The Magazine for ENERGY EFFICIENCY in Compressed Air Systems

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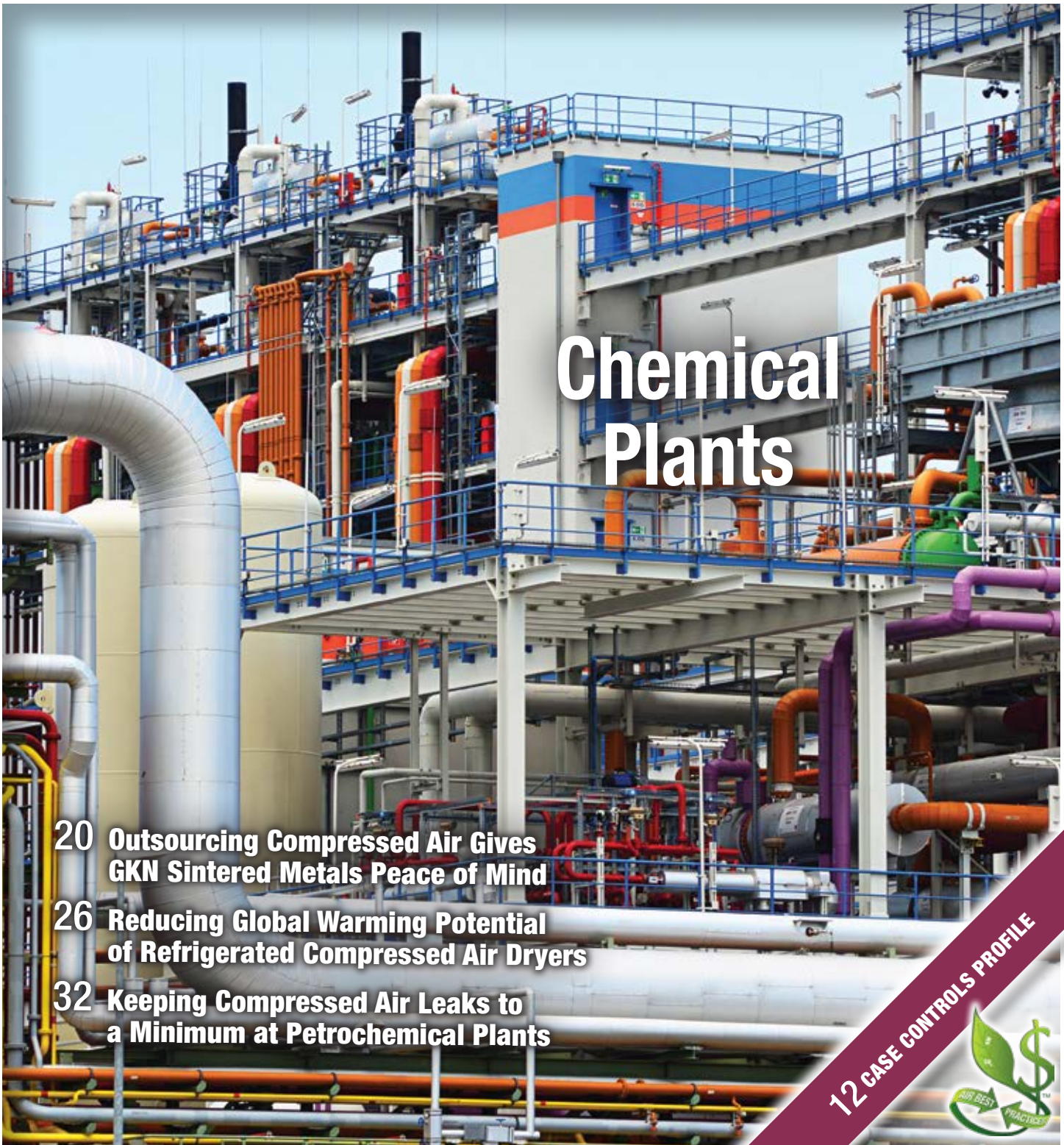

Chemical Plants

12 CASE CONTROLS PROFILE

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FEATURES

QUALITY, SAFETY & RELIABILITY FEATURES

PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION FEATURES

COLUMNS

FROM THE EDITOR | Chemical Plants

Quality, Safety and Reliability

I first visited Pittsburgh-based Total Equipment Company, in 1992, as a very-young and somewhat-nervous compressed air dryer sales rep. I'm pleased to report this Ingersoll Rand distributor is as strong as ever and hope you enjoy Jason Onyshko's article about a compressed air outsourcing solution they provided to GKN Sintered Metals.

We did some research this year on the global warming potential (GWP) of refrigerants and I put together an article on how this is impacting refrigerated compressed air dryers. I hope you enjoy what I consider an introductory article to the topic. Low GWP numbers can be offset by higher costs and reduced energy efficiency. My take-away is low-GWP refrigerants are well underway for use in refrigerated dryers below 1000 cfm, while the search is still on for larger dryers.

Productivity, Sustainability & Energy Conservation

Talk about being ahead of the curve. Case Controls began automating control systems and developed a centrifugal air compressor controller in the late 1980's and early '90's. Today, this Rockwell Automation OEM Partner for compressed air automation provides 24-hour remote monitoring support services for major powerhouses featuring multiple centrifugal air compressors. We were grateful for the chance to interview Lou York and Devin Sullivan to learn more about their work.

I know it's invisible, but compressed air leaks continue to bully systems – so we continue to dedicate editorial about the efforts to fight back! For this reason, Mike Grennier did our second interview article with James Nipper whose firm, Petro Chemical Energy, specializes in compressed air and steam leak audits for petrochemical plants.

Production shutdowns are the proverbial elephant in the room. If compressed air issues stop production for a day, you can blow through a year of energy savings right there. Ron Marshall provides us with an article about a "small" compressed air system where even though his audit produced energy savings, the larger benefit was the elimination of low-pressure events causing production shutdowns.

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

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INDUSTRY NEWS

Atlas Copco Acquires Appleton Compressor Service & Supply

Atlas Copco Compressors has acquired Appleton Compressor Service & Supply, Inc. Appleton, located in Menasha, Wisconsin, offers a wide range of equipment, including air compressors, vacuum pumps and air treatment equipment. As a long-established distributor of Atlas Copco, the company specializes in air installations and associated services.

"We are proud to take on the legacy of Appleton Compressor and turn the territory of Wisconsin into a factory direct branch of Atlas Copco Compressors, allowing us to get closer to our customers," said Robert Eshelman, General Manager for Atlas Copco Compressors LLC in the United States. Atlas Copco has appointed an integration manager who will take the company from distributor to a factory direct branch.

About Atlas Copco Group & Atlas Copco Compressor Technique

Great ideas accelerate innovation. At Atlas Copco, we have been turning industrial ideas into business-critical benefits since 1873. Our passionate people, expertise and service bring sustainable value to industries everywhere. Atlas Copco is based in Stockholm, Sweden with customers in more than 180 countries and about 37,000 employees. In 2018, revenues were BSEK 95, approximately 10 BUSD.

About Atlas Copco Compressors

Atlas Copco Compressors LLC is part of the Compressor Technique Business Area, headquartered in Rock Hill, South Carolina. Atlas Copco Compressors provides innovative solutions including world-class compressors, vacuum pumps, air blowers, quality air products and gas generation systems, all backed with full service, remote monitoring and auditing services. With a nationwide service and distribution network, Atlas Copco Compressors is your local, national and global partner for all your compressed air needs. Learn more at www.atlascopco.com/air-usa.

MIKROPOR Acquires DRYTEC of Belgium

One of the leading names in atmospheric air filtration and compressed air systems, MIKROPOR, an Ankara/Turkey based privately owned company with its own facility in Michigan City, is pleased to announce the acquisition of DRYTEC of Belgium, as part of the company's plans to expand its production capabilities outside of Turkey.

DRYTEC s.a., one of the pioneers of the industry, specializes in dryers and also supplies other related products such as in-line filters, condensate drains and many more. The company's main markets are in Europe, with a wide network of over 200 dealers and customers.

MIKROPOR, with its main markets in the US, aims to expand its European dealer network in the near future and the acquisition will boost the company's efforts, as it enables the company to take advantage of DRYTEC's reputation and experience in the market, built in the last 37 years.

MIKROPOR continues its strategic plan, aiming at confirming its leadership in the atmospheric air filtration and compressed air business, as it expands its product range both through organic growth and also strategic acquisitions worldwide.

For further information, please contact Mikropor America at 219-878-1550, or visit www.mikroporamerica.com

About Mikropor

Mikropor America Inc., headquartered in Michigan City, Indiana, a subsidiary of Mikropor Inc., offers a broad range of engineered solutions for the compressed air industry such as: Refrigerated and Desiccant Air Dryers, Nitrogen Generators, Air/Oil Separators, Compressed Air Filtration, Air Intake Filters, Oil Filtration, and aftermarket replacement filtration elements for compressed air. With foundation in 2011, our 75,000-square-foot facility was established to locally serve our North America's customer base of Distribution and OEM partners. Mikropor America Inc. is also a member of the Compressed Air and Gas Institute (CAGI).

Mikropor Inc. (www.mikropor.com), for over 30 years the Mikropor name has been recognized as the "best in class" serving the industrial filtration markets, including air compressor equipment, compressed air purification, power generation, gas turbine, dust collection, clean room and HVAC. Mikropor proudly has over 600 employees and 4 world class manufacturing facilities located in Ankara, Turkey. Mikropor is ISO certified, technology-driven and committed to engineering innovations satisfying customer expectations for product quality, reliability and extreme value.

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INDUSTRY NEWS

nano-purification solutions wins prestigious North East Business Export Award

On February 28th, nano-purification solutions was announced as the North East Business Export Awards' winner at the Grand Hotel, Gosforth Park, Newcastle Upon Tyne, UK.

The awards were open to all companies from Northumberland and Tyneside. nano-purification solutions was one of 3 companies shortlisted for the export award and were amongst very strong competition and some much larger companies.

"The team at nano-purification solutions is proud to have won the prestigious 2019 North East Business Award. Through our achievements in international business, we are the winner of the Export Award. A special thank you goes to all our customers, without who's support, this would not have been possible," said Adam Wright, Business Development Director.

"The North East Business Awards are the biggest and best of their kind. Held in association with the North East England Chamber of Commerce, the Awards shine a light on companies large and small and remind us that the North East is a great place to live, work and do business. They toast success, celebrate achievement and highlight successful and innovative businesses doing fantastic things right here in the North East! Almost 2,000 people attend the four awards ceremonies across the region before the Grand Finale to celebrate the cream of the crop," said a spokesperson from the North East Business Awards.

For more information, contact Purification Solutions LLC, tel: 704.897.2182 or email: marketing@n-psi.com

Left to right: David Gilligan, Peter Fearon, Michael Eccles, Adam Wright

Boyce Named EnergAir Eastern Regional Manager

EnergAir Solutions Inc. announced the appointment of Milton Boyce as the new Eastern Area Sales Manager. Milton will be based out of his home office in Jamestown, RI and will be responsible for business development and distributor relationships in Eastern US.

"Since EnergAir Solutions, Inc. was founded at the end of 2010, we've been quite successful in setting up several distributors all over the US. In order to keep growing and provide the same service to our existing and new distributors, it was absolutely necessary to create this new position within the company," says Nicolas De Deken, COO at EnergAir Solutions Inc. "Milton has proven to be successful in the compressed air industry before and we believe his extensive

Milton Boyce, EnergAir Eastern Regional Manager

experience, drive and enthusiasm will help us to accelerate our growth in the US."

EnergAir Solutions Inc. is the United States subsidiary of CMC NV, the world's leading compressed air and vacuum pump controls company. EnergAir specializes in the design and installation of energy management and IoT remote monitoring solutions for compressed air and vacuum installations, typically cutting energy consumption and costs by 30%.

"It is a great pleasure to be able to contribute to such an innovative and dynamic company as EnergAir Solutions Inc. I look forward to working with our distributors and partners to enable them to provide the most unique and unsurpassed energy saving controls and monitoring systems available in the compressor industry," says Milton Boyce.

For more information on EnergAir visit www.energair.com.

INDUSTRY NEWS

Randy Breaux and Kevin Storer Share 2018 GPC Manager of the Year Award

Motion Industries, Inc., announced its parent company, Genuine Parts Company (GPC), presented Randy Breaux, Motion Industries President – North America, and Kevin Storer, Motion Industries Executive Vice President U.S. Operations and President of Motion Mexico, the 2018 GPC Manager of the Year honor. It is the single highest individual recognition in all of Genuine Parts Company.

"This is the 60th consecutive year we have recognized one Manager of the Year out of all our associates worldwide," said Paul Donahue, President & CEO of Genuine Parts Company. "This year we decided to present the Manager of the Year Award to both Randy and Kevin to recognize the outstanding efforts of both leaders, resulting in a record year, during a challenging time with the passing of Tim Breen, former President & CEO, in August. This award is the highest honor at GPC – a significant recognition of both Randy's and Kevin's exceptional leadership of the Motion Team in 2018."

Prior to being named Motion Industries President in December 2018, Breaux was Executive Vice President of Marketing, Distribution, Purchasing and Strategic Planning for the company, and has nearly four decades of experience in the industrial manufacturing and distribution markets. He joined Motion Industries in May 2011, following 21 years of leadership roles with ABB/Baldor Electric Company.

Storer is responsible for all U.S. branch and field sales operations, as well as Motion's Mexico operations. Storer began his career with Motion Industries in 1987, and was a Branch Manager and Regional Manager prior to becoming Vice President/General Manager of Motion's Los Angeles Division. In 2006, he was promoted to Vice President/Group Executive before being named Senior Vice President, Western U.S. and President of Motion Mexico in 2014. He was promoted to his current position in 2017.

About Motion Industries

With annual sales of $6.3 billion, Motion Industries is a leading industrial parts distributor of bearings, mechanical power transmission, electrical and industrial automation, hydraulic and industrial hose, hydraulic and pneumatic components, industrial products, safety products, and material handling. Through EIS, which joined with Motion Industries to form its Electrical Specialties Group in 2018, the company has broadened its offerings with process materials, production supplies, specialty wire and cable, and value-added fabricated parts for the electrical OEM, motor repair and assembly markets.

Randy Breaux, Motion Industries President-North America.

Kevin Storer, Motion Industries Executive Vice President U.S. Operations and President of Motion Mexico.

Motion Industries has over 550 locations, including 15 distribution centers throughout North America and serves more than 190,000 customers from the food and beverage, pulp and paper, iron and steel, chemical, mining and aggregate, petrochemical, automotive, semiconductor, wood and lumber, medical, and pharmaceutical industries.

Motion Industries is a wholly owned subsidiary of Genuine Parts Company (NYSE: GPC). For more information, visit www.MotionIndustries.com

PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

PROFILE: CASE CONTROLS
and Centrifugal Air Compressor Management

By Mike Grennier, Compressed Air Best Practices® Magazine

Compressed Air Best Practices® interviewed Lou York (Director), Devin Sullivan (Vice President of Engineering) of Case Controls.

Good afternoon. Please give us the history of Case Controls. How and when did the business get started?

John Craddock started the business in 1986 in Evansville, Indiana, which is where we're located today. Case began as an industrial automation company willing to automate virtually any process. In fact, when PLCs were gaining traction in the industrial automation world, Case was one of the first Allen Bradley Systems Integrators when the program launched.

By the early 1990s, we identified the growing need for automated control in the compressed air industry, and in 1992, we developed our first centrifugal air compressor controller. Soon after, we developed a solution to load-share multiple centrifugal air compressors as an integrated system. At that point, we became solely focused on automating air compressors. Today, we offer robust, scalable solutions to control individual air compressors of all makes and models, as well as system-wide automation solutions to manage the air compressors and maximize overall system efficiency.

We've continued our relationship with Allen Bradley through Rockwell Automation's

Lou York, Director, and Devin Sullivan, Vice President of Engineering, Case Controls (left to right).

purchase of Allen Bradley years ago. Today, we're a Rockwell Automation OEM Partner for compressed air automation.

What benefits does being a Rockwell Automation partner offer customers?

Many plants use Rockwell's Allen-Bradley products for automation throughout their operations beyond the compressed air system. It's an assurance that we're well versed in these technologies, which is important since plant personnel are trained to support it. In many cases, our system is tied into their Rockwell/ Allen-Bradley based supervisory system.

It's also an advantage if something fails on the air compressor control system because parts are readily available. We can get things resolved quickly, which leads to improved uptime. Additionally, we're able to provide scalable solutions for integration with other Rockwell solutions available today and into the future as part of a plant network.

How is Case Controls structured on the management side of things?

Today, Lou and Devin jointly manage the company on a daily basis. We have a total of 13 employees including five full-time engineers, along with Devin and Lou. Our engineering team is unique in that they're not only experts in PLC/HMI programming, but they're also knowledgeable about centrifugal air compressors, as well as rotary screw and reciprocating units. This is in addition to system-wide compressed air automation.

Please give us an overview of Case Controls' control technologies.

I'll start by saying we all know a company's compressed air demand profile never perfectly matches its supply side capacity. Additionally, there is no one-size-fits all approach to

PROFILE: CASE CONTROLS AND CENTRIFUGAL AIR COMPRESSOR MANAGEMENT

managing multiple centrifugal air compressors to achieve energy savings and improve the reliability of the compressed air system.

Knowing this, we developed our flagship AirMaster™ product, which is an open platform and highly configurable master controller used to effectively manage load sharing of centrifugal air compressors, as well as other types of air compressors.

A master control scheme, however, requires the need to integrate with the local controllers. As such, we also provide local controllers that work seamlessly with our master controller. These include our AirLogix® for centrifugal air compressors and AirStarPD for rotary screw and reciprocating compressors. We also offer controllers for managing any type of compressed air system dryer and multiple headers. The controllers are built on an Allen-Bradley based open platform.

We also provide remote monitoring and on-site services to help plants optimize their compressed air systems and keep their machines up and running.

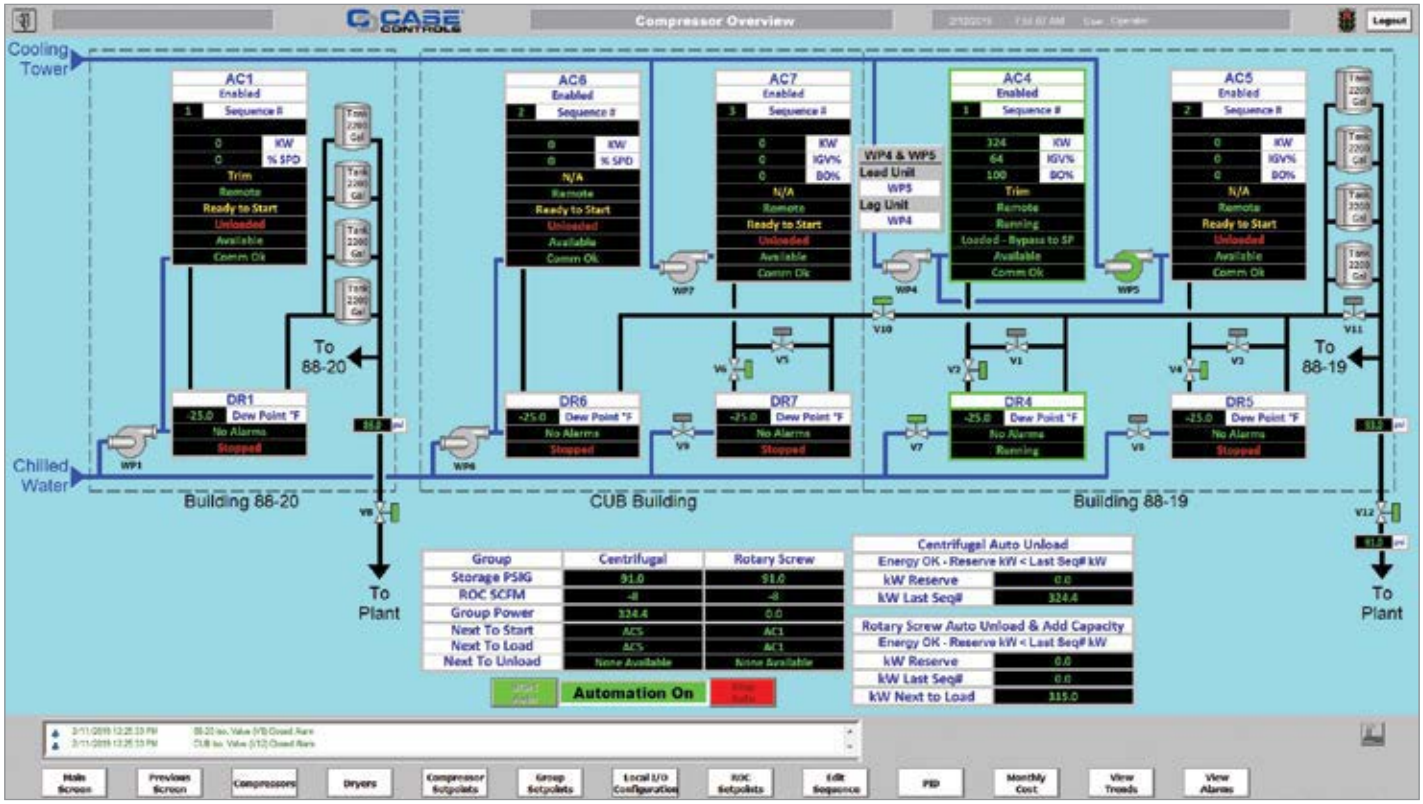
Why is an integrated approach to controls an advantage with centrifugal air compressors?

Often, multiple centrifugal air compressors are set up to simply react to air demand, which requires the system to not only meet the new demand, but also make up for air depleted in the main header. This typically results in too much supply, which results in bypassing the air to atmosphere. The result is wasted energy use.

Efficient operation of centrifugal air compressors cannot be achieved by pressure set point adjustments alone. The inlet valve will modulate to a closed position when pressure rises above a given set point. Incidentally, the bypass valve will tend to open when pressure exceeds the set point.

To achieve the true potential of centrifugal air compressors, it's important to properly coordinate the operation of the machines. So rather than allowing the units to react to demand, we often use feed-forward, predictive controls strategies to better control each machine and match the entire compressed air supply system with demand.

The goal is to optimize the centrifugal air compressors to ensure they work as efficiently



Displayed at the top the main screen of an AirMaster™ master controller is performance data for three centrifugal air compressors and two rotary screw units operating in sequence. The bottom of the screen shows the status of dryers along with pressure and dewpoint levels, as well as water pumps for the cooling circuit of the compressed air system.

as possible, which means we implement methods used to minimize or eliminate blow-off, reduce system pressure, and keep the units from unnecessarily running unloaded.

How does your control technology minimize/eliminate unnecessary blow-off with centrifugal air compressors?

It starts with a Dynamic Throttle Limit (DTL) on each centrifugal air compressor, which is a control algorithm designed to automatically adjust for air density and discharge pressure.

We do this because many centrifugal air compressors are set up based on the worst-case scenario when ambient temperatures are hottest. If that same machine is using a fixed throttle limit it won't adjust for cooler, denser ambient air and the larger mass of airflow, in turn, causing the air compressor to enter a surge condition and the need for blow-off.

The use of DTL, however, takes full advantage of the air compressor inlet throttle capacity and effectively provides increased turndown when available during cooler inlet conditions and less turndown in warmer conditions. In addition, throughout the dynamic inlet conditions, DTL provides superior protection against air compressor surge.

We'll then tie our local controller on each machine into our master controller so the air compressors are working together toward a common set point, and not chasing each other or fighting one another to get air into the header. Through tight air compressor integration, the inlet throttle capacity of each individual air compressor is fully utilized and the air bypassed through the blow-off valve is minimized or eliminated.

PROFILE: CASE CONTROLS AND CENTRIFUGAL AIR COMPRESSOR MANAGEMENT

Shown is an AirLogix controller on a centrifugal air compressor. The machine is one of three units networked with an AirMaster master controller.

Describe what you mean by integration of air compressors.

Generally speaking, when pressure rises and the air compressors need to reduce capacity, the unit modulates the inlet valve closed on one air compressor to reduce flow into the system. When the throttle machine closes the inlet valve to a minimum point it would normally begin to blow-off air. AirMaster, then, will modulate the inlet valve on a second air compressor rather than allow the first machine to blow-off. The second air compressor then becomes the throttle machine and the process is repeated with multiple units.

As long as the swing in demand for air is within the total throttle capacity of the system there is no need to blow off air. If the demand is not within the throttle capacity, only one air compressor will bypass at a given time. During the period, remaining air compressors remain at the reduced power provided by DTL. Operating conditions specific to the site determine when compressors are unloaded and stopped. Our master controller can also integrate fixed speed and variable speed drive rotary screw air compressors and reciprocating machines for an automated compressed air system. At the end of the day, it's about eliminating system inefficiencies and wasting expensive air.

Another way of conserving air and saving energy costs is through the reduction of system pressure. How does Case Control's technology accomplish this?

The more you're able to control pressure at the header and reduce pressure variability, the more opportunity there is to lower the header pressure set point of the compressed air system.

We use the master controller to automatically regulate the centrifugal air compressor's inlet air valve to match system pressure, resulting in tighter control of header pressure. It's a departure from many other instances where a standard sequencer adjusts the set points of the local controllers based on rising and falling pressure, which results in a lot of system variability.

In terms of energy costs, we measure it by motor current rather than airflow since many plants are without airflow meters. Motor current is directly proportional to the amount of airflow going through the machine.
On a centrifugal air compressor, as the need for pressure increases so does the need for airflow to keep it out of surge condition. When we tightly control the header and lower the discharge pressure of the air compressor, it translates into less energy consumption that would otherwise be used to keep the machine out of surge.

What's the strategy to prevent centrifugal air compressors from running unloaded?

Many operations keep their centrifugal air compressors running unloaded in case they need air to meet a spike in demand. When air is needed, the air compressors will go from the unloaded state to loaded. This is an attempt to reduce the starting and stopping large horsepower motors and provides air more quickly. However, it's not a good practice since it consumes 30 to 40 percent of the machine's electrical power when running unloaded. When running unloaded, all energy used is wasted. We have seen centrifugal air compressors running unloaded continuously for many hours and even days wasting thousands of dollars.

The main screen of an AirLogix local controller shows the DTL minimum limit, which is automatically calculated and adjusted based on air density entering the air compressor and its discharge pressure. The green area in the meter indicates the throttle range for a machine in operation based on these conditions. It also displays critical variables, such as vibration and system pressures.

PROFILE: CASE CONTROLS AND CENTRIFUGAL

We use automation to avoid having one air compressor running fully unloaded for long periods of time. Instead, the system will unload, stop, and start one air compressor based on the output of the other machines, instead of having multiple air compressors bypass air. As a result, we're able to reduce the number of load/unload cycles and minimize the amount of electrical power consumed. This also stabilizes system pressure.

Tell us about remote monitoring. Why are end-users interested in having an outside firm monitor their system?

Obviously, centrifugal air compressors are highly sophisticated machines with a lot of moving parts requiring attention. We recognized the need for it decades ago when we actually used dial-up modems to provide remote service and support.

Interest in remote monitoring is only growing as the Industrial Internet of Things (IIoT) continues to reshape the industry. Today, we offer 24-hour remote support services through a VPN, or another analog or cellular modem connection. The customer typically drives the type of service we provide based on plant security policies.

In some cases, a plant will have us proactively assess the health of their compressed air system. To do so, we'll review historical data going back several months, including alarm events, trip set points, shut downs, and frequency of loading and unloading, to name a few. We'll provide a detailed report for each air compressor and overall health of the system, as well as, provide comments so they can make informed decisions about predictive maintenance.

Many plants look to us to help with troubleshooting issues such as problems with inlet/bypass valve calibration, check valves, dirty inlet filters, inner/after-cooler performance, and compressor surge diagnostics. For example, it's not uncommon for our local controller to find an inlet valve out of calibration or not functioning at all, which can cause an array of problems. In that case, we'll remotely diagnose the problem and provide a recommendation to resolve the problem. We can also remotely take control of the machine and do what's needed, such as stroking the inlet/bypass valve to diagnose the issue.

In other cases, we'll monitor the compressed air system and fine-tune things in order to optimize the system, which gets back to things like ensuring the air compressor's inlet valve functions properly to ensure proper load sharing and energy savings.

AIR COMPRESSOR MANAGEMENT

A lot has certainly changed since the dial-up modem days. What does the future look like for compressed air system controls?

A big area for us is helping decision-makers at the corporate level better understand their compressed air system and what they can achieve in terms efficiencies and cost savings.

There was a time when people at the corporate level didn't know they had a compressed air system, but that's changing. We've got a ways to go in that regard but we work with quite a few companies who appreciate what can be done, which is why we're continuing to build on that model.

Looking ahead, we see a continued emphasis on the visualization of compressed air system metrics. Visualization gives decision-makers the ability to quickly and easily see what's going on with their compressed air system. This is particularly important in terms of the amount of electrical power the system has consumed in the past month or year and what it's costing them, not to mention maintenance.

For example, we'll establish a baseline for power consumption based on a 13-month history of the system. Our software then displays the information using a green and red bar graph to indicate where the system is in terms of energy consumption. If the data is in the green area, all is good. If it's red, it's an opportunity to assess and make changes.

We're also excited about tying together the controls of not just compressed air systems, but also other utilities like cooling towers and vacuum systems. We're now working with some companies to bring it all under one platform to better manage it. We definitely see that as an area of growth.

Thanks for your insights, Case Controls. BP

For more information, please contact Lou York, email: lou.york@casecontrols.com; tel: 812-422-2422, or visit www.casecontrols.com.

All photos courtesy of Case Controls.

To read similar ***Air Compressor Control Technology*** articles visit www.airbestpractices.com/technology/air-compressors.

QUALITY, SAFETY & RELIABILITY

OUTSOURCING COMPRESSED AIR
Gives GKN Sintered Metals Peace of Mind

By Jason Onyshko, Total Equipment Company

GKN Sintered Metals, St. Mary's Pennsylvania, excels at developing innovative customized high-precision metal-shaped solutions, in addition to providing a high level of engineering support, for products used in a variety of industries such as the automotive marketplace. The company has also created well-honed processes that give it a competitive advantage when it comes to product performance, quality and cost.

With an eye toward strengthening its competitive edge, GKN (www.gknpm.com) opted for a new approach for the compressed air it uses to power metal molding machines in addition to a variety of other applications at its manufacturing facility. After careful analysis and planning with the Total Equipment Company (www.totalequipment.com) located in Coraopolis, Pennsylvania, GKN opted to move beyond its aging compressed air system – and instead – outsource compressed air as a utility. Doing so allowed it to free up valuable floor space, while also achieving peace of mind

"It's very comforting to know what my compressed air is going to cost me for any given year."

— Shawn Gnan, Engineering Manager, GKN Sintered Metals

since it can now count on a fixed cost for a reliable compressed air supply for years to come.

Freeing Up Space, Gaining Fixed Costs for Compressed Air

GKN Sintered Metals Engineering Manager Shawn Gnan set out to accomplish a number of goals when planning a better approach to meeting the plant's needs for compressed air.

A top priority was to expand production square footage and add production equipment to the facility. As such, Gnan looked at the air compressor room as an option since it occupied 2,200 square feet of valuable space. The compressor room would also be an ideal location to store raw materials, freeing up other areas for production.

Gnan also wanted to address increased maintenance costs associated with the aging compressed air system. Importantly, GKN also experienced frequent periods of downtime due to breakdowns with the compressed air system, which limited production and threatened to shut down the plant. Something had to be done to provide a constant and highly reliable supply of compressed air to the facility.

Another priority for Gnan was to establish a fixed cost for compressed air, and thereby eliminating the challenges of budgeting for it since demand for air and the energy cost to produce the air fluctuates throughout the year. A related goal was to more effectively address the costs associated with compressed air maintenance and repairs, which were often unpredictable.

Compressed Air Powers Metal Molding Machines

Compressed air is a vital utility at GKN, which operates 24 hours a day, seven days a week. In addition to powering molding machines,

The 40-by-8-foot sea container at GKN houses a complete compressed air system. The unit is located six feet away from the exterior wall of the manufacturing facility.

OUTSOURCING COMPRESSED AIR GIVES GKN SINTERED METALS PEACE OF MIND

GKN uses air to power grinders used in the production process, as well as other hand tools used throughout the facility. It also uses compressed air for blowing off the molding machines after parts are ejected.

GKN's aging compressed air system was comprised of two, 100 horsepower (hp) fixed-speed, oil-lubricated rotary screw air compressors, a refrigerated dryer and one 1,080 gallon air receiver tank. GKN operators had manually controlled the air compressors. Under normal operating conditions, both units would operate simultaneously to meet air demand of between 400-700 cfm.

When evaluating the compressed air system, the team at Total Equipment Company (TEC) determined there is less air demand during the weekends. The weekend load profile is around 450 cfm of compressed air, while weekday demand averages around 618 cfm.

Based on the plant's air demand and GKN's goals, TEC and GKN together decided the best solution was to replace the aging units and install an over-the-fence compressed air system. The solution incorporates the use of a 40-by-8-foot sea container designed to house a complete compressed air system. Sometimes called an "over-the-fence compressed air system", TEC assumes all responsibility for owning, operating and maintaining the compressed air system. GKN pays a fixed amount for compressed air per month over the life of the long-term year contract with TEC, eliminating the need to invest in capital for compressed air - while also addressing the GKN's goals.

A crane deftly places the sea container into place at GKN. The container houses the entire compressed air system used to meet the air demands of the manufacturing facility.

Integrated Compressed Air Packages Fit the Bill

Located outdoors and just six feet away from the GKN facility, the modified sea container features three, 100 horsepower (hp) compact Ingersoll Rand Total Air System (TAS) contact-cooled rotary screw air compressors. Two units are fix-speed R75i TAS air compressors, while the third is an R75n TAS VFD unit equipped with variable frequency drive (VFD). All three were sized to provide complete compressed air redundancy to ensure the availability of compressed air at all times.

Each air compressor has a integrated dryer package housed in an enclosed cabinet. Each package contains the air compressor, as well as a coalescing filter and refrigerated dryer for the delivery of high-quality, clean dry air. Having all components inside the same cabinet allowed for three air compressors to be placed inside the container – and provides ample room to service the units. Additionally, the components are smartly placed inside the cabinets for ease of serviceability. Double doors installed on the back of the container also allow for the removal of any unit, if necessary.

Aside from space constraints, the team designed the compressed air system to perform flawlessly despite the wild temperature swings in and around St. Mary's. The temperature can go from extremely cold to relatively warm, sometimes in a matter of days. This meant the system would see temperatures as low as -15 ˚F and as warm as 100 ˚F. Given the conditions, the container would have to use some of the warm discharge air to heat the compressor when the temperature dropped in the cold winters. It would also need to be able to ventilate air in the summer to keep it cool.

To address ambient temperature issues, the team installed thermostatically controlled dampers on the air compressor exhaust for each unit. It also installed electric heaters on each end of the container to help control the temperature in the colder months. Also taken into account in the design of the system was air intake. With such a small space it opted for louvers that open to direct cold away from the air compressor intake, allowing for acceptable intake air temperatures in extremely cold weather. Additionally, the cold air from the outside has time to mix with the warm interior air before entering the airend.

The compact air compressors, with integrated dryer/filter packages, are all housed in the same cabinet, allowing three air compressors to be placed inside the sea container with room to spare.

Efficient Control, Plus Remote Monitoring Capability

In addition to tackling space constraints and ensuring optimum performance year-round, the over-the-fence solution is designed to efficiently and cost-effectively deliver compressed air. The team also added remote monitoring capabilities to the system to further support GKN's need for quality compressed air without fail.

Efficient production of compressed air is achieved through the use of an Ingersoll Rand X8i System Automation controller, which rotates the two 100 hp fixed-speed units to meet the majority of GKN's demand for air during the business week. The 100 hp VFD unit serves as a trim machine and supplies additional air needed when demand increases beyond the capacity and pressure of the base load air compressors. The controller also allows the VFD air compressor to carry the compressed air load on the weekends.

The team installed an UptimeRMX cloud-based diagnostic and analytic wireless remote monitoring system to the solution, which is

OUTSOURCING COMPRESSED AIR GIVES GKN SINTERED METALS PEACE OF MIND

particularly beneficial since GKN is over 150 miles away from TEC's office. The TEC team connected all of the compressed air equipment to the Uptime RMX 4G base unit, which allows it to view the system status, performance and history from any web-enabled device.

In addition to providing a customizable compressed air system overview, the web interface shows real-time data for pressure, acfm, ambient temperature, kW usage, uptime, and energy savings. It also serves as an extremely valuable service tool since it sends an email and a text message alert to TEC based on alerts issued by the X8i control, or a system alarm. It specifically relays the exact alarm code to allow a service technician to assess the situation remotely. Service technicians can then be dispatched when needed with the correct parts.

Worry-free Compressed Air

While the new compressed air system at GKN wasn't overly large it involved quite a few moving parts, which came together successfully during a short window of opportunity to install the system.

The GKN-TEC team carefully coordinated the installation during a scheduled compressed air system downtime. The project involved coordination of electricians, mechanical piping contractors, crane operators, and an air compressor technician to ensure the plant could be back up and running. Synchronization and teamwork allowed the installation to be completed in less than six hours.

In addition to the self-contained compressed air system, the team addressed a number of challenges associated with the existing piping

About Total Equipment Company

Total Equipment Company is based near Pittsburgh in Coraopolis, Pennsylvania. It also has a facility in St. Albans, West Virginia. For 35 years, the company has distributed and serviced fluid- and air-handling products for industries in Pennsylvania, West Virginia and beyond. As an Ingersoll Rand distributor, it has become the go-to source for air compressors and air system accessories, including dryer and filtration equipment. It offers the largest inventory of pumps, air compressors, blowers, mixers and mechanical seals in the region.

The company's equipment is used in a variety of applications, including construction, mining and water/wastewater. Energy companies also rely on the TEC to help them unearth natural gas from the region's Marcellus Shale.

In addition to it's extensive product offering, TEC provides air quality audits, leak detection and industry-specific solutions to enhance compressed air system efficiency and productivity. It has an extensive staff of factory-certified technicians who maintain, repair, and install equipment daily. The company is backed by Ingersoll Rand's more than 100 years' experience in compressor engineering, manufacturing, service and parts distribution. Offering unparalleled service has earned it the honor of being Ingersoll Rand's 2018 Distributor of the Year designation. Visit www.totalequipment.com

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featuring countless elbows, which impeded the efficient delivery of air. The team installed a new, larger piping system in a straight run. It also eliminated the older inefficient filters. The piping and new filters together eliminated of a pressure drop of six psig. This allowed the new compressed air system to be set at a lower pressure, while still satisfying the compressed air demand of the facility. Overall, the project resulted in an overall decrease of 245,340 kWh in energy consumption.

According to Gnan, the over-the-fence compressed air solution was a success by all counts since it freed up valuable floor space and alleviates any concerns associated with fluctuating costs for compressed air and maintenance of a compressed air system.

"It's very comforting to know what my compressed air is going to cost me for any given year," Gnan said. He also said he appreciates the ability to see up-to-the-minute data on the compressed air system since it provides valuable insights he wouldn't have had before.

"The remote monitoring system is extremely successful," he said. "The visibility and data collection ability give me a chance to take a closer look at how the plant is running. Anytime we see a jump in compressed air or electrical usage I can check to see what event caused that. This will provide plenty of opportunities to improve our overall efficiency."

Looking ahead, GKN plans to examine other plants elsewhere to determine where it might come out ahead by utilizing an over-the-fence compressed air system. BP

For more information about the over-the-fence compressed air system installed at GKN, contact Total Equipment Company Sales Engineer Jason Onyshko, tel: 412-269-0999, email, Jason.Onyshko@totalequipment.com, or visit www.totalequipment.com. For more information about the RMXUptime monitoring system, visit www.uptimermx.com.

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QUALITY, SAFETY & RELIABILITY

REDUCING THE GLOBAL WARMING POTENTIAL of Refrigerated Compressed Air Dryers

By Roderick Smith, Compressed Air Best Practices® Magazine

Long gone are the days when cost and performance could be the only concern for companies manufacturing refrigerated compressed air dryers using refrigerant compressors. In 2019, accelerated governmental (Europe) regulations and a global concern for sustainability have brought new considerations to the table. What is the Global Warming Potential (GWP) of the refrigerants used in dryers and what is their environmental impact?

There are trade-offs between energy efficiency and GWP with refrigerants. Environmental impact, therefore, cannot only be measured in terms of GWP. This complicates things significantly. Regulatory direction is driving innovation and the primary applications are in chillers for residential and commercial HVAC systems. The compressed air industry will observe and use what is decided upon by these applications.

With the Montreal Protocol, industry realized the ozone depletion potential (ODP) of the industry-standard refrigerants – specifically, chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) – a fairly immediate shift began to replace them with more environmentally friendly refrigerants. But, as we learned from talking to experts in a wide range of applications and locations, this shift has been far from linear, and has a long ways to go.

> "Globally, we have agreed on a phase-down schedule for HFCs. Notably, the US and China have not ratified it."
>
> — Mark Menzer, Director of Public Affairs, Danfoss

What is the future of refrigerants? Is it best practice to use one refrigerant over another? Do the experts in the field expect refrigerated compressed air dryers, using refrigerant compressors, to move primarily to any specific refrigerant? We found that the answer is complicated.

Refrigerated Compressed Air Dryer Application Basics

Compressed air leaves an air compressor at a high temperature carrying significant volumes of moisture. If this moisture isn't removed, it can cause a lot of damage and negatively impact manufacturing. Moisture will oxidize piping systems creating rust scale which can block pneumatic valves. Moisture can come into direct and indirect contact with food and pharmaceutical products, creating the potential for harmful biological growth. Moisture can also create product rejects such as when moisture impacts a painting process.

For this reason, compressed air dryers are today a standard component placed directly after an air compressor. The most common type is a refrigerated dryer using a refrigerant circuit and a heat exchanger to cool the compressed air to condense the moisture in the compressed air stream. A separator then physically removes the condensate and the compressed air continues on its way, now dried to a pressure dewpoint of 38 °F (3 °C).

A common practice today is to have the refrigerated compressed air dryer integrated into the air compressor package. This saves floorspace, reduces piping connections and allows for a dryer to be built specifically for an air compressor model.

Refrigerated compressed air dryers have normally used hermetic, piston type refrigeration compressors ranging from fractional to 3 horsepower for flow sizes from 5 to 1000 cubic feet per minute (cfm).

Refrigerated compressed air dryers use a refrigeration circuit and heat exchangers to condense and remove moisture from compressed air. Photo credit: SPX FLOW

REDUCING THE GLOBAL WARMING POTENTIAL OF REFRIGERATED COMPRESSED AIR DRYERS

A rotary screw air compressor with an integrated refrigerated compressed air dryer using R-513A refrigerant. Photo credit: Kaeser Compressors

These units have normally used low pressure refrigerants evolving from R-22 to R-134a today.

For larger refrigerated compressed air dryer sizes (1,000 to 10,000 cfm), semihermetic scroll refrigeration compressors have often been used. These have used medium pressure refrigerants like R-404a.

Three Options Enter the Refrigerant Ring

In the push to replace chlorine-based refrigerants, three alternatives have captured the majority of the market share: hydrofluorocarbons (HFCs), hydrofluoroolefins (HFOs), and natural refrigerants.

Each comes with a unique set of pros and cons. HFCs, for example, are often non-toxic and non-flammable and compatible with the most prevalent commercial refrigerated dryer and compressor technology. They do, however, emit greenhouse gases. Those gases can contribute to global warming.

That means that while their environmental damage is significantly lower than CFCs or HCFCs, their global warming potential (GWP) still needs to be considered – and minimized. As Tom Hoopes, Director of Marketing & Business Development at Vilter Manufacturing/ Emerson, says, "We have been doing this for years and see a continuing decline in HFC refrigerant requests and a desire to replace existing HFC systems with a sustainable alternative."

What's more, Mark Menzer, Director of Public Affairs at Danfoss, says "Globally, we have agreed on a phase-down schedule [for HFCs]. Much of the world has signed onto it and is following. Notably, the US and China have not ratified it, but we think it's prudent for companies to follow it. We will ratify it someday."

Natural refrigerants, then, seem full of promise at first glance. With no global warming impact, these refrigerants – like carbon dioxide, ammonia, and propane – seem like an ideal fit. They meet our need to cool and chill without harming the environment. At least, in theory.

But, in practice, they're often flammable or toxic, making them a challenge to integrate into any manufacturing or production environment. Justin Tuchscherer, Global Product Manager of Dehydration at SPX FLOW, explains, "As we get to the next levels of GWP requirements, you run out of non-flammable and non-toxic options." Additionally, natural refrigerants often require system redesign to be usable with much of the compressor and dryer technology on the market today.

HFOs seem like the next best thing, with low GWPs and greater compatibility with existing commercial dryer and compressor technology. But they can cause losses in delivered capacity, especially in high-pressure applications. In the work to minimize environmental impact, efficiency has to be a priority, making HFOs less than ideal for some applications.

With three options and none of them a perfect replacement, where is the industry headed? To find out, we first need to look at what's in use today.

The Current State of Affairs

First, it should be noted we spoke primarily with a small sampling of U.S. and European refrigerated compressed air dryer, chiller and refrigeration air compressor manufacturers. Many opinions on specific refrigerants, are driven by the choices made by the refrigerant compressor manufacturer. What is clear is that European regulators are forcing change to lower GWP refrigerants. As Roberto Sandano, Group Head of HVAC Marketing at CAREL (headquartered in Italy), points out, "Europe is leading the transition to different kinds of refrigerants." Their regulations surrounding GWP are significantly more stringent, so the state of affairs looks differently across the pond.

In the United States, HFCs are still sitting fairly comfortably. R-134a is fairly widely used in lower pressure applications, while R-410A is a frontrunner in higher-pressure compressors. Both are HFCs.

That said, R-134a has a GWP of 1,300 and R-410A's GWP is 2,088. When compared against HFOs and natural refrigerants, many of which have GWPs in the single digits, it's no surprise that companies have begun exploring alternatives. But the right solution depends on a range of factors, including the pressure of the application.

Refrigerated Dryers Below 1000 cfm: Low Pressure Refrigerants

In lower pressure applications, options seem to abound. In fact, Jeff Staub, Director of Application Engineering at Danfoss, says, "If you look at many of the centrifugal compressors used today, they can be used with the HFO refrigerants." At Danfoss, in particular, the transition from R-134a has begun. In their low-density applications, they're swapping R-134a for HFOs including R-513A, R-1234ze, an R-1234yf.

Kaeser Compressors manufactures stand-alone refrigerated compressed air dryers and also integrates them into their air compressor packages. "Kaeser uses R-513A in integrated refrigerated dryers in our air compressors," said David Phillips, Air Treatment Product Manager at Kaeser. "Up to 1,000 cfm, we will transition in 2019 all stand-alone Secotec and Cryotec dryers to R-513a," said Kaeser Air Treatment Product Engineer, Liam Gallagher.

In fact, R-513A seems to be pulling ahead as the winner in the low- and medium-pressure applications. SPX Flow Dehydration is also leveraging it. "We have already introduced R-513A refrigerated compressed air dryers in Europe," said SPX FLOW's Tuchscherer. With a GWP of 573 (less than half that of R-134a's GWP of 1430) and high compatibility with existing R-134a equipment, it's a fairly natural fit. Plus, it's got an ASHREA Safety Classification of A1, meaning it delivers low toxicity and low flammability.

Atlas Copco, meanwhile, has seen the same regulatory push necessitating the move to low-GWP alternatives. They were using R-410A, an HFC, in their low pressure (150 to 1,000 cfm dryers) reciprocating refrigerant compressor applications. But 2019 brought change. "Europe is phasing out R-410A starting this year," explained Mike Robinson, Product Marketing Manager of Oil Injected Screw Air Compressors (30kW - 90kW) at Atlas Copco

A stand-alone refrigerated compressed air dryer using R-513A. Photo credit: Kaeser Compressors

REDUCING THE GLOBAL WARMING POTENTIAL OF REFRIGERATED COMPRESSED AIR DRYERS

Compressors. He expects that as soon as R-452A is approved for industrial use in the United States, they will primarily use it as their lower-GWP replacement.

Refrigerated Dryers Above 1000 cfm: More Pressure, More Problems

But when an application calls for a higher-density refrigerant, like refrigerated compressed air dryers rated for more than 1,000 cfm, the waters are significantly less clear. R-404A has long been the go-to in this arena, but it has a GWP of 3922, the highest of any commonly used refrigerant today. So, clearly, an alternative is needed. But Staub asks, "What will be the end refrigerant? This is probably one of the areas of greatest turmoil. Today, there is no ideal solution as an R-404A replacement."

Danfoss is using R-1234yf in their medium-pressure applications, but Staub mentions that the full adoption has been contentious because you lose some efficiency when applying this refrigerant to units designed for R-134a.

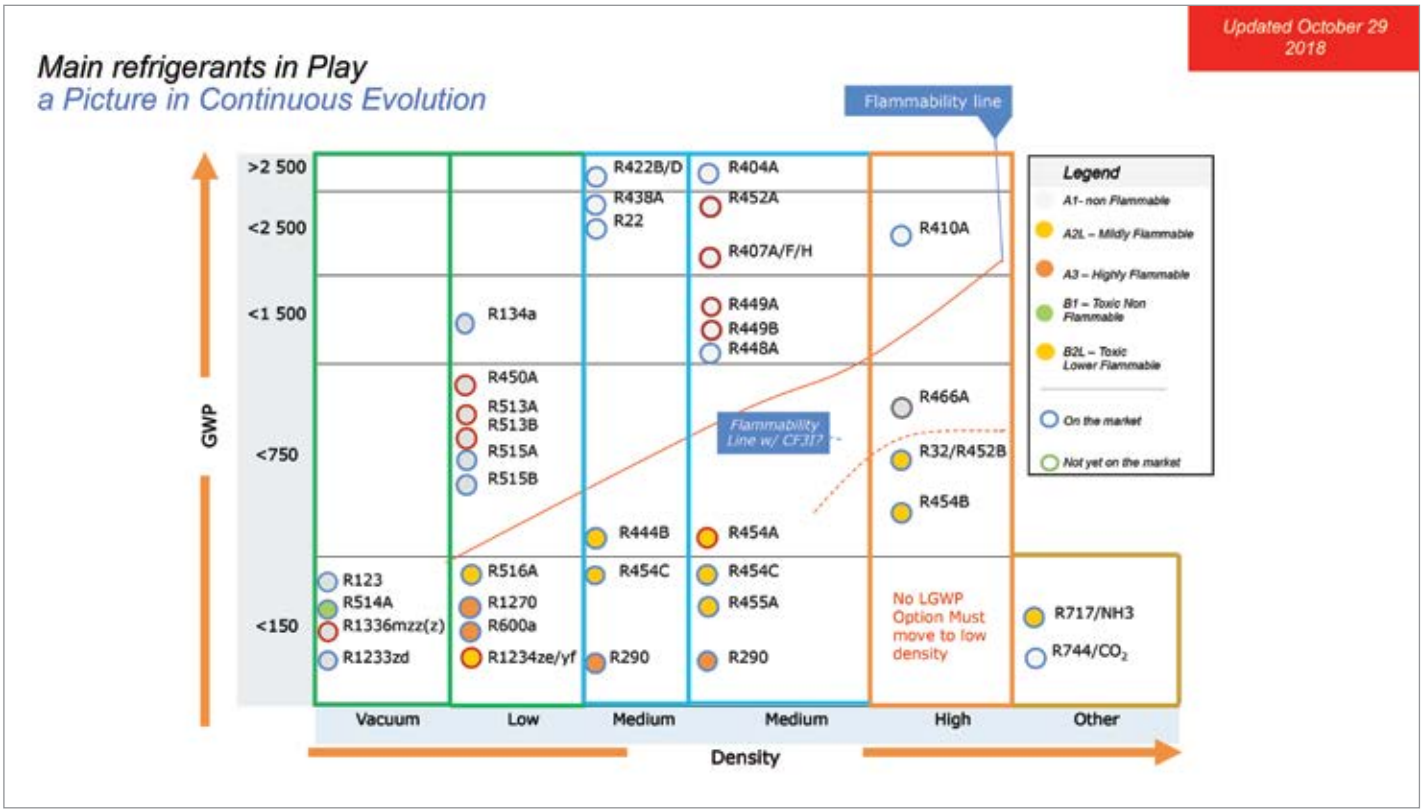
But one is needed. Mike Robinson, Product Marketing Manager of Oil Injected Screw Air Compressors (30kW - 90kW) at Atlas Copco Compressors, says that although they are currently using R-404A in their medium-pressure scroll compressor applications, "We're definitely going to continue to push to use refrigerants that have lower GWPs than we have now."

The hunt for an ideal high-pressure, low-GWP refrigerant continues. As this chart from Danfoss shows, no ideal solution has yet entered the market.

Going Natural

All this doesn't consider a third player on the stage: natural refrigerants. There are multiple options in this arena. As Hoopes explains, "The most common refrigerant in industrial applications is ammonia, but CO_2 is gaining momentum as contractors and design engineers become more comfortable with its unique system architecture. These refrigerants have a GWP of 0 and 1, respectively."

That's an impressively low GWP, but natural refrigerants don't come without their own drawbacks. Tuchscherer puts it succinctly, "My biggest concern with natural refrigerants are toxicity and flammability." Ammonia, for example, has a safety classification of B2, denoting higher toxicity. Similarly, propane has a classification of A3, meaning it's highly flammable.



In the bottom-right corner, the absence of a viable alternative underscores the need for continuing industry effort. Graph courtesy of Danfoss.

A larger 12,500 cfm refrigerated compressed air dryer using R-404A. Photo credit: SPX FLOW

If, as Hoopes suggests, more companies can get comfortable working with CO_2, they may find a solution there. CO_2 has a safety classification of A1, meaning it's low on both toxicity and flammability spectrums.

For now, the hunt for the ideal refrigerant continues. Hoopes says, "The trend in industrial refrigeration is toward lower-charge ammonia systems and ammonia/CO_2 cascade systems that utilize the benefits of ammonia but isolate it from the occupied space and product." As new systems are developed, the safety concerns associated with natural refrigerants – and new, low-GWP refrigerants in general – can likely be mitigated, opening up new possibilities.

Moving Forward: R&D, Safety Considerations, and more

The problem here is, of course, time. As Staub points out, "To qualify one refrigerant compressor on one new refrigerant, we're looking at about one year of research." As companies work to develop high-efficiency, safe, low-GDP refrigerants, the end users of these fluids find themselves waiting.

For now, as those paths are explored, companies will be well served by staying informed about the shifting governmental regulation and technological advancement that will drive the adoption of low-GWP refrigerants. BP

For more information contact Roderick Smith, Publisher, Compressed Air Best Practices® Magazine, at email: rod@airbestpractices.com.

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PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

KEEPING COMPRESSED AIR LEAKS to a Minimum at Petrochemical Plants

By Mike Grennier, Compressed Air Best Practices® Magazine

➤ Compressed Air Best Practices® interviewed James Nipper, Vice President of Petro Chemical Energy, Inc.

Good afternoon. It's been some time since we last visited. Please refresh our readers on Petro Chemical Energy, Inc.

Good afternoon. We are trained experts in performing energy loss surveys. We identify and report wasteful and expensive compressed air, nitrogen, steam and steam trap leakage at petrochemical and manufacturing plants. We have more than 75 years of experience in helping refining, chemical and manufacturing companies save millions of dollars in lost revenue annually.

What makes a compressed air leak survey at a petrochemical plant different than a survey at other manufacturing plants?

A petrochemical plant is just so much larger than the average manufacturing plant. The physical size of a petrochemical plant is measured in acres whereas the size of a manufacturing plant is measured in square footage. At a petrochemical plant, we're talking 20 to 30 acres and sometimes as much as 100 acres at a single site. It all needs to be surveyed.

In terms of compressed air systems, it's not unusual to see a plant with 10 to 15 air compressors, each of which is rated to provide 3,000 to 4,000 scfm of air. The air is used for everything from moving product, to powering pneumatic tools, pumps, and fans, to cleaning. There are easily 1,500 pneumatic control valves at a single plant.

The term, "petrochemical plant" is also a little misleading. There are two types of operations in this industry. Virtually every refinery has a chemical plant sitting right next door to it. We typically survey the refinery, which is an operation that processes crude oil into different components like gasoline. We also survey the operation's petrochemical plant, which takes the petroleum-based feedstock from the refinery and produces chemical products.

James Nipper, Vice President of Petro Chemical Energy, Inc.

How much compressed air is lost to leakage at these types of plants?

Normally, about 30% is lost to leakage. A plant can usually get that down to 15 to 18 percent with a good compressed air leak detection and repair program.

Some plants are more diligent about fixing compressed air leaks than others. We have a plant in Texas we survey every year. They've gotten their leaks down to about 8%, but that's unheard of in this industry. It took them five years to get to that level, but it can be done. It takes a very rigorous leak detection and repair program to stay on top of leaks. The reality, however, is most plants don't have the personnel to dedicate to it.

Why are there so many compressed air leaks at petrochemical plants?

The size of a plant and the amount of compressed air used has a lot to do with it. More air means more leaks. Plus, many of these plants are more than 100 years old.

You can also imagine there are a lot of places where leaks occur. Some of the biggest

offenders are loose tubing connections, piping connections, air traps, leaky regulators, holes in corroded pipes, and valve packings. And then you have open lines since valves are left partially open, or all the way open.

You run into all kinds of situations. For example, it's very easy for an air trap to become clogged with debris and no longer work. An operator will come by and open the valve to bypass the air trap, allowing air to blow directly to atmosphere as a stopgap measure until the trap is to be cleaned a short time later. But the operator can easily forget to close the valve later because it's very hard to hear the air leak with all the background noise at these plants.

A compressed air leak detection survey can take as many 12 weeks to complete. Engineering tape wrapped around leaks, such as the one shown here, makes them easy to spot for repair.

Given the size of these plants and the volume of compressed air leaks where do you even begin a compressed air survey?

We'll gather basic information before we start, such as the number of air compressors in use, the processes using the air, and areas the plant needs us to focus on. We also ensure the compressed air system is operating normally. That sounds basic, but we don't want to do a survey only to find out later one or more of the air compressors were shut down.

We'll then map out the route based on certain units of the plant identified, such as the powerhouse where most air compressors are located, or the boiler house, or the coker, or a specific process, etc. At that point, the surveyor will establish an inspection zone and walk up and down different pathways and structures to perform the survey. We're talking miles of pathways and 15-story structures that need to be surveyed.

Wow! That's a lot of territory to cover. How long does it take to complete a compressed air leak survey?

At smaller plants we normally complete a survey in about a week. At a larger refinery

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Gary Gillespie
President, Compressed Air & Gas Institute

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KEEPING COMPRESSED AIR LEAKS TO A MINIMUM AT PETROCHEMICAL PLANTS

or petrochemical plant it will take upwards of 12 weeks to do get the job done. That's just one person doing the survey, but we normally have two people survey a plant. One of them is a trainee because we need them to do on-the-job training.

We know the process involves the use of ultrasonic leak detectors, but help us understand how it's used.

An ultrasonic leak detector operates on sound and picks up noise the human ear can't hear. I like to tell people to think of it as a metal detector.

A surveyor will listen to the detector as it makes a hissing sound. Since ultrasound is a short wave signal it means the sound level will be loudest at the leak site. As such, the closer the surveyor gets to a leak, the louder the sound.

This is where experience comes in. Many plants have found they can't simply give an ultrasonic gun to one of their staff members, train him for a week, and have him go out and do a proper job. It just doesn't work that way. It takes us roughly a year to train our people to go out and do a proper air leak survey.

Why does a compressed air leak survey require so much experience?

The surveyor needs to know what to listen and what to look for, especially with the high level of noise in these environments.

For example, an experienced surveyor will hear a leak, zero in on it, and then look up to see where it's coming from and say, "Okay. That's an air regulator right there and it's the source of the leak." Or, he might say, "That's a steam leak. I've seen that before and it's not what I'm looking for," and move on.

Unless you're really careful you will end up with a lot of false readings. The ultrasonic leak detector doesn't know the difference between an air leak and a steam leak. It will also pick up multiple leaks at the same time, whether it's compressed air, steam or another type of compressed gas. This is where it gets into measuring the size of the leaks, which requires a combination of knowledge and methodology.

How does your team measure compressed air leaks?

Let me tell you what many others do first. Many say you should measure the leak based on the level of decibels the leak is putting out. And that's fine, but not at a petrochemical plant because you're going to get a lot of false readings with the constant background noise.

Many also suggest the use of a caliper to measure the diameter of the orifice of a leak

A metal tag with a stamped number identifies the source of a compressed air leak.

KEEPING COMPRESSED AIR LEAKS TO A MINIMUM AT PETROCHEMICAL PLANTS

to determine the CFM lost for that specific leak. The total number of leaks is then added up to determine the total CFM of air leakage. A universal mathematical formula is then used to estimate annual CFM and dollar loss.

Using a caliper for measuring isn't realistic for the types of surveys we do, however. If we used a caliper to measure 2,000 leaks at a single plant it would take us a year to complete the survey.

So instead of using a caliper, we physically feel the leak to assess the discharge pressure of a leak. To do this, our surveyor puts the back of his hand in the path of the leak and measures the approximate length of the air plume. We then assign a value to it in terms of small, medium, or large and assign a plus or minus factor to each value. We'll also note the rough size of orifice causing the leak.

Since your method of measurement isn't 100% scientific how accurate is it?

The CFM loss we assign to leaks is very conservative based on our experience with leaks. We know we can confidently tell our customers you're losing a certain amount of compressed air at the very least.

Our approach also takes into account the sensitivity of the ultrasonic leak detector, which again, can detect leaks the human ear can't pick up. If we hear a leak and then put our hand to it and can't feel it, it's not worth fixing it. The plant would rather focus on larger leaks that allow them to more effectively address the loss in pressure to avoid lost production, or the need to invest in additional air compressors and related equipment.

To put it in perspective, you might have a compressed air leak you can't feel in some cases. But, in other cases, you can have a leak large enough to blow the hardhat off an operator's head, which has happened.

That brings safety to mind. What are the safety training and precautions involved?

For starters, each of our surveyors takes literally 55 different safety lessons at our facility before he goes out on a job. The surveyor also goes through every plant's site-specific training program before stepping foot in the plant, which can take anywhere from a few hours to an entire week.

We also adhere to ongoing training. This includes daily "toolbox meetings" where we cover any number of safety topics. We also require our surveyors to take at least one online safety class every month. Additionally, our people are outfitted with all of the latest personal protective equipment, such as fire-retardant clothing and precisely calibrated gas monitors. This is all in addition to on-the-job training.

When working in a petrochemical plant it's vitally important for surveyors to be aware of their surroundings and what's happening at all times.

What does a surveyor do after he's identified a compressed air leak?

It depends on the type of leak. We recommend having a plant operator work with us when we survey the plant. That way, he can immediately fix leaks that only take a few minutes or less to fix. It's relatively easy to fix as many as 30% of the leaks during the course of a single survey.

If the leak can't be immediately fixed, we'll place an aluminum tag stamped with an identification number at the spot of the leak. We'll also wrap a piece of fluorescent engineering tape around the tag so it can be easily identified. The maintenance team will then come back and fix leaks as soon as they can get to them. Sometimes, the plant might choose to fix a leak during routine shutdowns of certain processing areas.

There are also times when we might see something like the same air regulator leak year after year. If we see something like that we'll suggest the plant replace it as part of its ongoing maintenance and repair schedule, if they can't get to it before then.

What's the final step in the compressed air leak survey process?

We provide the plant with a report in the form of an Excel spreadsheet. It includes the location and description of all leaks, as well as the rough size of the leak, the plume length and the estimated CFM loss. We'll also estimate the total dollar loss annually.

While a survey has a start and finish, every plant knows they need to survey their plant for leaks regularly whether that means doing it quarterly, twice per year, or annually. It depends on any number of factors, such as the condition of their piping, or whether the plant might have a higher-than-normal caustic environment.

Finding and fixing leaks at petrochemical plants is an ongoing battle and probably more so than most manufacturing plants. The goal is to keep them to a minimum.

Thank you for sharing more insights on this topic. BP

For more information, please contact James Nipper, Petro Chemical Energy, Inc., email: james@petrochemicalenergy.com, or visit www.petrochemicalenergy.com.

All photos courtesy of Petro Chemical Energy, Inc.

To read similar articles on ***Compressed Air Leak Surveys*** visit www.airbestpractices.com/system-assessments/leaks.

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PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

CHEMICAL PACKAGING PLANT SHAVES 41% Off Annual Electric Bill with Compressed Air Energy-Saving Measures

By Ron Marshall, Marshall Compressed Air Consulting

A chemical packaging facility had done everything right when they last upgraded their compressed air system a few years ago. They installed a Variable Speed Drive (VSD) air compressor and implemented other energy efficiency measures, but plant expansions caused increased system demand, which exceeded the capacity of the system. The packaging lines were now seeing low pressure, causing shut downs in production. And projections showed plant demand would increase even further.

This article discusses the upgrades to the system and energy efficiency measures applied to address the plant's issues. As a result of the improvements, the plant saved 41% on their previous compressed air-related electricity costs and better stabilized their air pressure.

Plant Flows Exceed Compressed Air System Capacity

The growing plant had upgraded their 30 horsepower (hp) modulating screw air compressor quite a few years earlier and added a 40 hp VSD air compressor with a smaller 25 hp fixed speed unit. That project gained them large capacity and energy savings. In addition to the new air compressor, the plant added cycling dryers, a larger storage receiver, and a pressure/flow controller to keep the air compressors running well, and to reduce plant pressure to a constant lower level, saving on artificial demand.

Back in the early days the production shift was eight hours per day, five days a week. But as plant output increased, the plant updated its production schedule to 24 hour per day, five days a week. Peak plant flows started to increase little by little, until gradually the capacity of the existing system was exceeded. When this happened, the plant pressures

Shown is a 25 hp fixed speed unit rated to deliver 100 cfm.

started to drop to as low as 65 psi, at times, because the air compressors could not keep up. As a result, plant managers called in a local compressed air auditor to do a study.

Multiple Opportunities for Energy Savings

The goals of the compressed air scoping study were as follows:

- To provide an operating profile and consumption report on the cost of compressed air operations in the facility.
- To provide commentary on any potential opportunities to improve compressed air related production processes.
- To generally determine how well the compressed air system is meeting the facility needs.
- To identify any compressed air system problems that could be solved in an energy-efficient way.

The readings and observations during the measurement period showed the compressed air system was operating at lower efficiency during peak operating times and good efficiency during average operation compared to similar optimized systems. It also showed small improvements were possible. In general, the study suggested better operation would be gained if the existing or new air compressors had the pressure settings properly coordinated so the fixed speed unit would not load and unload when it runs. It could also be set high enough to better contribute to adequate air pressure.

Data loggers were used to monitor the electrical input to the compressed air system in order to calculate the approximate annual electrical operating consumption. The data showed the annual energy consumption for compressed air was about 200,600 kWh with a peak demand of around 50 kVa. Average facility air loading was measured at about 76 cfm. Sustained peaks were seen around 200 cfm.

The compressed air system represented about 18% of the total facility annual electrical costs. Based on rates taken from the facility's electrical bill, the cost of operating the compressed air system was $20,000 per year, including taxes and typical maintenance costs.

CHEMICAL PACKAGING PLANT SHAVES 41% OFF ANNUAL ELECTRIC BILL WITH COMPRESSED AIR ENERGY-SAVING MEASURES

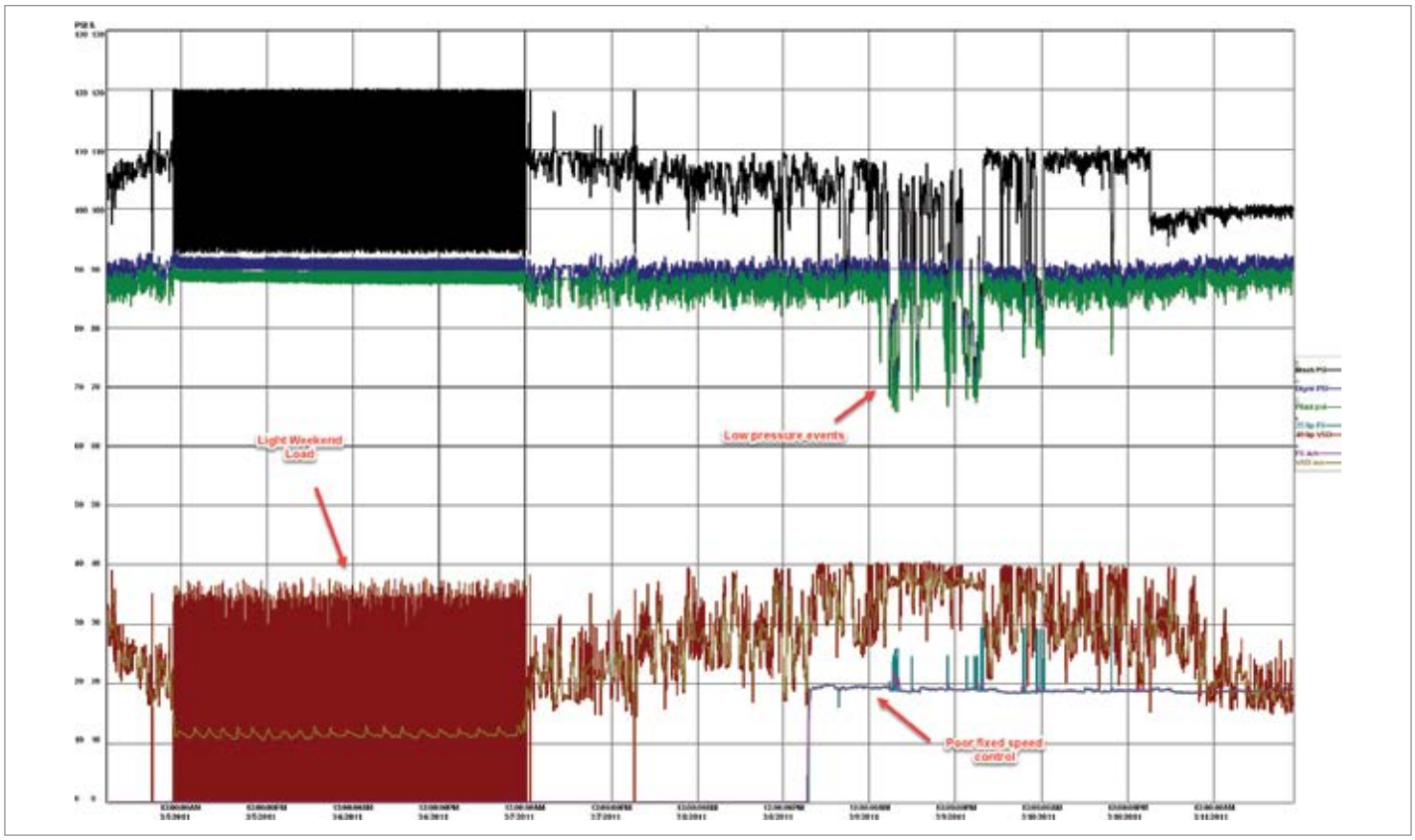

Figure 1: Low-pressure events at the chemical packaging plant led to production shutdowns and the need to evaluate compressed air supply and use.

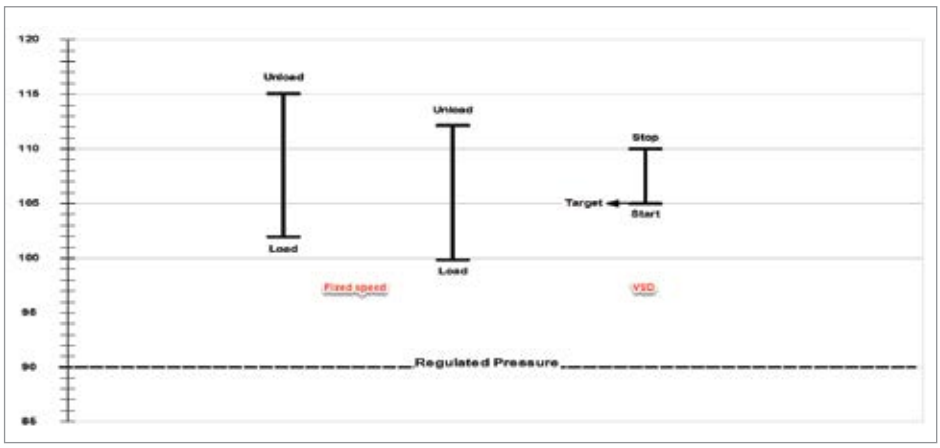

Figure 2: The recommended control band places the VSD inside the pressure band of the fixed speed compressors.

Analysis of the information collected showed some potential opportunities that would result in improvements in the operation of the compressed air system. It also showed potential savings in compressed air related electrical and maintenance costs of up to 37% of the base costs.

Opportunities for Savings with Supply-side and End-use Measures

The audit showed multiple opportunities for savings. A thorough assessment of the complete compressed air system led to the following recommendations:

Air compressor control and coordination – The existing air compressors had a problem with control pressure coordination. The smaller unit was not loading until the pressure dropped well below the set point of the VSD air compressor, and when loaded it ran in modulation mode. This is a common problem where the VSD compressor control bands need to be nested within the control band of the fixed speed unit as shown in Figure 2.

Air compressor hours – The auditor noticed there was no production on the weekend. The only load on the compressed air system was some heating and ventilation dampers and the dry fire system, both of which are very low loads that could be supplied by a small reciprocating air compressor. This would allow the main system to be turned off on weekends.

Backup capacity – The system peak capacity was measured at slightly over 200 cfm, but

the backup air compressor had only 100 hp capacity. This did not provide good reliability should the 40 hp VSD need to be shut down, or serviced. The 200 cfm peak meant both air compressors needed to run during peak demand.

Reduction of leakage – The plant leakage was measured at 25 cfm, which worked out to 30% of average system flow. Some reduction of this would save energy by reducing the air compressor loading.

End-use reduction – Four end uses were identified for optimization:

- Dust collector pulse valves – A dust collector in the plant had been poorly adjusted so the pulse valves were blasting for one half second rather than the recommended two-tenths of a second. The frequency of blasts was set higher than optimum, both conditions resulting in excessive compressed air consumption.
- Air crane – A compressed air powered crane lift was being used to move product. This crane consumed 35 cfm peak flow and contributed to plant peak demand. An electric crane was recommended that consumed about one-tenth of the equivalent electrical power.
- Vacuum – A compressed air-powered drum vacuum was being used that consumed about 60 cfm. It contributed to overall compressed air demand and had the potential to increase peak demand if used during peak production times.
- Air booster – A nitrogen system had been installed in a laboratory area that required compressed air at about 150 psi. Staff had installed a compressed air powered booster to increase the compressed air pressure to the required level used by the nitrogen generator. The booster consumed significant constant flow. A small reciprocating air compressor was recommended to more efficiently boost the air to high pressure.

A poorly adjusted blast valve and leakage created problems with this dust collector.

A pressure/flow controller kept plant pressure at a low level and reduced artificial demand.

Air dryers – The study recommended purchasing cycling air dryers if any new dryers were installed.

Filters – The auditor recommended oversizing any main filtration to reduce pressure loss.

Condensate drains – The study recommended changing timer drains to more efficient airless style units.

The study predicted the recommended changes would reduce the electrical consumption of the compressed air system by 37% over the existing system and improve the air pressure.

CHEMICAL PACKAGING PLANT SHAVES 41% OFF ANNUAL ELECTRIC BILL WITH COMPRESSED AIR ENERGY-SAVING MEASURES

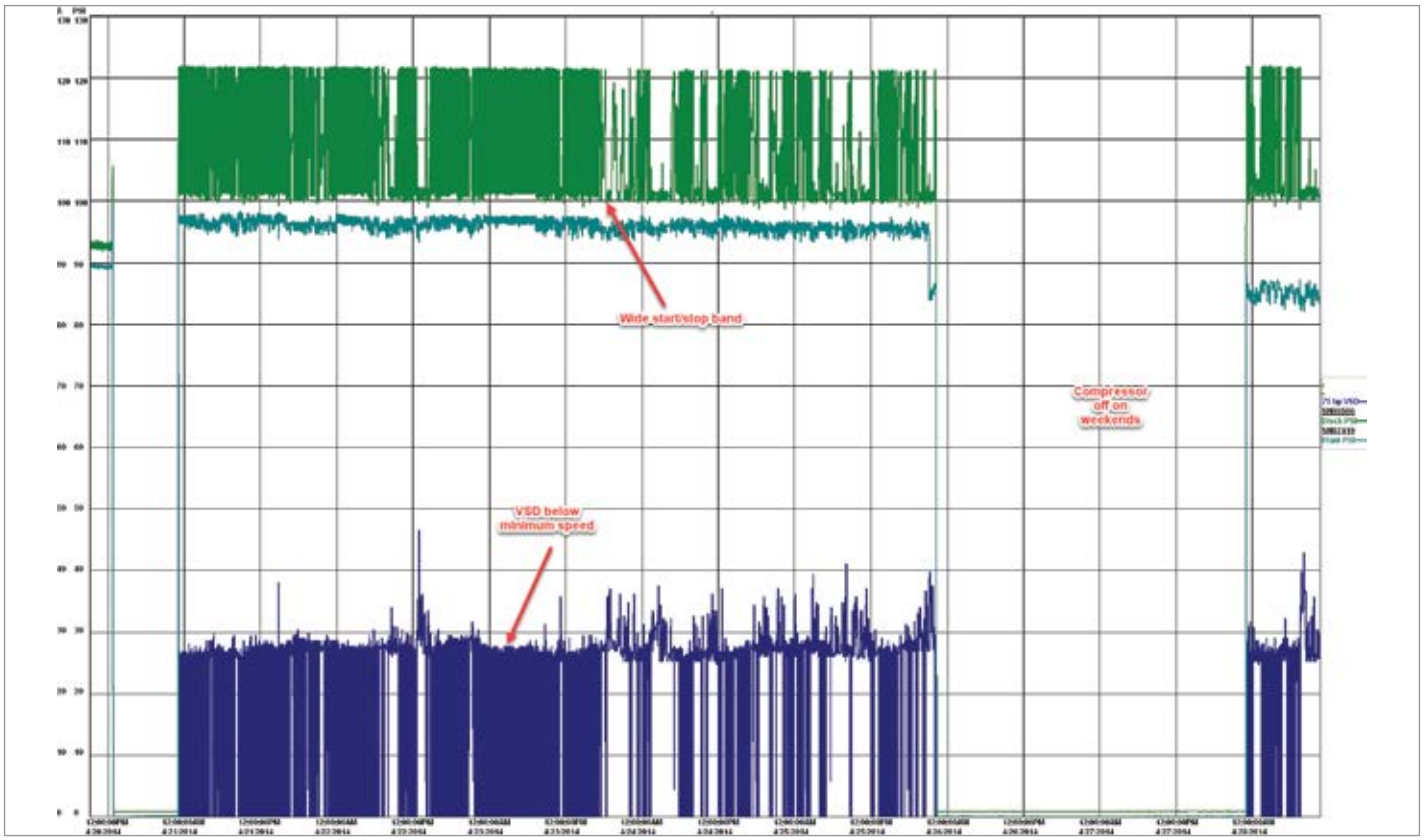

Figure 3: Running with a wide pressure band (green trace) allows the air compressor to run longer during minimum speed operations. Turning the system off on weekends saves energy that would normally feed leakage.

Plant management decided to upgrade system capacity by installing a larger 75 hp air compressor. The unit was installed with large storage capacity sized so the air compressor would start/stop with a low frequency if it ever ran at below minimum speed. It turns out with the reduction of the leakage and end uses the operation was frequently in this range. Operation at below minimum speed is not typically recommended because the air compressor will not build up enough heat to drive off any water that condenses in the lubricant.

Setting the pressure band very wide and using large storage allows the air compressor to run longer between starts, thereby better heating the air compressor. This comes at the expense of slightly higher energy consumption.

Plant Saves $10,000 in Annual Electrical Costs

Final numbers showed this project yielded higher savings than expected. Savings of 101,000 kWh were gained, saving slightly over $10,000 in electrical costs per year. Average load fell to 57 cfm with peak flow of 150 cfm. This load reduction meant the previous system would have been able to supply the plant, but production increases were planned so a larger air compressor was purchased. The power utility granted a financial incentive of over $16,000 to help pay for the project.

This project showed the value of bringing in a compressed air auditor to have a look at the system. Often only the supply side of the system is looked at, with potential end use and leakage reductions overlooked. It pays to evaluate the complete system. Often end uses yield significant savings that can reduce electrical cost and qualify the plant for a larger financial incentive from the power utility. BP

For more information contact Ron Marshall, Marshall Compressed Air Consulting, tel: 204-806-2085, email: ronm@mts.net

To read more ***System Assessment*** articles please visit www.airbestpractices.com/system-assessments.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

New Parker CDAS and OFAS Drying and Filtration Systems

Parker Hannifin Industrial Gas Filtration and Generation Division has introduced a new range of integrated drying and filtration systems: the Parker dominick hunter Clean Dry Air System (CDAS) and Oil Free Air System (OFAS) featuring innovative technology to ensure validated air quality and efficient operation.

The air quality is third-party validated to ISO 7183 and ISO 8573-1 for both systems, while OFAS also offers Class 0 with respect to total oil from both oil-lubricated and oil-free air compressors. This classification ensures the highest quality air at the point of use for critical applications at a fraction of the cost of a dedicated oil free air compressor.

The innovative systems have been designed to provide consistently high performance even over an extended period of time. They use a special high-strength desiccant cartridge with snowstorm filling that maximizes packing density, prevents channeling effects, guarantees a consistent dewpoint and contributes to an extremely low differential pressure, all of which helps to reduce the energy consumption of the air compressor. Minimum total cost of ownership and the best cost-benefit ratio of any high-quality air treatment solution is guaranteed through reduced service times, more simplicity in the replacement of parts, maximum uptime, extended maintenance periods and longer operational life. Advanced filters used in the CDAS and OFAS systems include state-of-the-art OIL-X technology and are available in four different variants (water separation, coalescing, dry particulate and oil vapor removal). Additional highlights include:

- Standard energy saving technology automatically adapts the dryer operation to the ambient inlet conditions and compressed air demand, ensuring optimum energy consumption and full utilization of the desiccant material. The result is reduced maintenance and significantly lower energy costs with savings of up to 85%.
- Full bore internal flow paths and full-bore cylinder valve systems provide full airflow and decrease the system differential pressure, helping to significantly reduce compressor energy consumption.
- Large HMI display screens provide real-time information of the system status and operating conditions.
- The purge setting can be set at minimum operating pressure easily, without the need for specialist tools.
- Threaded top end-caps enable the straightforward replacement of the desiccant cartridges, enabling a quick desiccant change without the need for special tools.
- Corrosion protected columns ensure a long operational life and come with a 10-year guarantee.

About Parker Hannifin

Parker Hannifin is a Fortune 250 global leader in motion and control technologies. For 100 years the company has engineered the success of its customers in a wide range of diversified industrial and aerospace markets. For more information, visit www.parker.com.

The Parker dominick hunter Oil Free Air System (OFAS) provides validated air quality and efficient operation.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

Champion Pneumatic Launches D/DRS Series Rotary Screw Compressors

Champion Pneumatic is expanding their product line by launching the new fixed speed D Series and the energy saving variable speed DRS Series rotary screw air compressors.

These cost effective 5-200 horsepower (hp) compressors, offer a flow range of 16 to 926 cfm and working pressure up to 145 psig. D and DRS Series compressors are ideal for continuous-use applications with reduced noise levels as low as 63 dBA for customer satisfaction. These easy-to-use compressors feature convenient control solutions to monitor and simplify maintenance for reliable and efficient performance. D and DRS Series compressors feature clean, service-friendly designs.

The robust, semi-integrated airends and intuitive layouts, with minimized connections, spin-on oil filters and air/oil separators make these units maintenance friendly. Models available now include 40, 50, 75 and 100 hp fixed speed (D Series) and 50, 75 and 100 hp variable speed (DRS Series). Additional D and DRS Series products will be released, in the coming months, culminating in 5-200 hp rotary screw offering. For more information, please visit: www.gardnerdenver.com/en/champion/products.

D/DRS Series compressors are ideal for continuous-use applications

About Champion

Champion is part of Gardner Denver, a leading global manufacturer of highly engineered products. Champion provides the highest quality reciprocating and rotary air compressor systems, parts and service. Utilizing a century of experience in design and manufacturing air compressor systems, we know and understand the application of our products in many different operating environments. With the compressed air market's widest breadth of compressed air products – reciprocating, rotary vane, rotary scroll, and rotary screw – choosing the right product for the application is key to continuing the success that was started in 1919. Champion has more than 500 authorized air compressor Distributors and Service Centers available to sell or service your compressed air system. For additional information please visit: www.gardnerdenver.com/en/champion

New Atlas Copco ZR 90-160 VSD+ Oil Free Rotary Screw Air Compressors

Atlas Copco Compressors has expanded its oil-free air compressor offering with the introduction of the new ZR 90-160 VSD+ (120-200HP) – delivering an average of 12 percent energy savings when compared to the previous industry-leading savings of the former generation. The most recent version of the ZR series provides the latest technology in oil-free rotary screw air compressor innovation – available with or without an integrated dryer; savings of up to 35 percent are possible depending on the application.

Ideal for applications in the food and beverage, electronics, automotive, textile and pharmaceutical industries, the water-cooled ZR 90-160 VSD+ is equipped with two high-efficiency permanent magnet motors, state-of-the-art compressor elements, and a redesigned monitoring system. The drive design of the ZR 90-160 VSD+ incorporates Atlas Copco's most sophisticated Variable Speed Drive (VSD) technology – NEOS drives combined with permanent magnet motors. The dual motor concept allows automatic variable synchronization of the independently driven airends ensuring maximum operating efficiency at every speed.

Clean and dry air is guaranteed. The ZR 90-160 VSD+ is available with an integrated MDG rotary drum dryer, providing a stable and guaranteed pressure dew point of -40°F at almost zero energy cost. The design and

TECHNOLOGY PICKS

sealing of the venting chamber ensure physical separation between the oil and air circuits, eliminating any possibility of oil entering the compressed air chamber and guarantees Class 0 oil-free air.

"The latest generation of ZR compressors significantly cuts energy consumption and reduces environmental impact by adjusting output to match process needs," says Neil Breedlove, vice president of oil-free air solutions in the United States. "Its adjustable water-cooled motor features full regulation between 15 to 100 percent of the maximum capacity to save even more energy at reduced air demand."

All components in the compressor element, such as the rotor profiles, smart inlet and rotor coating, have been redesigned for maximum efficiency and durability. The IP66 motors and new drivetrain offer complete protection from dust and moisture – while maintaining extreme levels of efficiency. The new ZR models can work in extreme temperatures up to 131° F (55°C). All this is possible with a footprint that is up to 20 percent smaller than comparable machines on the market.

New Atlas Copco ZR 90-160 VSD+ Oil Free Rotary Screw Air Compressors

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

The redesigned cooler incorporates a highly efficient water separator. Parallel water flow optimizes cooling of the motor, element and the cooler itself. Enlarged stainless steel surface coolers improve cooling efficiency and ensure top performance over a long lifetime.

The ZR 90-160 VSD+ is equipped with the new, user-friendly Elektronikon® Mk5 Touch Controller to optimize system pressure and maximize energy efficiency. The new Touch Controller includes warning indications, maintenance scheduling and online visualization of the machine's condition. This works together with Atlas Copco's new Optimizer 4.0 central controller. It enables a compressed air system to be optimized through selection of the most efficient combination of air compressors while assuring supply of required pressure and having balanced running hours.

The data monitoring program, SMARTLINK is integrated as a standard feature. This remote monitoring system provides analysis of the whole compressed air system on how you can reduce energy costs and plan your preventive maintenance. The ZR 90-160 VSD+ can be included in a Total Responsibility Plan, in which Atlas Copco takes care of all compressor maintenance, upgrades, repairs and possible breakdowns.

Atlas Copco Group & Atlas Copco Compressor Technique

Great ideas accelerate innovation. At Atlas Copco, we have been turning industrial ideas into business-critical benefits since 1873. Our passionate people, expertise and service bring sustainable value to industries everywhere. Atlas Copco is based in Stockholm, Sweden with customers in more than 180 countries and about 37,000 employees. In 2018, revenues were BSEK 95, approximately 10 BUSD.

Atlas Copco Compressors

Atlas Copco Compressors LLC is part of the Compressor Technique Business Area, headquartered in Rock Hill, South Carolina. Atlas Copco Compressors provides innovative solutions including world-class compressors, vacuum pumps, air blowers, quality air products and gas generation systems, all backed with full service, remote monitoring and auditing services. With a nationwide service and distribution network, Atlas Copco Compressors is your local, national and global partner for all your compressed air needs. Learn more at www.atlascopco.com/air-usa.

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TECHNOLOGY PICKS

Siemens Introduces Sinamics G120X Drive Series

Siemens now offers its Sinamics G120X, a simple, easy-to-use drive, designed for use in pump, fan, and compressor applications in industries such as water/wastewater, HVAC/R, irrigation/agriculture, and in industrial environments.

Sinamics G120X has a power range of 1–700 horsepower and can operate in a temperature range from -4 °F to 140 °F (-20 °C to 60 °C) with any standard motor. An integral DC choke improves harmonics and EMC performance. The G120X is suitable for harsh environments and a high C2 or C1 EMC category ensures the drive can be reliably used in any kind of industrial and public networks.

The new drive meets all the latest UL, NEMA and EN/IEC standards for 2019 offering an operating efficiency level of over 98%. Its comprehensive range of integrated application-specific functions for pumps and fans ensures improved energy efficiency, performance, and minimal energy losses. The compact design saves space in the control cabinet and can also be easily integrated into MCC solutions.

"The Sinamics G120X offers outstanding 'out-of-the-box' ease of use and is simple to commission and operate using its high-resolution graphical color keypad, known as IOP-2, as well as the optional Wi-Fi-enabled Smart Access wireless module – both optimized for pump and fan applications," said Nikunj Shah, Product Manager, Siemens, Digital Factory, US.

"Sinamics G120X drives offer an automatic restart function after power failures and the multi-pump/staging operation mode allows the user

Sinamics G120X easily integrates into existing applications.

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TECHNOLOGY PICKS

to control several pumps using just one drive. Its energy-saving mode automatically switches the motor on and off to save energy and reduce wear. G120X also has built-in energy functions which display energy consumed, as well as energy saved," he said.

Compatible with Mindsphere and the Mindsphere app, Analyze MyDrives, the G120X offers the opportunity to analyze valuable operating data gathered from the drive and enables the visualization and analysis of status information, providing users with valuable data, which can be used as the basis for process optimization and maintenance strategies. Mindsphere is the cloud-based operating system from Siemens that connects products, plants, systems and machines, while enabling a user to harness a wealth of data.

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Siemens Corporation is a U.S. subsidiary of Siemens AG, a global powerhouse focusing on the areas of electrification, automation and digitalization. One of the world's largest producers of energy-efficient, resource-saving technologies, Siemens is a leading supplier of systems for power generation and transmission as well as medical diagnosis. With approximately 379,000 employees in 190 countries, Siemens reported worldwide revenue of $94.0 billion in fiscal 2018. Siemens in the USA reported revenue of $23.7 billion, including $5.0 billion in exports, and employs approximately 50,000 people throughout all 50 states and Puerto Rico. For more information visit, www.siemens.com

IMI Norgen® B17 Combination Filter/Regulator Offers Flexibility, Performance

The IMI Norgren® B17 filter/regulator combination unit for filtering and regulating compressed air gives engineers and designers in industrial automation, energy, mining and other demanding industries greater flexibility and robust performance.

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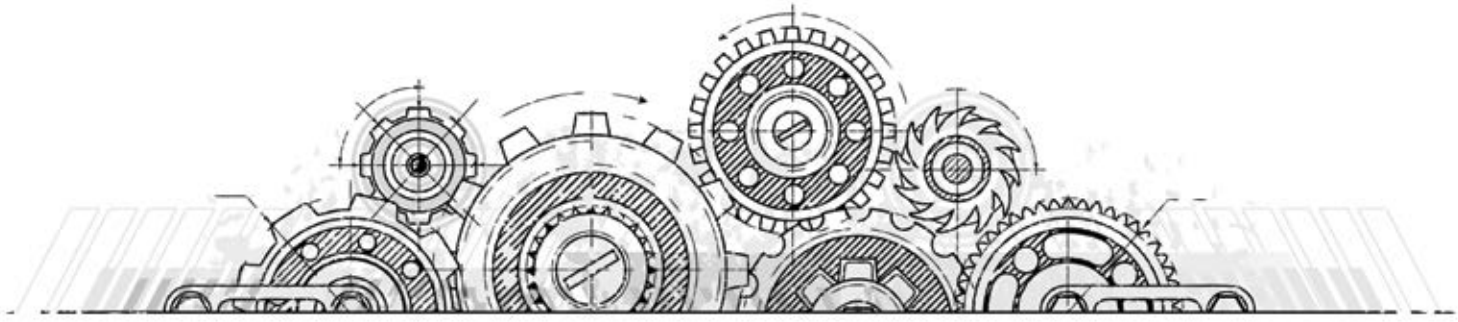
The IMI Norgren B17 filter/regulator combination unit gives users options to meet space and design requirements.



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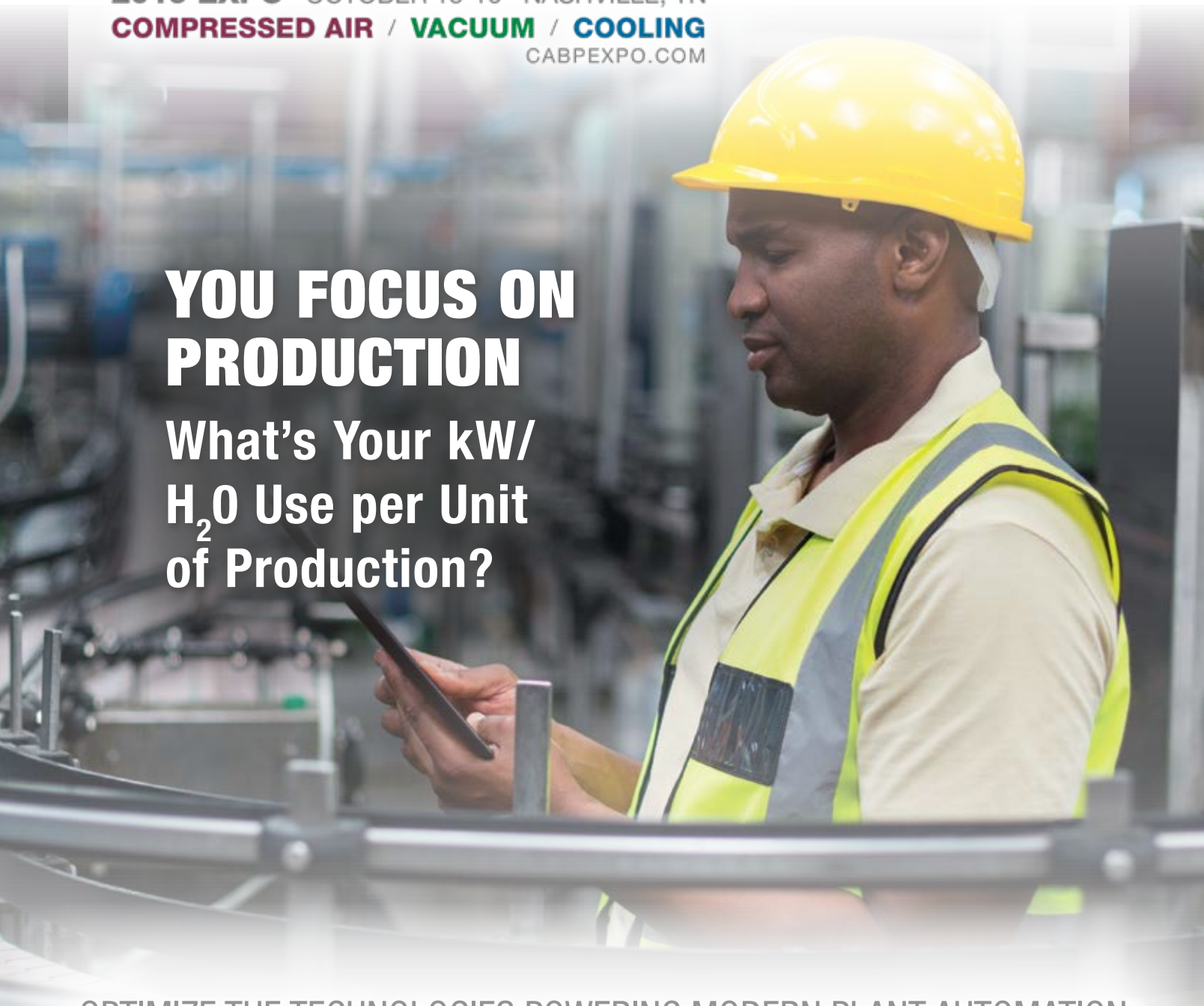

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