and challenge, representing 3,200 facilities and roughly 12% of the U.S. manufacturing energy footprint. These partners come from all 50 states, Washington, D.C., and Puerto Rico, and include Fortune 100 companies, family-owned small businesses, and water treatment organizations.

"Better Plants Partners exemplify the innovative spirit of American manufacturing," said Deputy Assistant Secretary for Energy Efficiency Alex Fitzsimmons. "These partners are developing, implementing, and sharing innovative, energy-

Schulz hopes to expand business in North America with the new Atlanta-area headquarters.

efficient practices that help their organizations save energy and money, which in turn helps the U.S. economy stay competitive."

Through the Better Buildings, Better Plants program, DOE works with partners who have set ambitious energy, water and/or waste reduction goals. As of 2020, partners have successfully met 67 energy and water goals. DOE supports these partners by providing technical expertise, managing peer-exchange opportunities, highlighting successful solutions, and expanding access to innovation.

In addition to setting energy-efficiency goals, Better Plants Challenge partners also share their solutions and best practices. There are now 49 Better Plants Challenge partners sharing a combined 83 showcase projects, implementation models, and "solutions-at-a-glance" on the Better Buildings Solution Center.

Read the full 2020 Better Plants Annual Progress Update to learn more about partner successes and how the Better Plants Program boosts competitiveness through improvements in energy efficiency.

About the Better Buildings Initiative

Through the Better Buildings Initiative, DOE partners with public and private sector organizations to make commercial, public, industrial, and residential buildings more efficient, thereby saving energy and money while creating thousands of jobs. To date, more than 950 Better Buildings Partners have shared their innovative approaches and strategies for adopting energy efficient technologies. Discover more than 2,800 of these solutions in the Better Buildings Solution Center. For more information, visit www.energy.gov.

QUALITY, SAFETY & RELIABILITY

AZEK Compressed Air Project Enhances Reliability While Saving Energy

By Megan Orange and Jan Hoetzel, Airleader North America, and Dave Suder, Industrial Air Centers

The AZEK Company is a producer of durable and low maintenance building materials.

The AZEK Company is a producer of durable and low maintenance building materials, and like many manufacturers, it found its compressed air system to be time consuming and expensive to keep maintained. But that changed after the company replaced its outdated and faulty compressed air system with a new design that includes technically advanced air compressors, dryers, receiver tanks – as well as controls to provide better control of the entire system and achieve optimal performance.

Based on the successful project, AZEK improved the reliability of compressed air needed to maintain production and reduced its annual electrical consumption by 1,444,332 kWh for a savings of $90,993 per

"The peak energy usage was reduced to 762 kW, a reduction of 152 kW. The energy savings reduce the power cost $90,993 a year."

— Megan Orange and Jan Hoetzel, Airleader North America, and Dave Suder, Industrial Air Centers

year. In addition, the system is now managed by the compressed air service provider – allowing AZEK to focus on its core business.

Reliable Compressed Air System a Top Priority

Headquartered in Chicago, AZEK (https://azekco.com/) is a producer of durable and low maintenance building materials. The company wanted to upgrade its compressed air system at its Wilmington, Ohio, location to enhance its reliability and save energy. AZEK also wanted to get out of the air compressor service business and work with a vendor who could manage, maintain, monitor, and guarantee air compressor components for them.

In late 2017, AZEK was contacted by Industrial Air Centers (IAC) after learning other vendors were not able to offer what AZEK needed. Subsequently, AZEK determined IAC was the best company to work with based on its capability and the flexibility it offered with the overall project scope. IAC is a full-service compressed air and vacuum solutions provider.

Together, IAC and AZEK developed a plan catered to the plant's specific needs and based it on a program IAC calls "Compressed Air Supply." The focus of the major capital project, which required a lot of planning and time management, was to replace AZEK's faulty compressed air system and create a new setup resulting in a reliable system designed to meet the demands of the plant. In addition, IAC would manage the compressed air system.

AZEK's existing compressed air system had major issues as it was in very poor condition. The original system included 11 rotary screw air compressors ranging from 75 horsepower (hp) to 200 hp spread out over three locations. Two of the air compressors were down permanently which limited the capacity of the system. Additionally, the system did not use Variable Speed Drive (VSD) air compressors and the existing equipment was a varied mix of different brands. Some of the equipment had been brought from other facilities and didn't fit the needs of the plant. The system also included nine refrigerated dryers and limited compressed air storage, which included three dry receiver tanks and two wet tanks.

Assessments Show Savings Opportunities

To get a better understanding of AZEK's needs IAC performed a supply system audit at the end of November 2017. This provided the necessary baseline to start planning next steps. During the seven-day audit, IAC found AZEK's system had an average demand of 4,190 scfm and would

AZEK COMPRESSED AIR PROJECT ENHANCES RELIABILITY WHILE SAVING ENERGY

AZEK's original compressed air system at its Ohio plant experienced numerous issues, prompting the company to upgrade to new equipment.

The upgraded compressed air system at AZEK's Ohio plant includes two 300-horsepower VSD rotary screw air compressors.

peak at 4,560 scfm for about an hour. It also averaged a pressure of 95 psig with pressure drops at filters and at various points of use. The pressure in the main production areas fluctuated from 60 to 105 psig, causing inconsistent production.

When conducting its assessment, IAC learned AZEK was using 76% of the system capacity at peak production and if a single air compressor went down the operation would not be able to meet demand causing delays in production. It also found other significant issues. This included the lack of sufficient storage capacity, as well as limited airflow between two production areas due to poor pipe sizing. This significantly reduced the capacity of the system. These problems, as well as the poor equipment setup resulted in AZEK having high energy cost to the system.

In addition to inefficiencies, AZEK's compressed air system was not reliable. Other items to be addressed were pressure dew point as well as poor air quality caused by a very dusty environment. Lastly the company had an air compressor control system that did not provide the level of control, remote monitoring, and historical data management it wanted.

Another key part of the planning process included an audit conducted by the local utility company, Dayton Power & Light (DP&L). AZEK worked with DP&L to conduct pre-scenario and post-scenario energy metering of the operation's compressed air system, which in turn, illustrated the energy savings to be created by updating the operation's compressed air system. DP&L's pre-scenario audit showed AZEK had an average annualized energy consumption of 7,831,152 kWh. With a peak power consumption of 914

kW for the air compressors. The assessment demonstrated the potential for DP&L to provide AZEK with a rebate based on reduced energy consumption and demand charges.

Overall AZEK was running an unreliable compressed air system costing $493,362 per year just in energy usage. The system was also a source of major risk given production problems which would occur if a single air compressor failed.

Better Equipment and Better Control of Air Compressors

To solve these problems, IAC proposed the installation of a compressed air system leading to significant energy savings, while also providing system redundancy. Additionally, the recommended plan would give AZEK a compressed air system to meet the highest standards for reliability.

The Airleader Master air compressor controller is part of the air compressor management system used to control AZEK's compressed air system and ensure it operates as efficiently as possible.

AZEK COMPRESSED AIR PROJECT ENHANCES RELIABILITY WHILE SAVING ENERGY

Industrial Air Centers

The team at Industrial Air Centers (IAC) believes business is still conducted on a personal level. Excellence in customer service, innovation, and long-term personal relationships have been the cornerstones of our success since 1991.

IAC pursues excellence in all that we do; from premium equipment and OEM quality parts to expert service, rental equipment and turn-key installations. IAC has assembled a team of experienced, trained, and motivated professionals. By providing full-service engineering, professional technical sales and around the clock service, we are more than just another distributor. We strive daily to be the very best in the industry, and IAC recognizes a compressed air system is more than a collection of components. Through engineering analysis, the needs of the demand side are identified, and we perfectly match the proper supply side equipment, not just the best sell.

IAC pioneered the use of technology to identify and analyze process requirements. We continue to break new ground, providing comprehensive, solutions-based recommendations for system optimization. Solutions range from basic equipment recommendations to complex component integration, including IAC owned and operated systems in your facility.

IAC recognizes every customer is unique. Unlike other compressed air equipment suppliers who offer only one manufacturer's product for every application. IAC offers multiple quality manufacturers' products. We combine unparalleled industry knowledge, experience and service, along with offerings from multiple global manufacturers of the highest quality equipment. Our goal is to improve production, maximize efficiency and increase reliability for your facility. For more information about IAC, visit www.iacserv.com.

Industrial Air Centers' Cincinnati, Ohio, location.

IAC's plan consisted of removing all the outdated air compressors and installing four new 300-hp rotary screw air compressors, two of the new compressors with VSD. Each of the compressors is rated to deliver 1,667 scfm at 125 psi. Each of these machines is designed to be an excellent trim unit. Additionally, the new system included five new refrigerated dryers and four small desiccant dryers. The desiccant dryers would dry air traveling outside through piping between buildings to different point-of-use locations. Also included in the new system are the addition of two wet receiver tanks and one dry storage tank to its existing mix of storage tanks. It also added a system of filters. The plant retained two older air compressors for use as backup. Additionally, it continues to use its original dryers.

The new air compressors were connected to an Airleader air compressor management system. The Airleader is a system designed to control the air compressors as a whole system and runs them in the most efficient manner possible. The VSD units are now sequenced trim air compressors while the other air compressors are either running at full capacity or in standby. Additionally, Airleader is not limited to specific brands, making it a good fit for AZEK's multi-brand compressed air system.

The Airleader ensures production demand is met by turning on and off compressors as needed, eliminating the problem of having multiple air compressors running at partial capacity. It also logs data it gets from sensors and makes it easy to monitor and review historical data for kW, dew point, pressure and temperature. Importantly, access to historical data allows both IAC and AZEK to review the system at any time to see trends which could indicate a potential issue early on, or the need for preventive maintenance.

Piping Obstacles Resolved and Production Maintained

Like most projects, the IAC-AZEK team overcame numerous complications. One hurdle it was able to work out included a compressed air system spread out over multiple locations. Due to pipe sizing restraints there were limits to how much flow could be shared between locations. So, before any new equipment could be added, redundant piping headers were installed.

Once this was completed IAC installed the new equipment into what was previously office space. There were also several delays due to unrelated plant construction they had to work around. By working carefully with AZEK, IAC was able to maintain the production of the facility while installing the new equipment. IAC managed it by using standby compressed air equipment during the installation period.

After this initial portion of the project AZEK had a new system including six air compressors, two of which are VSD units. The new equipment ensured they could always meet production demand. The new system also provided ample backup in the event of an air compressor breakdown. The new piping system allowed for more airflow to each location. The dryer set up fixed the high dew point related problems. The new filters also helped manage the air quality problem caused by the dusty environment.

Gaining Energy Savings and Reliability

After the new system was up and running, DP&L gathered data to gain insight into compressed air energy usage. DP&L recorded new annualized energy usage of 6,386,820 kWh, representing a savings of 1,444,332 kWh. The peak energy usage

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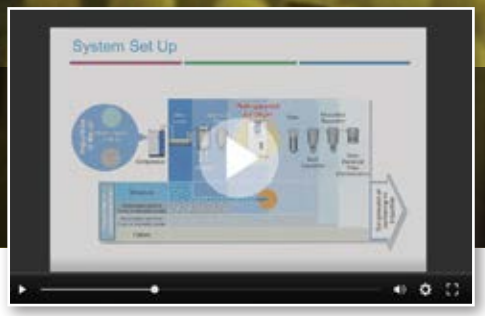

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AZEK COMPRESSED AIR PROJECT ENHANCES RELIABILITY WHILE SAVING ENERGY

was reduced to 762 kW, a reduction of 152 kW. The energy savings reduce the power cost $90,993 a year. In addition to energy savings, DP&L issued a rebate check to AZEK for $130,746.56 thanks to the reduced energy use and demand charges. Based on the data, the energy savings alone pay for approximately 40% of the monthly cost of the new system. In addition, AZEK now has a significantly more reliable compressed air system with advanced air compressor management controls allowing it to operate at peak performance levels.

Following the project completion, AZEK expanded in early 2020 and added another 200-hp air compressor, as well as a refrigerated dryer to its newly configured system. In August of 2020, it approved yet another expansion of a compressed air system in a nearby building. When completed, the system there will consist of three, two-stage 150-hp air compressors, three 1,100 cfm refrigerated dryers, two 1,060-gallon-tanks, and a crossover pipe to the main building. The piping will allow both systems to supply air to the entire manufacturing complex and use the Airleader system for control to ensure efficient operation.

This was a major project completed with the help of different people from multiple companies all with the same goal of creating a compressed air system that is reliable and energy efficient. AZEK started this project with the goal of not having to worry about their compressed air needs, and now with IAC managing the company's compressed air system AZEK can focus on other manufacturing needs. At the end of the day, AZEK proved the value of updating and maintaining a compressed air system. BP

About the Authors

Megan Orange is an operations manager at Airleader North America. Jan Hoetzel is Head of Airleader North America and Vice President/Instructor at Compressed Air Challenge, email: jan@airleader.us. Dave Suder is President of Industrial Air Centers IAC, email: dsuder@iacserv.com, tel: 513-770-4161 x 3005.

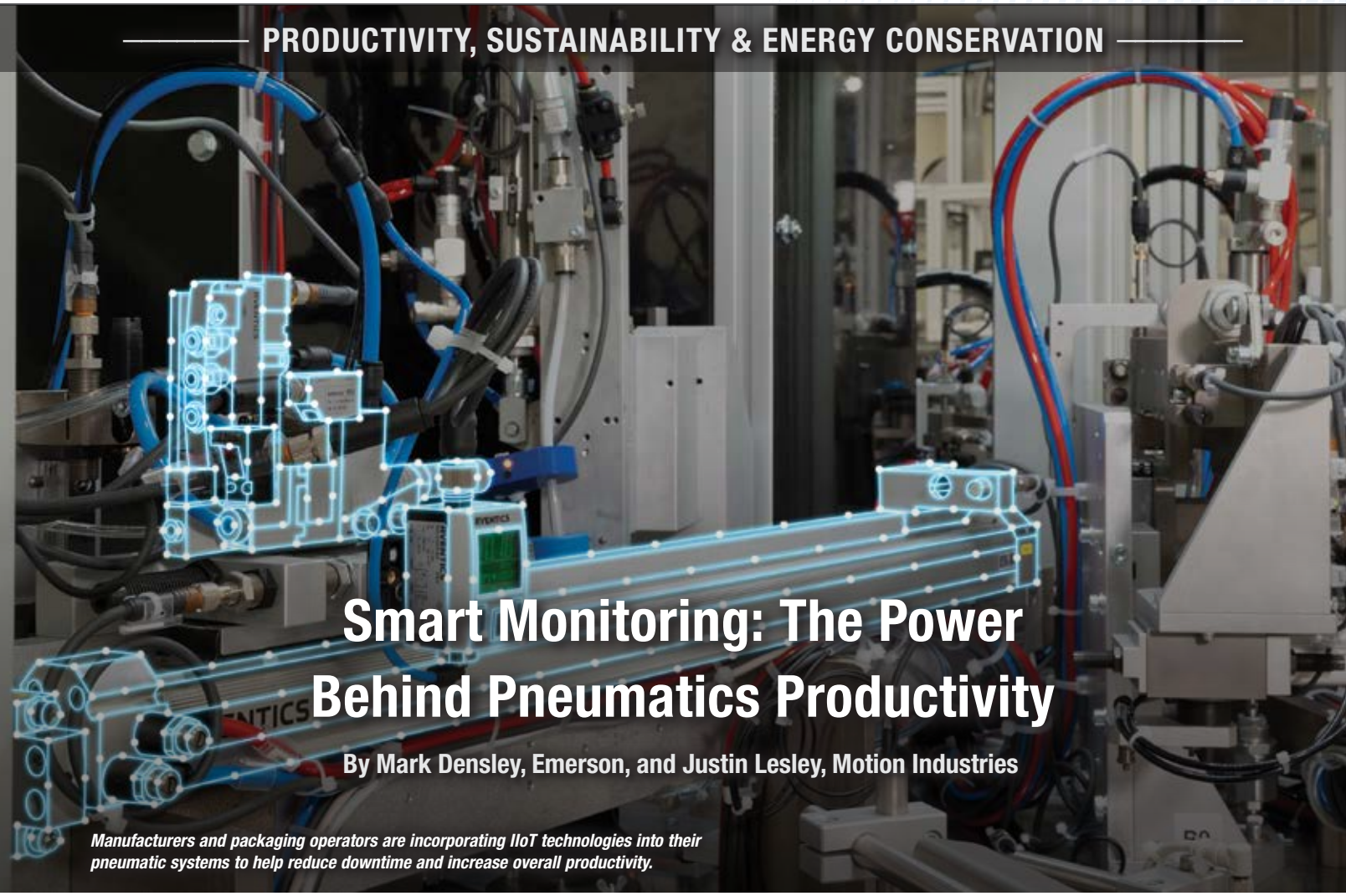
About Airleader Compressor Management

Airleader Compressor Management is a company that focuses on continuous improvement. Their Airleader Master air compressor controllers run a whole compressed air system based on actual demand and self-learning capabilities to ensure the most efficient operation without brand limitations. Their Master controllers monitor and data log key points of a compressed air system providing 24/7 system awareness. Their goal is to create a system that helps customers "Be In the Know." To learn more, visit https://airleader.us/.

All photos courtesy of IAC and Airleader North America.

For more stories about ***Compressed Air System Assessments,*** visit: https://airbestpractices.com/system-assessments.

PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION



Smart Monitoring: The Power Behind Pneumatics Productivity

By Mark Densley, Emerson, and Justin Lesley, Motion Industries

Manufacturers and packaging operators are incorporating IIoT technologies into their pneumatic systems to help reduce downtime and increase overall productivity.

In manufacturing and packaging facilities that rely on pneumatics, there's a four-letter word worse than virtually any other: leak. Unidentified air leakage and unexpected maintenance in pneumatic systems are significant sources of revenue and productivity loss but identifying the cause of leakages and preventing unforeseen downtime is typically a challenge.

Today, the Industrial Internet of Things (IIoT) – and the smart pneumatics monitoring it enables – has the potential to revolutionize pneumatics productivity. New systems and technologies are making it easier than ever for operators of all sizes to see the enormous productivity increases and energy savings these systems can provide.

Day-to-day Challenges for Manufacturers

The fourth industrial revolution is upon us. Called "Industry 4.0," this change in traditional manufacturing and industrial practices was brought about largely by the intercommunication of machines made possible by a network of sensors, software and other technologies that communicate via internet protocols. The convergence of sensing networks, automation, control systems, analytics and related developments is more commonly known as the Industrial Internet of Things (IIoT), and it has enormous potential for manufacturers. More specifically, several unique IIoT capabilities are leveraged to address challenges faced by manufacturers with pneumatic operations.

"New systems and technologies are making it easier than ever for operators of all sizes to see the enormous productivity increases and energy savings these systems can provide."

— Mark Densley, Emerson, and Justin Lesley, Motion Industries

Whenever energy is converted from one form into another, some of it is lost. When compared to electric energy, for example, pneumatics energy could be considered inefficient. But when installation, maintenance, and other costs are considered, pneumatics still provide a compelling value proposition. In order for manufacturers to run an efficient operation, therefore, maintaining optimal energy use within the pneumatics system is critical. The most obvious enemy to pneumatics efficiency is leakage. In fact, the average manufacturing plant loses up to 35% of compressed air annually due to leakage. Unsurprisingly, large leaks lead to machine downtime and increased costs.

Operators with pneumatic machines also face a volley of competitive pressures from every angle. Whether the competition is regional, national or even international, production consistency and throughput are critical to maintaining a competitive edge. Extended troubleshooting and production downtime due to unexpected maintenance on pneumatic components within the system can have a dramatic effect on the ability to remain competitive and profitable.

To that end, Overall Equipment Effectiveness (OEE) is becoming a buzzword that equates to profitability and increased competitiveness for many facilities. OEE is a simplified way of expressing any form of lost productivity in a manufacturing process by looking at:

- Availability – A 100% score means the process is always running during planned production times. Any stops during this time result in a reduced score.
- Performance – A 100% score equates to a process that is running as fast as possible. Any stoppage or slow cycles will likewise decrease this score.
- Quality – A 100% score indicates there are no defects or reworks.

SMART MONITORING: THE POWER BEHIND PNEUMATICS PRODUCTIVITY

Multiplying availability by performance by quality provides the total OEE score. It should come as no surprise, then, that systems operating at or near design capacity are inherently more efficient than those that don't. Even so, studies from the automation experts at Emerson® indicate a typical packaging line's OEE is only about 45 to 55 percent – meaning as little as half of planned production time is truly productive.

Unfortunately, many manufacturers don't currently have adequate measures for determining OEE, much less a big-picture understanding of their operations. Without consistently measuring air consumption, leakage in pneumatic systems can be difficult to identify while leading to significant energy loss and an unclear picture of overall efficiency.

The Promise of IIoT Intelligence

For manufacturers with pneumatic operations, the benefits of IIoT are realized most effectively by monitoring air usage within systems. Continuously monitoring the flow of air to detect leakages in real time, the system can identify the machine exhibiting the problem and send alerts directly to maintenance staff to investigate. The benefits of this real-time approach to addressing leakage include:

- Reduced downtime – both planned and unplanned.
- Improved overall equipment efficiency.
- Quantifiable reduction in compressed air energy spend.

Misconceptions Surrounding IIoT Adoption

While IIoT stands ready to unleash new standards for productivity and efficiency, there are still a number of myths, misconceptions and perceived barriers to adoption within the manufacturing and packaging sectors. Typical barriers to smart system adoption can be overcome and should be considered in the context of the benefit potential.

- Up-front investment costs – Connected predictive maintenance solutions can create rapid savings when used effectively. According to Accenture,

The AVENTICS Series AF2 flow sensor continuously monitors air consumption in pneumatic systems, providing actionable insights to help optimize energy consumption, prevent machine downtime, and reduce costs.

predictive maintenance can reduce costs up to 12% versus scheduled repairs, while lowering overall maintenance costs up to 30% and decreasing breakdowns by up to 70%. If initial implementation costs are a concern, consider starting small with a targeted pilot. Once savings are proven in the pilot, getting approval for the cost of scaling up will be less of an obstacle.

- Data complexity – Transforming raw data into actionable intelligence that operators and maintenance personnel can implement requires the right set of tools. Modern predictive maintenance solutions provide users with pre-configured data analysis tools for key machine characteristics, such as compressed air consumption and possible leakages. Software can provide root-cause analysis in real time and provide a range of warnings or critical alerts, which can help prevent further performance degradation and maximize overall plant efficiency.

- Interoperability with other/existing systems – Unlike traditional Internet of Things (IoT) devices that are simply defined as any device that can connect to the internet, IIoT devices are built specifically for industrial settings, and typically offer much higher levels of security, precision, serviceability and, more importantly, cross compatibility. Cross compatibility helps ensure devices can coexist with other devices using software that is programmable and scalable. Open, globally available communication protocols are a key factor in the growth of IIoT. This is why many solution providers support development of the OPC-UA architecture, which is the leading communication standard for IIoT applications.

- Integration – Between network protocols, sensors, modules, data storage, consolidation, analysis and display, a trusted partner with subject matter expertise is critical to realizing the benefits of IIoT solutions. Working with a trusted partner helps ensure your systems function properly and all stakeholders are able to leverage technology investments.

- Infrastructure and cybersecurity – IIoT solution providers use different architectures for generating, transferring, analyzing and storing data. Some solutions utilize a cloud-based infrastructure while others use "local" infrastructure at the edge (on premises). There are pros and cons for each structure and there are even hybrid designs that use multiple strategies. Depending on your company's preferences and your goals for leveraging industrial data, infrastructure may be a significant factor when choosing an IIoT solution. Cybersecurity is another critical selection factor that must be considered. Any cloud-based solution should be properly secured through data encryption and multi-factor authentication for logging into software.

SMART MONITORING: THE POWER BEHIND PNEUMATICS PRODUCTIVITY

Real Results for the Real World

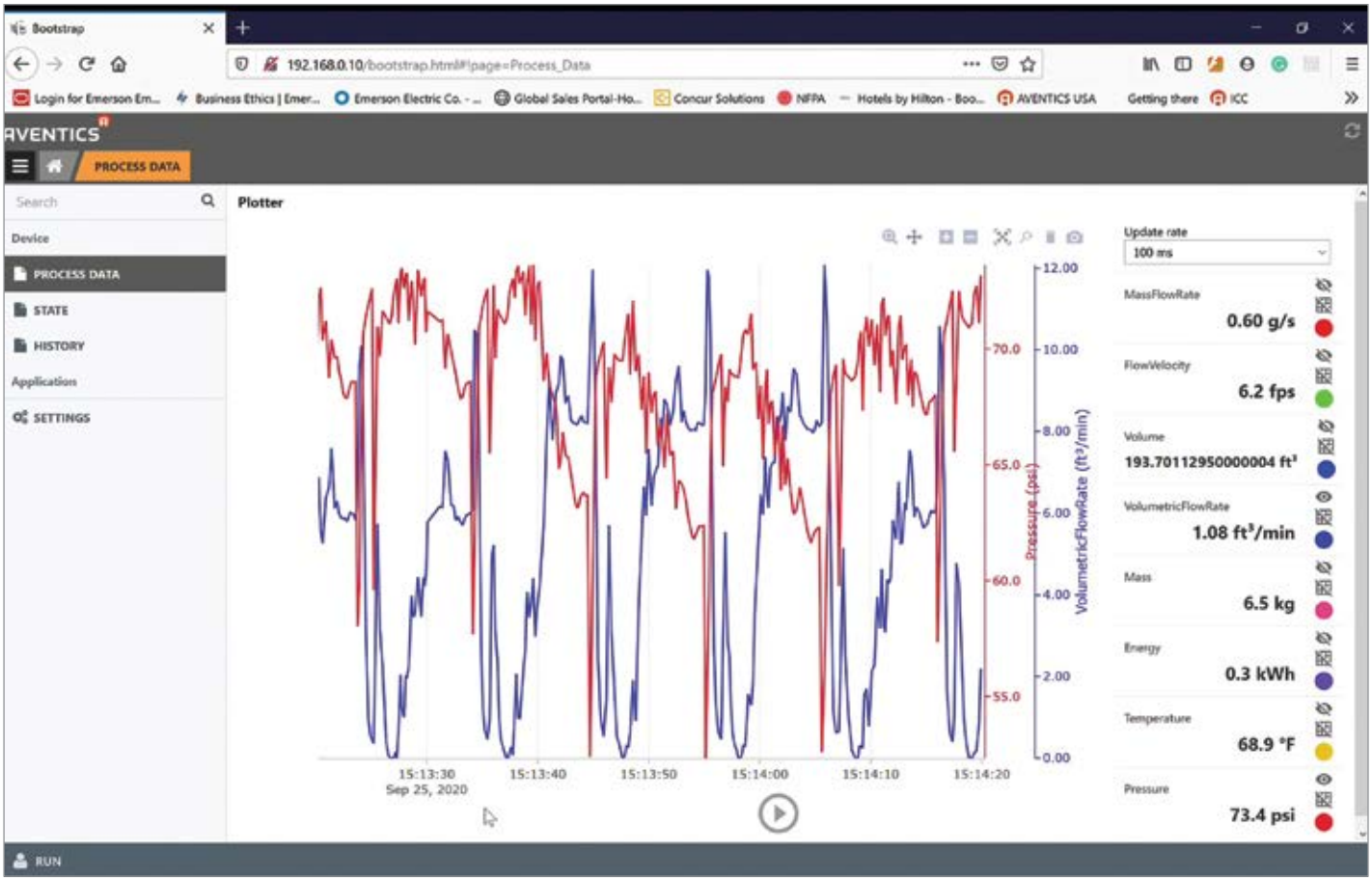
Thoughtful integration of smart pneumatics can provide actionable, easily understood data that leads to improved machine effectiveness and a positive return on investment – with the potential to revolutionize real-world pneumatics productivity for manufacturers.

- Reduced downtime – Smart pneumatics monitoring powered by the IIoT can help better inform maintenance and production teams of potential issues within the machine. Continuous monitoring and visualization of compressed air consumption can be provided by the day, hour, piece or process step, and can measure usage and cycle time to monitor wear. Combined with cycle indicators, it can provide insight into remaining system life, aiding in the reduction of downtime through the power of predictive maintenance.

- Lower operating costs – Reducing pressure in the system overall can result in reduced airflow and lowered energy costs while still maintaining optimal cycle time. In other words, pneumatic operations can be improved by operating at pressures no greater than what is required. At the same time, the removal of leaks means the removal of artificial demand – by the time a leak is audible, the pressure has already dropped enough to change the throughput of equipment. And that's a big reason why continuous monitoring can lead to big energy cost savings.

- Increased productivity – Smart pneumatics monitoring can help detect anomalies in manufacturing processes caused by cylinder movement and can likewise help identify the optimal parameters to keep cycle times high. Notifications and alerts can advise of leakages, anomalies or threshold breaches during manufacturing, helping to ensure optimal OEE and maximized productivity.

The history of industrialization spans centuries, but the revolution for manufacturing and



Airflow and pressure is monitored to understand air usage of equipment through its various cycles.

packaging facilities is happening right now. IIoT – and the possibilities it enables through advances like smart pneumatics monitoring – is bringing digital transformation to operators of every size. Start your journey with smart pneumatics today; it has never been easier or more cost effective to add new technology to your operation. BP

About the Authors

Mark Densley is a Director of Business Development for Factory Automation at Emerson, specializing in AVENTICS products. Emerson's trusted AVENTICS pneumatic solutions deliver steadfast and long-lasting operation for industrial applications with industry leading IIoT connectivity. Densley brings over 20 years of technical experience and acts as a consultant on Emerson's Digital Transformation Team focused on delivering IIoT solutions and actionable insights with a clear return on investment for their customers. He possesses an outstanding understanding and practical application knowledge of automation technologies and engineering solutions.

Justin Lesley, Industry 4.0 Innovation Manager at Motion Industries, directs IIoT strategy and partnerships related to the MRO industry. His career centers on operational efficiency supported by his Lean Manufacturing and Six Sigma certifications combined with his engineering credentials. Lesley guides manufacturers along their digital transformation journey by helping them utilize connected predictive maintenance solutions.

About Emerson

Emerson is a global leader in engineering technologies and services providing solutions for customers in the industrial, commercial and residential, and machine automation markets. Our industry-leading brands including – ASCO™, AVENTICS™ and TopWorx™ – deliver an extensive suite of leading fluid control, pneumatic products and automation services. When applications demand innovation, reliability, and highspeed deterministic control, turn to Emerson experts who can help with your fluid control, pneumatics, industrial automation and control needs. To learn more, visit www.emerson.com/en-us/automation-solutions.

About Motion Industries

With annual sales of $6.0 billion, Motion Industries is a leading industrial distributor of bearings; mechanical power transmission products; electrical and industrial automation components; hose, belting, and gaskets; hydraulic and pneumatic components; process pumps; industrial and safety products; seals and accessories; and material handling products and solutions. With the goal of increasing customers' productivity, the company offers many valued-added services, including engineering, fabrication, repair, and Industry 4.0 solutions across these product groups. In addition, Mi Automation Solutions Group and Mi Conveyance Solutions Group were formed to offer a wide range of specialized, related products and innovative solutions for many applications. For more information, visit MotionIndustries.com. To discover the advantages of Motion Industries' cloud-based comprehensive predictive maintenance solution P2MRO, visit www.p2mro.com.

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PRODUCTIVITY, SUSTAINABILITY AND ENERGY CONSERVATION

Automaker to Save $3.6 Million Over 10 Years with Outsourced Compressed Air

By Kurt Metzler, Universal Compressed Air

A major automotive company needed a newer and more efficient compressed air system at one of its manufacturing plants. The original system had been operating inefficiently with old equipment and controls. Faced with a major capital investment, the plant switched to a performance contracting model.

The long-term agreement with Universal Compressed Air (UCA) for a dry compressed air supply service resulted in the installation of a modular and more efficient compressed air system that eliminated over $1 million per year of O&M costs including $440,000 of electrical power. Based on contract air supply costs, the plant expects to realize a net savings of $3.6 million over the next 10 years.

Aiming for Compressed Air Quality and Reliability

Automotive manufacturing facilities need large amounts of compressed dry air at pressures

"Annual power savings with the new compressed air system versus using the existing systems for future operations is 3,696,000 kWh."

— Kurt Metzler, Universal Compressed Air

up to 120 psig depending on application. Air is needed in almost every part of the process which includes stamping, painting, cleaning, engine and vehicle assembly. Typical uses of compressed air include:

- Air operated robots.
- Plasma cutting and welding.
- Air tools.
- Power to lift, position, move and convey items.
- Automobile finishing.
- Tire inflation.

Dry air is especially important given the need to reduce corrosion potential, improve controllability/operations and, among other things, support state-of-the-art environmentally friendly painting operations. At this location compressed air is used to operate solenoids, activate cylinders, provide blow-off of parts, etc. The amount of compressed air required is highly variable depending on how much of the process equipment is in operation and the weekly production schedule.

Given the age of its compressed air system, the facility needed an update to improve efficiency, increase reliability and reduce maintenance costs. The company knew substantial savings could result by retiring its ten air compressors and replacing them with a new state-of-the-art system. The automotive company established the criteria to guide the new design. It wanted to:

- Increase system efficiency.
- Reduce utility costs.
- Better match air supply with air demand.
- Improve controls and locate air compressors in a central location.
- Reduce air leaks.
- Improve reliability.
- Reduce total cost of compressed air supply including O&M resources/ materials, make-up water, water treatment, etc.
- No capital outlay.
- Eliminate compressed air piping insulation that was a maintenance headache.

With goals established, the company began discussions with UCA to review the plant's compressed air system operation and establish plans for the future.

Plant Compressed Air Use Analyzed

Before working with UCA, the company had an assessment done to determine future air consumption if they were to continue running their existing equipment in a more efficient way.

The company decided it could operate the existing air systems at 85 psig and save a significant amount of power. The assessment analyzed weekly operations as air consumption changes dramatically throughout the work week. Weekend demands can be 40 to 50 percent of weekdays and air use is still required during shutdowns. Peak flow demand was predicted to be 9,330 scfm and the average weekly flow was 5,930 scfm.

AUTOMAKER TO SAVE $3.6 MILLION OVER 10 YEARS WITH OUTSOURCED COMPRESSED AIR

Continued use of the existing compressed air system with the predicted flow profile showed a future air volume of 3.2 billion cubic feet per year and total annual energy usage of 13,090,400 kWh.

After defining how the existing equipment would perform under future conditions, the plant evaluated outsourcing its air supply to UCA. Based on a performance-based air delivery contract, UCA would design, build and construct a new air facility and then operate and maintain it for the duration of the multi-year contract. Additionally, UCA would guarantee performance (power consumption and a minimum savings) over the life of the contract. The auto company would be compensated if performance goals were not met.

The benchmark for performance was a pre-project air study. UCA assessed air consumption and performance for the existing operations through analysis of historical logged data and observations of the system. The existing air compressors had been installed in the automotive plant's utility building. Multiple older air compressors (both centrifugal and reciprocal units) with refrigerated dryers were delivering air at a 40˚F (4.4˚C) dew point.

Contracting for Compressed Air

With the potential benefits of UCA's compressed air system clearly defined, the automotive company contracted with UCA to build, operate and maintain the air system to receive their compressed air supply like a utility. They chose UCA's Pipeline Air™ option for their supply.

The new UCA system includes four high-efficiency Atlas Copco ZH centrifugal air compressors with three Heat of Compression (HOC) dryers capable of a -40˚F (-40˚C) dew point and new cooling towers. Each air compressor has a nominal capacity of 3,250 scfm airflow. Compressed air is provided at 85 psig and a pressure dew point of +0˚F (-17.7˚C) or lower depending on daily operational requirements.

Universal Compressed Air of Bethlehem, Pennsylvania, supplies an automotive manufacturer with compressed air through a long-term contract featuring a modular compressed air system. The new system is expected to save the plant $3.6 million during the next 10 years.

With this design, UCA modeled the air compressor performance curves to evaluate operating the air system under average annual conditions at the expected future flow profile discussed previously. Turndown, air venting and auxiliary equipment loads, such as cooling towers, water pumps, and other miscellaneous equipment were considered. The resulting total energy usage was estimated at 9,394,000 kWh (versus 13,090,000 kWh with the existing system). Annual power savings with the new compressed air system versus using the existing systems for future operations is 3,696,000 kWh. This represents a savings of $440,000 per year at a $0.12/kWh cost of power. The company's existing systems were to be shut down.

System Built for Efficiency and Reliability

UCA's centralized modular systems allows the plant to cost effectively shut down its existing inefficient units. These systems can be located at a site outside of the existing production buildings and piped to the main plant, saving valuable real estate within the manufacturer's plant that is better suited for an upgrade or expansion. Highlights of the system built for the automotive plant are as follows:

- It is designed to meet peak flow requirements of the plant. Selection of the right equipment and a robust control system ensures efficient operation, especially during turndown.
- Centrifugal air compressors provide the highest efficiency with variable flows. Utilizing the efficient centrifugal air compressor sequencing and variable

flow is key to minimizing product air venting.

- The new air compressor motors are more efficient than the older units.
- The air compressors have inlet guide vane control that can efficiently vary airflow. Each air compressor has its own microprocessor that controls critical air compressor operations. The individual microprocessors are integrated into a master control system that optimizes the whole facility operation to meet the demand pattern while minimizing energy consumption.
- HOC dryers use waste heat generated by the air compressors to regenerate the desiccant dryers. This eliminates the need for a heater which reduces capital costs and saves power.
- The master control system is designed with the latest Bay Controls Distributed Capacity Control (DCC) technology to efficiently run the facility. The system eliminates unnecessary air blow-off by allowing the most efficient air compressors to run at full capacity while varying flow only on one unit. The average efficiency is higher this way than if all air compressors were run at turndown. After maximum turndown is achieved on one unit, the control system will determine the maximum efficient operation of the remaining units. The master controller also allows for tighter pressure control (approximately plus or minus one to two psi across all the air compressors for lower power consumption).

AUTOMAKER TO SAVE $3.6 MILLION OVER 10 YEARS WITH OUTSOURCED COMPRESSED AIR

- An overall Supervisory Control and Data Acquisition system (SCADA) is furnished to tie the air compressors, dryers and auxiliary system controls together into one package which also provides remote monitoring at all times, as well as data logging for reporting/evaluating performance and assistance with maintenance planning.

- Locating all air compressors in a centralized area and controlling them with a master controller allows the airflow from all air compressors to be managed to meet demand thus minimize venting air. This is a simple point but key to improving the efficiency of today's industrial plants whose air systems have evolved inefficiently over time due to technology obsolescence and situational-independent upgrades. Many plants did not have space in their central utility locations when they were expanded. Due to limited space, new independent air systems may have been dispersed in different locations.

The entire system employs an "N+1" reliability design so that the loss of any one piece of equipment (i.e., air compressor, dryer, cooling tower, etc.) does not disrupt production. This ensures the plant can maintain 100% air supply. The approach adds cost to the project but maintains full air production in the event of an equipment or component failure and allows maintenance of equipment without disrupting production. A new dedicated electrical supply system is included. Redundant transformers enhance reliability by handling all the new load on either unit. A split bus electrical architecture with a "tie-breaker" ensures either transformer can power the entire system if needed.

Clear Advantages with Performance-based Contract

UCA supplies the automotive plant with compressed air through a performance-based contract, which guarantees the company will save a pre-specified amount of energy based on the pre-project analyses. The savings were calculated to be 400 kW ($440,000 per year).

Inlet air hoods protrude from the main modules of the compressed air system at the automotive plant. The overhead door of the modular system provides easy access for maintenance.

If UCA does not deliver savings of at least this amount, the automotive company will be credited the sum of the shortfall.

After consideration of the contract air supply costs, there is a net savings of $3.6 million over the next 10 years. This includes cost savings for power, cooling water make up, water treatment, maintenance, rental compressors, etc. In addition, the automotive plant is projected to benefit from:

- Minimal capital investment in a new air utility system, which frees up capital that can be allocated for capital investment in their core business (expansions, productivity improvements).
- The ability to use critical resources to focus on core business functions.
- Elimination of worries to support a utility system that creates headaches/distractions from critical production activities. Monthly utility costs are fixed/predictable and scheduling maintenance and renting backup air compressors, if needed, are all handled by UCA.
- A new state-of-the-art compressed air facility.

Typical project duration for this type of installation is 10 to 12 months from contract to startup. This result was accomplished on this project even with factors such as COVID-19 and weather induced transportation permit delays.

Modular Design Philosophy Fuels Success

The key to successful project execution is UCA's modularized design philosophy. UCA has experience with retrofits to existing plants but prefers supplying modular designs that minimize the occurrence of unpredictable and unproductive events that can occur in the field.

Generally, installation occurs on a plot adjacent to the customer's main compressed air users where the air is piped directly to

AUTOMAKER TO SAVE $3.6 MILLION OVER 10 YEARS WITH OUTSOURCED COMPRESSED AIR

At the automotive plant, modules for the compressed air system are individually offloaded by a crane and set on a foundation.

the facility. Modular plant systems are used to improve cost, reduce field installation time, lower delivery/other risks, minimize customer business interruption and save space versus "stick-built" construction within the customer's plant.

Modular construction is performed at an off-site fabrication shop unimpacted by weather and site issues. In the shop, accuracy and productivity are high and safety conditions can be monitored better than a field installation. Module installation time in the field is much lower than with a stick-build installation and interactions/disruptions to the customer's facility and people are minimized.

The modular design for this project has the main compressed air supply equipment housed in multiple shop-built modules of similar dimensions meeting over-the-road trucking limitations. The modules, dual transformers and cooling water towers were shipped and installed in the field.

High Comfort Level with Contract Air Supply

The compressed dry air facility commissioning went well and the plant has been running successfully since startup. Having met project execution, reliability and transparency expectations, the automotive company has developed a strong comfort level with the concept of a contract air supply. Also, a transparent, real-time access to operational data builds confidence. And, certainly, meeting performance goals to date (power, production, and reliability) is an important step in building trust for the future.

Space has also been freed up in the automotive plant by moving the compressed air system outside of the current production facility. UCA's modular design approach minimized field construction time and inconvenience to the plant. Guarantees are in place to make sure the company will achieve targeted savings. UCA's reliability philosophy and guarantees ensure reliable pipeline air supply. Lastly, UCA and the automotive company have a long-term relationship that will be based on open communications and shared objectives. BP

About the Author

Kurt Metzler is the Business Development Manager for Universal Compressed Air. He has extensive background in the industrial gas industry and has experience in both the technical and commercial aspects of industrial gas project development. Contact Kurt at email: kmetzler@UniversalCompressedAir.com, tel: 610-419-9053.

About Universal Compressed AIR

UCA, Bethlehem, Pennsylvania, is an industrial gas company specializing in producing and distributing compressed air to manufacturing sites that require air as a utility for around-the-clock operations. To do this UCA maintains complete compressed air supply and distribution systems for a range of companies and markets reliable compressed dry air delivered like a utility under the Pipeline AirTM trademark. For more information, visit www.UniversalCompressedAir.com.

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QUALITY, SAFETY & RELIABILITY

Networked Air Compressors Operate in Harmony at Automotive Manufacturer

By Stephen Parry, Bay Controls

When an automotive company added a new 200-horsepower (hp) rotary screw air compressor and accompanying dryer to a satellite building at its Chicago-area assembly plant, it needed a cost-effective way to integrate the equipment into its existing compressed air network. Doing so would allow plant personnel to easily monitor the air compressor's performance and ensure it operates in harmony with the plant's centrifugal air compressors. Importantly, it would contribute to efficient and reliable air compressor operation at all times.

While a complete controls retrofit would have accomplished the technical aim of the project, it would not have been cost effective given the size of the new air compressor. Instead, Bay Controls installed its BayNet control solution on top of the new air compressor's factory controls. The end result is a communications and control interface that delivers the control and monitoring capability needed at a palatable project cost.

Air Compressors Operated as a Network

The primary compressed air system at the plant consists of six,1,000-hp centrifugal air compressors located in a single air compressor area in the main assembly complex. Each of the centrifugal units is controlled by a Bay Controls V-Series controller, and the air

"With the completion of this project, the plant personnel can now remotely monitor and control the new air compressor even though it is located far away from the main compressed air system."

— Stephen Parry, Bay Controls

compressors are operated as a network using embedded network logic called, "Distributed Capacity Control" (DCC).

Distributed capacity control has been a signature capability of Bay Controls controllers for over 35 years. It is built on the principle that multi-air compressor systems run their best (and most efficiently) when each air compressor is directly tied to every other air compressor and controlled as a network. Under this control strategy, one or more base-load air compressors run at or near 100% of their capacity while a single trim air compressor ramps up or down in response to fluctuations in plant demand. This provides the dual benefits of consistent pressure regulation and maximum compressed air system efficiency.

As part of a previous project, the six centrifugal units at the plant are monitored via a Tridium Niagara network, which records every air compressor operating point (e.g. discharge pressure, oil temperature, vibration, etc.) and feeds the data to the company's corporate analytics platform. This enables the company to track all of its water, gas, electric, and compressed air usage from the air compressor level all the way up to the organizational level.

Remote Monitoring and Optimization Drive Decisions

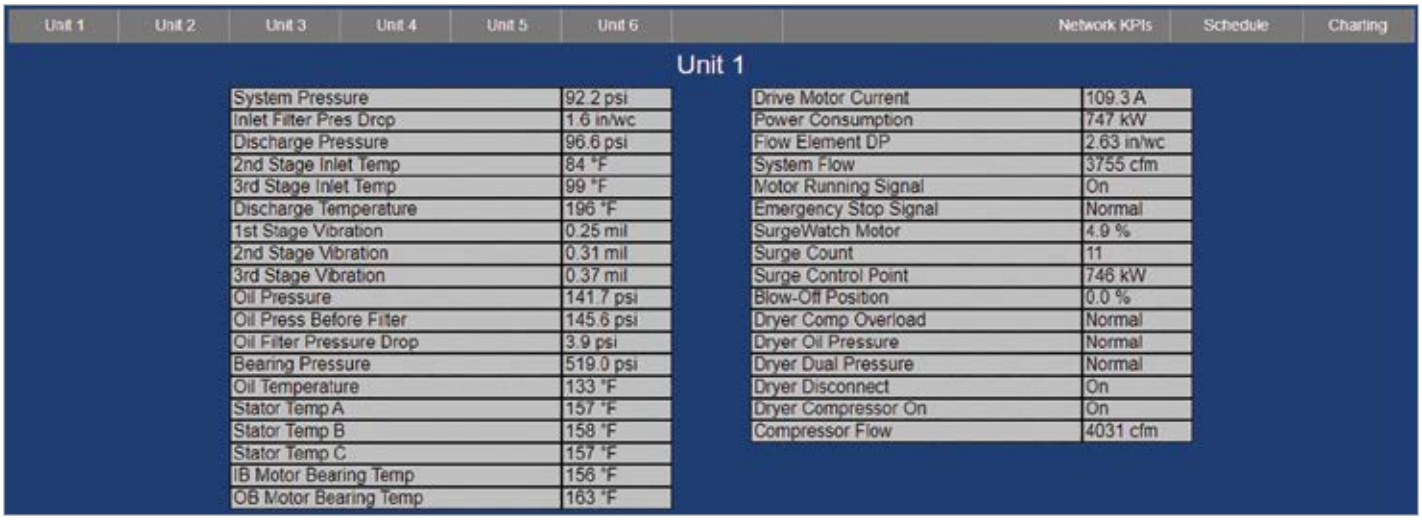
The catalyst for the project at the automotive plant was the addition of the new air compressor to a satellite building, which is separate from the main assembly building and the existing compressed air system. A 200-hp Variable Speed Drive (VSD) air compressor was chosen for the facility based on its flexibility and efficiency at part load. Given the plant's commitment to data-driven efficiency and quantifiable metrics, decision-makers had always intended to integrate the new air compressor into the Tridium Niagara monitoring system. Similarly, even though the air compressor is not directly connected to the larger compressed air system, plant personnel wanted a control solution that would ensure the new air compressor could be controlled remotely to minimize unnecessary runtime.

Given the physical distance between the main plant and satellite building, the separation of the two compressed air systems, and the project budget, the Bay Controls team decided not to retrofit the new air compressor's OEM controls with the V-Series controller used with the centrifugal air compressors. The V-Series controller is a proprietary, purpose-built air compressor control system with 33 or 66 input channels, 16 or 32 output channels, and embedded C-link and Modbus communications capability. These specifications make it ideally suited for controlling large, complex air compressors such as the centrifugal units in the main assembly building. The same solution can render it cost prohibitive for smaller, simpler air compressors like the new VSD rotary screw air compressor installed at the plant, especially when the primary objective is monitoring capability and simple on/off remote control.

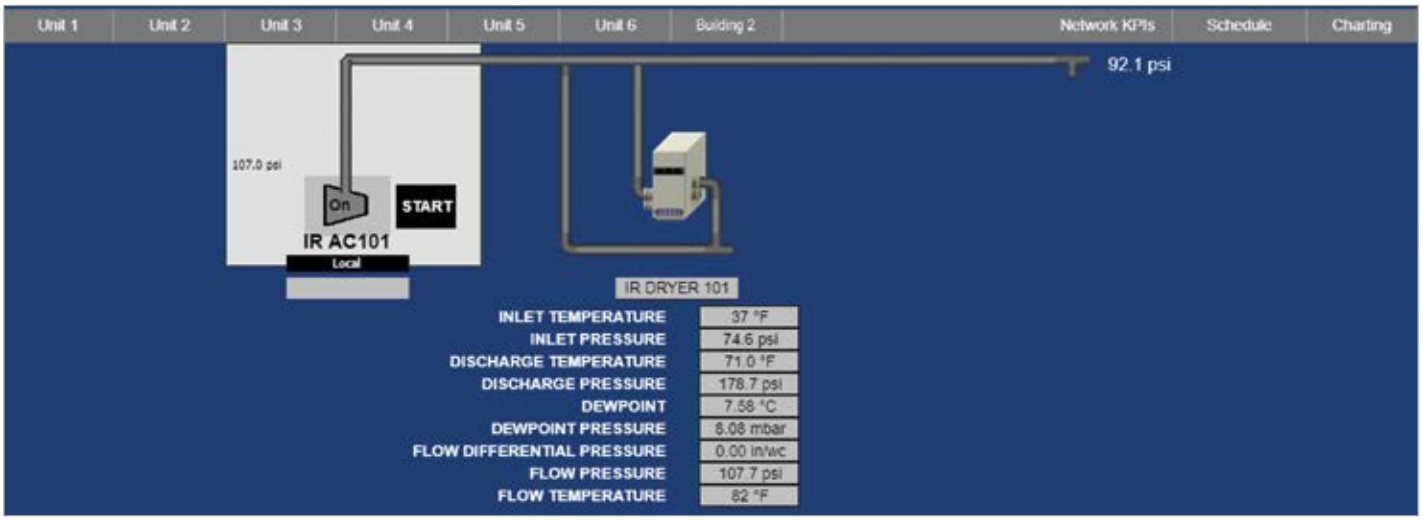
Cost-effective Network Control

In consultation with plant personnel, the Bay Controls team decided its BayNet solution would best meet the goals of the project at a cost that made the project feasible.

NETWORKED AIR COMPRESSORS OPERATE IN HARMONY AT AUTOMOTIVE MANUFACTURER



The Tridium Niagara Network monitors numerous Key Performance Indicators (KPIs) for one of the 1,000 hp centrifugal air compressors in the automotive company's main plant. Compared to the 200-hp VSD air compressor, the centrifugal unit has many more crucial pieces of instrumentation to monitor and control, which necessitates a more capable controller like the Bay Controls V-Series.



Shown are the monitoring points made available through Tridium Niagara for the automotive plant's 200-hp air compressor and accompanying dryer that were integrated into the main plant's monitoring system. Plant personnel can quickly check the status of the satellite air compressor from anywhere they have Internet access.

BayNet is a control solution that delivers network control and monitoring capabilities to smaller air compressors that don't require the same level of control capabilities as larger, centrifugal air compressors at a lower price point than stand-alone V-Series control systems. BayNet utilizes a combination of open-source hardware and a customized software platform built using the Tridium Niagara framework. Unlike the V-Series controller, BayNet does not replace the OEM control system. It also does not directly control the air compressor. Instead, it uses the Modbus communications protocol to read monitoring data from the OEM control system and sends on/off control commands, which are ultimately executed by the OEM control system.

For this project, a Tridium Niagara-compatible Industrial PLC from Phoenix Contact was used as the bridge between the air compressor's OEM controller and the plant's existing Tridium Niagara network. Utilizing the OEM controller's Modbus interface, the Phoenix Contact PLC can read all 17 of the air compressor's control and monitoring points and feed them to the plant's Niagara network. Once connected to the Tridium Niagara network, the air compressor can utilize all of the existing monitoring, control, and scheduling capabilities the Bay

The automotive company's Niagara network (as shown) gives plant personnel the ability to control and monitor six, centrifugal air compressors that comprise the main compressed air system at the plant. Personnel can also gain the same level of control and monitoring capabilities for the 200-hp air compressor via the "Building 2" tab of the software screen.

Controls team previously built out for the main compressed air system at the plant.

Remote Air Compressor is Not So Remote

With the completion of this project, the plant personnel can now remotely monitor and control the new air compressor even though it is located far away from the main compressed air system. This ensures the new air compressor can be operated in harmony – and efficiently – with the main compressed air system, and all of its operating data is captured by the plant's Tridium Niagara network. BP

About the Author

Stephen Parry, International Sales Manager for Bay Controls, works with customers in the Western United States and internationally to implement projects built around the Bay Controls suite of products, including air compressor controls retrofits, monitoring solutions, and HVAC integration, email: Stephen.parry@baycontrols.com, tel: 419-891-4390.

About Bay Controls

For more than 35 years, Bay Controls has been providing control and monitoring solutions to a broad range of industrial, commercial, and government customers in the United States and 60-plus countries across the world. The Bay Controls suite of cloud-ready hardware, and a state-of-the-art, cloud-based analytics platform deliver the actionable intelligence companies need to make smart, data-driven decisions about compressed air system operations, energy savings, and maintenance. For more information, visit www.baycontrols.com.

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PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

Slovenian Chemical Plant Compressed Air Audit Using Cloud-based Software

By Rok Trelc, CALMS Air Inc.

➤ A large chemical plant in Celje, Slovenia, planned to retrofit a kiln used to produce titanium dioxide. To make space for the new equipment related to the retrofit, the plant needed to relocate its high-pressure compressed air system feeding an adjacent pressing process used to dry the material before firing it in the kiln. However, a comprehensive compressed air audit using cloud-based software showed the plant did not need to relocate the system.

Based on the audit and careful planning, the plant opted to replace its high-pressure compressed air system with pneumatic boosters and reconfigured the delivery of air to its pressing process. In so doing it eliminated the need to invest more than $200,000 for relocating the high-pressure system – and is now expected to save approximately $45,000 per year in energy and maintenance costs. The project also delivers a payback of just over two years.

Compressed Air Powers Pressing Process

The original high-pressure compressed air system used for the titanium dioxide pressing and drying process consisted of three water-cooled, 125-horsepower, two-stage reciprocating air compressors delivering a total of 320 scfm of compressed air at 300 psi. The 33-year-old air compressors experienced high maintenance costs and were maintained by an authorized service contractor in France.

"In so doing it eliminated the need to invest more than $200,000 for relocating the high-pressure system – and is now expected to save approximately $45,000 per year in energy and maintenance costs."

— Rok Trelc, CALMS Air Inc.

Despite their age, the air compressors were key to powering the presses.

The presses are used to help dry the raw material at the plant before the titanium dioxide extract is fed to the kiln. Two presses running independently of each other have three distinct sub processes where compressed air is used for the drying process. First, the raw material is pressed to eliminate excess water by means of a set of 60 bellows operated by compressed air. To do so, compressed air is released into the bellows, which increases the pressure slowly from zero to 180 psi. The expansion of the bellows, in turn, squeezes out excess water. Next, compressed air is used to purge the excess water away through drainage passages and into a separation tank. Lastly, the bellows are relaxed and separated and compressed air is again used to release the product from the bellows via forced blowing where it falls to a conveyor system and on to the next process.

In normal operations, the plant used two air compressors for the process with the third unit serving as a backup unit. The compressed air system also included an 8,000-gallon receiver tank installed for storage. The plant used a pressure switch mounted on the receiver tank to control the air compressors.

Operators at the plant closely monitored pressures used in the pressing stage of the process as it is one of the main parameters needed for the presses to function properly. The plant did not monitor the rest of its air usage, including purge times and release times.

Remote Audit Conducted

The chemical plant needed to have the compressed air system audit performed during the COVID-19 pandemic. As such, the plant

Based on the results of an audit using cloud-based software a large chemical plant replaced a high-pressure system with these pneumatic boosters, allowing it to avoid a costly relocation. The newly configured system is also expected to save the plant $45,000 per year in energy and maintenance costs.

Shown is the load profile of the pressing process at the chemical plant. As shown, only the pressure sequence at 12:35 am requires high pressure air at 180 psi. Additionally, consumption of compressed air is low during this same period compared with the rest of the sequence. The short period of high pressure at 12:40 am during the purge sequence is caused by backpressure of stationary liquid. The rest of the sequence only requires compressed air at 100 psi.

SLOVENIAN CHEMICAL PLANT COMPRESSED AIR AUDIT USING CLOUD-BASED SOFTWARE

determined it was best to conduct the audit remotely as much as possible.

The plant commissioned CALMS Air Inc. to conduct the audit, which set out to quantify actual and future operating costs of compressed air and calculate potential operating savings of a new air compressor station. To conduct the audit, CALMS used its cloud-based assessment and monitoring system. The review consisted of site measurements using remote data acquisition equipment to monitor pressure, power, and flow both at the air compressor station and at the presses. Additionally, CALMS interviewed plant personnel.

Due to the nature of the process, where the raw material is pressed in small batches roughly once every 40 minutes, there was a lot of unloaded operation. This wasteful condition constituted more than half of all electricity consumed by the high-pressure air compressors. The audit also showed that only a small portion of compressed air is actually required at high pressure for the first stage of the process using bellows to eliminate excess water. Air pressure during the water drainage and pulp release stages did not need to exceed normal plant pressure, which meant the compressed air for these second and third stages could be supplied by the plant's centralized compressed air system.

The centralized plant system consists of four centrifugal air compressors and one large Variable Speed Drive (VSD) oil-free rotary screw air compressor with the ability to deliver 15,000 scfm at 100 psi. The air is dried to a pressure dew point of 38˚F (3.3˚C). The system, which also features a 55,000-gallon dry receiver tank for stable pressure, has a specific power of 18 kW per 100 cfm.

The booster configuration at the chemical plant consists of three rows of four boosters to supply high pressure air to presses used in the process of drying titanium oxide.

Together with a local compressed air service provider, CALMS recommended the plant replace the high-pressure air compressors with pneumatic pressure boosters to supply air to the first stage of the pressing process and use plant air supplied by the centralized plant system for the remaining two stages of the pressing process.

Pneumatic Booster Package Installed

The team worked closely with the plant to replace the high-pressure compressed air system and install an array of 12 pneumatic boosters, which are located adjacent to the pressing process. In addition, it reconfigured the piping for the centralized compressed air system and also modified the presses.

The booster configuration consists of three rows of four boosters, each of which is capable of increasing the air pressure by a factor of two. Each row is activated separately and works as a single unit of four boosters running in parallel. Two rows of boosters supply air to the presses, while the third row serves as a backup unit. The active rows supplying air to the presses rotate each week so that no single row is idle for more than one week while it acts as a backup unit. A central controller controls and monitors the booster system.

To supply compressed air to the boosters, the plant reconfigured its piping system by adding a new high-pressure pipeline and a ball valve to allow the centralized compressed air system to supply air from the main header pipe to the boosters. The boosters boost air from 100 psi to 180 psi and supply it to the first stage of the pressing process. Additionally, compressed air piping was re-routed to allow the centralized system to supply air to the presses at lower pressure for the purging and release stages of the process. The presses were also modified

The chemical plant reconfigured its compressed air piping system to allow the newly configured system to deliver air more efficiently and cost effectively at the appropriate pressure to specific press processes.

for optimal use of compressed air supplied via the newly configured system.

The boosters serve as an ideal solution since the small array of boosters did away with the need for a large air compressor station and the need to build a facility associated with it. In addition, the boosters are cooled by the expansion of plant air supplied to them, which means they actually cool themselves off while running. Ambient dust is also not an issue as the inlet air for the boosters is clean compressed air. Due to the harsh environment with significant heat and dust, an electrical system with ambient air intake would have been unreliable and expensive to maintain.

The plant uses the same cloud-based monitoring software that was used to conduct the audit to ensure the reliability and efficiency of the newly configured system. The software monitors both the energy efficiency of the booster package as a whole and the operating status of each booster. Anomalies are reported automatically to both plant personnel and the local compressed air service provider – and monthly reports are automatically generated. Any deviation from expected efficiencies is logged and available for review. Additionally, the system allows for maintenance to be carried out proactively to ensure reliability of the system remains high while keeping costs to a minimum.

Energy and Maintenance Savings and More

As detailed in the compressed air audit, the compressed air system upgrade is expected to save the chemical plant $31,000 annually in electricity costs due to the lower specific power consumption of low-pressure compressed air from the plant's centralized compressor station. Additionally, it stands to save another $14,000 in maintenance costs. A ROI of 2.2 years is expected. Although the cost was not formerly calculated, the plant also saved at least $200,000 by not having to relocate the high-pressure air compressor station.

In the end, the plant installed a highly efficient compressed air system that uses less energy and is less expensive to maintain. Additionally, the new cloud-based monitoring software system continues to track energy and maintenance savings, which are expected to be delivered throughout the life of the solution. BP

About the Author

With more than 15 years of experience Rok Trelc is as an independent specialist for compressed air systems with CALMS Air Inc. His main work consists of conducting tests and implementation support for CALMS' international customers. Early in his career Trelc worked as a sales engineer in the field of flow and level measurement. He was also a project manager and a sales partner with Ingersoll Rand. Contact Rok at email: rok.trelc@hpe.si, tel: 386-41-339-328.

About CALMS Air Inc.

CALMS Air is part of HPE group found in 2001. HPE is known as a total compressed air solutions provider; performing audits, projects, energy solutions, delivery, installation and maintenance of compressed air systems. HPE has earned customer's recognition as "The Compressed Air Expert." CALMS Air headquarter is located in Europe Slovenia with a branch in New York City, New York. We introduce modern information technology and advanced energy services to the demanding technical fields of compressed air. To learn more, visit https://calms.com/about-us/.

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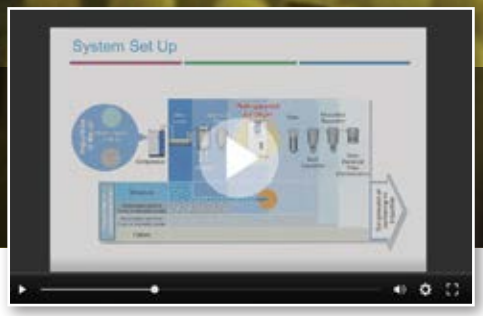

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COMPRESSED AIR SYSTEM TECHNOLOGY NEWS

Hankison Modernizes HPR and HPRN Series of Refrigerated Compressed Air Dryers

Hankison, a premiere brand of SPX FLOW, has streamlined the HPR and HPRN refrigerated compressed air dryers to offer flow rates of 5–1,200 scfm (17 to 2,040 m^3/h). The updated range consists of the HPR5/10–HPR50, providing 5/10–50 scfm; and the HPRN75–HPRN1200, providing 75–1,200 scfm. The range also meets growing customer demand for low voltage compressor room ready refrigerated compressed air dryers, capable of 5 scfm–150 scfm in 115 voltage, single phase power; and 200 scfm–1,200 scfm in 460 voltage, three phase power.

The expanded line-up enables compressed air customers to treat a greater range of air flows than ever before, in more readily available industrial voltages, provided for by the majority of compressor room electrical infrastructures. The new HPR and HPRN Series continue to build on Hankison's expertise in refrigerated compressed air treatment, providing optimal dewpoint performance at 0-100% load. As a result, the Hankison HPR and HPRN series of refrigerated air dryers achieve moisture removal to ISO 8573-1: 2010 Air Quality Class 4 to 5 pressure dew points and are certified for quality and safety to UL1995/CSA 22.2 No. 236-95.

The Hankison HPR and HPRN Series of refrigerated air dryers also have an updated user interface providing more instrumentation and control for at-a-glance readings, and the ability to conduct drain maintenance directly from the control panel, reducing maintenance time by 80% on average.

Hankison HPR and HPRN refrigerated compressed air dryers are designed and built to be long-lasting and reliable and as such are supplied with the following warranties:

- HPR Series 5–10 and 15 scfm: standard one-year warranty parts and labor
- HPR 25–50 scfm: standard two-year warranty parts and labor
- HPRN 75–2000 scfm: standard two-year warranty parts and labor

As an extra measure of protection, customers who select a dryer with Filtration Package and the annual purchase of a maintenance kit receive an additional three years protection, parts and labor – giving five years protection and peace of mind. All major components are covered.

The HPR and HPRN series of refrigerated compressed air dryers from Hankison, a brand of SPX FLOW.

About SPX FLOW

Based in Charlotte, North Carolina, SPX FLOW innovates with customers to help feed and enhance the world by designing, delivering and servicing high value solutions at the heart of growing and sustaining our diverse communities. The company's product offering is concentrated in rotating, actuating and hydraulic technologies, as well as automated process systems, into food and beverage and industrial markets. SPX FLOW has approximately $1.5 billion in annual revenues with operations in more than 30 countries and sales in more than 100 countries. For more information, visit www.spxflow.com.

COMPRESSED AIR SYSTEM TECHNOLOGY NEWS

Gardner Denver Introduces Next Generation Electra Saver G2

Gardner Denver announced that the legend continues with the introduction of the Electra Saver II G2 125HP/150HP/200HP and the Electra Saver G2 125HP/150HP compressors. These next generation products feature top tier flows and efficiencies while preserving the same 1800rmp slow-speed, super-sized bearings and larger airend design principles as their legacy predecessors.

The G2 models also feature the state-of-the-art full color touch screen Governor Controller, and of course they couldn't carry the Saver/ Saver II name without the innovative varying capacity controls (Saver II G2 – load/no load and inlet modulation; Saver G2 – Turnvalve/ variable displacement). With superior serviceability and exceptional performance, the Electra Saver G2 and the Electra Saver II G2 compressors will exceed your demands.

About Gardner Denver

Gardner Denver is a leading global provider of mission-critical flow control and compression equipment and associated aftermarket parts, consumables and services, which it sells across multiple attractive end-markets within the industrial, energy and medical industries. Its broad and complete range of compressor, pump, vacuum and blower products and services, along with its application expertise and over 155 years of engineering heritage, allows Gardner Denver to provide differentiated product and service offerings for its customers' specific uses. Gardner Denver supports its customers through its global geographic footprint of 40 key manufacturing facilities, more than 30 complementary service and repair centers across six continents, and approximately 6,500 employees world-wide. For more news and information on Gardner Denver, please visit www.gardnerdenver.com.

Gardner Denver Next Generation Electra Saver II G2 125HP/150HP/200HP.

Atlas Copco Specialty Rental's Compressors Comply with EPA and Save on Stack Testing

Environmental regulations are becoming increasingly stricter and they are necessary to help us face the challenges and transformations that this decade presents upon us. Lower emissions, HAP (Hazardous Air Pollutants) thresholds aWIPnd carbon footprints are now goals and key performance indicators on everyone's agenda, we see a need for reshaping the way we build our solutions in a more dynamic way.

As specified by the National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE NESHAP) Stack Tests for compressor ignition engines larger than 500 HP in Major Sources must be performed initially and subsequently with annual or semiannual compliance performance tests and usage reports.

As necessary as they are, these tests can cause a heavy cost on producers, each test can stop a machine for about half a day and costs around $3,000 USD, for plants that have multiple Area source engines that exceed 500 HP annual costs for testing and derivatives, such as recordkeeping, data processing, reporting, replacement compressors, and technical support, become an unwanted burden, in some projects they choose to rent larger numbers of smaller compressors to maintain their productivity while complying with the RICE NESHAP requirements increasing their rental, fuel and operational costs.

Here in Atlas Copco Specialty Rental, we see a problem, and we develop a solution. We understand that markets, customer needs, challenges

and technical requirements are constantly changing, that's why we take the lead in reshaping solutions and our customers success, It's our goal to reduce downtime and other associated costs to the end-users of our compressors.

By maintaining the maximum power in our PTS1600 compressors to 500 HP, we can stay below the stack testing requirements and exceed the RICE NESHAP Standards of Performance for Major Sources, this EPA validated compressor output classification delivers instant savings in costly tests and documentation without losing any functionalities and keeping 1600 cfm free air delivery flow, say goodbye to stack tests.

Stay safe from complicated, time consuming and expensive tests, while remaining compliant and with the full power and reliability that Atlas Copco Specialty Rental's Fleet will always offer. The Leaner PTS1600 T4F is good for the environment and good for your productivity.

Atlas Copco Specialty Rental's PTS1600 compressors maintain maximum power to 500 HP and stay below stack testing requirements.

For more information, contact Jose Cardenas, Product Marketing Manager for Atlas Copco Specialty Rental, tel: 866-863-4065, email: jose.cardenas@atlascopco.com, or visit www.atlascopco.com/en-us/rental.

COMPRESSED AIR SYSTEM TECHNOLOGY NEWS

ControlAir Achieves Safety Certification for its Volume Boosters

ControlAir LLC, a leading manufacturer of precision pneumatic and electro-pneumatic controls, is pleased to announce that its Type 6100 Aluminum and Type 6200 Stainless Steel Large Flow Capacity Volume Boosters were awarded a Certificate of Compliance to IEC 61508 for a SIL 3 safety rating. This is in addition to the larger Type 6500 Aluminum and Type 6600 Stainless Steel Volume Booster family.

SIL is an industry measure of safety system performance and reliability and is used as part of the Functional Safety Standard IEC 61508 to calculate risk protection in a system. When a company is using the IEC 61508 standard for safety, SIL components are required in system design.

The IEC 61508 standard defines the requirements to ensure products have a high level of resistance to random hardware and systematic design failures. ControlAir's Type 6100/6200 Large Flow Capacity Volume Boosters were evaluated by a qualified third party certification agency, Factory Mutual (FM), which assessed and certified that the Type 6100/6200 Volume Boosters had been designed and developed in accordance with the IEC 61508 standard. FM followed a rigorous process that verified the Safety Integrity Level (SIL) for the Type 6100/6200 series hardware design, as well as its manufacturing and quality control procedures.

The Type 6100/6200 and Type 6500/6600 Large Flow Capacity Volume Boosters are ideal for any application that requires high flow capacity or remote pressure control. Typically, they are used to increase throttling speed of large volume control valve actuators. When used in a safety system, the volume boosters are used in conjunction with a valve actuator, to perform a safety-related function. The greater air flow provided by these large flow capacity units allows a valve to actuate more rapidly, which would then allow a safety shut-off system to reach a safe state quicker.

ControlAir Volume Boosters were awarded a Certificate of Compliance to IEC 61508 for a SIL 3 safety rating.

The Large Flow Boosters handle up to 250 psig (17.0 BAR) supply pressure and deliver an output pressure up to 150 psig (10.0 BAR). The Type 6100/6200 units provide a flow capacity of up to 225 SCFM (6,300 Nl/min). The Type 6500/6600 units will provide up to 400 scfm (11,300 Nl/min). Both units are rated to a wide operating temperature range of -40º to 200ºF (-40º to 93ºC) with low temperature options available. The Type 6500/6600 are available in 3/4" and 1" NPT porting. The Type 6100/6200 are available in 1/4",1/2" and 3/4" NPT porting.

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A Publication of — Smith Onandia Communications LLC, 37 McMurray Rd. Suite 106, Pittsburgh, PA 15241

Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 104, Pittsburgh, PA 15241. Periodicals postage paid at Pittsburgh, PA and additional mailing offices. POSTMASTER: Send address changes to: Compressed Air Best Practices®, 37 McMurray Rd, Suite 104, Pittsburgh, PA 15241.

About ControlAir

ControlAir manufactures precision pneumatic and electro-pneumatic controls. ControlAir's markets include process control, semiconductor, printing and converting presses, diagnostic and surgical medical equipment, robotics, quality control, automotive, analyzers, compressors, pumps and paint equipment. For more information, visit www.controlair.com.

Kingston Valves Announce New API 527 Compliant Soft Seat Safety Valves

Kingston Valves, California-based industrial valve manufacturer, introduced the KSV line of soft seat safety valves. These new valves are designed to API 527 leak tightness to protect systems from over-pressure damage and failure. The stainless-steel springs allow maximum operating temperatures to 400°F. Kingston KSV soft seat safety valves are ASME Section VIII, Div.1 and National Board certified.

The KSV line features a brass valve body with a silicone disc as standard. There are multiple configuration options available allowing flexibility for use in most applications. Additional options include stainless-steel valve bodies, FKM disc, EPDM disc, oxygen cleaning, thread sealant, steam service, and nickel plating are available upon request.

About Kingston

Established in 1908, Kingston has been a leader in the safety relief valve manufacturing business; primarily focused on the brass industrial valve market, they have an expert understanding of industrial OEM and Distribution customer needs and challenges. The Kingston brand has a longstanding history within the compressed air/gas/steam/liquid markets. Kingston is an ISO 9001 certified company whose valves continue to represent the performance and reliability that have been the industry standard for over a century. For more information, visit www.KingstonValves.com.

The New KSV Soft Seat Safety Valve Collection from Kingston Valves.

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— Sharon Nolen, Manager of Global Natural Resource Management, Eastman

"As an example, we were using higher pressure air compressors for an application that didn't need that amount of pressure so we installed a blower rated to deliver air at 15 psi, which saved $30,000 a year."

— Nick Waibel, Global Energy Lead, Tate & Lyle

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Industrial energy managers, utility incentive program managers, and technology/system assessment providers are the three stakeholders in creating energy efficiency projects. Representatives of these readership groups guide our editorial content.

"Our commitment to sustainability is a corporate-wide effort and a plant wide-effort. We want the next generation to have the same or better experiences than we have now."

— Lora Gans, Environmental Health & Safety Manager, Stanley Black & Decker

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