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FEATURES

QUALITY, SAFETY & RELIABILITY FEATURES

PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION FEATURES

COLUMNS

FROM THE EDITOR | Chemical Plants

The importance of Maintenance Personnel in the reliable and efficient performance of compressed air systems is finally getting my full attention. If any readers would like to write about this area, please let me know.

Quality, Safety and Reliability

I'd like to thank Kurt Kniss, from Shaw Industries, for sending us an insightful article pointing out "Sustainability also means operating a system consistently in the manner it was designed." Reliability and maintenance are often overshadowed by energy conservation and his article points out their importance in "maximizing the life and performance" of the air compressor.

Compressed air monitoring and controls can have a significant impact on reliability. I'm sure you'll enjoy Tim Dugan's insightful article titled, "Reliability: Should Compressed Air Monitoring be Combined with Control?"

The Association of Independent Compressor Distributors held their annual meeting and again I was honored to be invited to participate. I hope you enjoy my "2019 AICD Show Report" to get a taste of what goes on and who attends this excellent annual conference and trade show.

Productivity, Sustainability & Energy Conservation

Since the Best Practices Expo & Conference will take place in Nashville this year, we continue to highlight plants who partner with Tennessee's Department of the Environment & Conservation (TDEC). This month we highlight SumiRiko's automotive parts plants located in Midway and Tazewell,Tennessee. As a member of TDEC's Tennessee Green Star Partnership program, SumiRiko allowed us to write about their significant improvements to their compressed air systems. Check out the pictures of Gardner Denver's new VFD air compressors!

Variable Frequency Drives (VFD's) have of course made a big and positive impact on the energy efficiency of compressed air systems. Our industry has learned a lot about when and how to deploy them. I know you'll enjoy Ron Marshall's article covering how to operate and control multiple VFD air compressors in one plant.

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

ROD SMITH, *Editor*
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INDUSTRY NEWS

Atlas Copco Acquires a Pennsylvania-based Distributor of Compressors

Atlas Copco has acquired the operating assets of Taylor Air Center, a division of Vallen Distribution Inc. The company has around 20 employees and is located within the densely populated Lehigh Valley, Pennsylvania.

"Taylor Air Center has a very long history of being a successful distributor and has a well-served, established customer base," said Vagner Rego, Business Area President Compressor Technique.

Taylor Air Center sells mainly directly to end users across a focused range of market sectors, along with some sales to smaller resellers in their region. The purchase price is not material relative to Atlas Copco's market capitalization and is not disclosed. The acquired business will operationally become part of the Compressor Technique service division.

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.

Atlas Copco Compressor Technique partners with customers to turn industrial ideas into smart, connected air and gas solutions and leading edge compressed air technology. By listening to our customers and knowing their needs, we deliver value and innovate with the future in mind.

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.

Hertz Kompressoren USA Rotary Screw Air Compressors Receive Certification

Hertz Kompressoren USA, Inc. rotary screw air compressors have been certified by the Compressed Air and Gas Institute's (CAGI) Performance Verification Program.

Hertz Kompressoren full line of rotary screw compressors have been verified against CAGI data sheets by independent third-party testing (Intertek). Based on this testing, the rotary screw compressors are now certified by CAGI.

The Hertz Kompressoren CAGI certified rotary screw compressor.

Hertz Kompressoren is one of only eleven of the twenty compressor manufacturers members, that have participated in this verification program, to receive the CAGI certification. The certification means that hertz compressors perform exactly to the standards the company publishes. Certification is an assurance that a hertz compressor will meet the users intended performance.

The CAGI Program provides a means for users to assess and compare brands and models before purchasing and eliminates the need for interpretation of non-standard data. Because hertz units perform in accordance with the information on the data sheets, they are certified to carry the official CAGI Performance Verification Program label. Compressed air users are invited to view the Data Sheets for compressors at www.hertz-kompressoren.com/us or contact their local hertz Kompressoren USA, Inc. representative for information.

CAGI Launches Personnel Certification Program

The Compressed Air & Gas Institute (CAGI) has officially launched its new Certified Compressed Air System Specialist (CCASS) program. The program provides a means of verifying the capabilities of professionals in the compressed air systems industry. The program will allow customers, utilities, employers, and others to have confidence in the skills and abilities of the professionals in the industry who design, service, sell, and install compressed air systems and compressed air systems equipment.

"CAGI believes the certification program will raise the credibility and confidence in the industry and help qualified individuals differentiate themselves as certified compressed air professionals," said Wayne Perry, chair of CAGI's System Assessment Section.

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INDUSTRY NEWS

CAGI's Compressed Air System Specialist certification.

Information on the program and the registration process can be obtained from CAGI's website: www.cagi.org/personnel-certification. A Certified Personnel Directory of compressed air professionals who have passed the exam and now possess the CCASS designation can be downloaded from the website as well.

Coming soon will be a program for Certified Compressed Air System Assessors (CCASA). This program will be for compressed air system assessors and will provide a means of verifying an assessor's understanding of and ability to apply the industry's audit standards.

About CAGI

For more than 100 years, the Compressed Air and Gas Institute has been the leading source on all matters related to compressed air. As the united voice of the industry, CAGI's activities include the development and organization of educational material including compressed air system training programs to benefit the users of compressed air systems. For more information visit www.cagi.org or email: cagi@cagi.org.

Best Practices EXPO & Conference Announce Initial Keynote Speakers

Best Practices EXPO & Conference (October 13-16, 2019) has announced select Keynote Speakers for the October event. Known for bringing together a diverse group of credible experts, industry leaders and technical professionals to share compressed air, vacuum, blowing, and cooling system energy management and water conservation best practices, Best Practices EXPO & Conference helps improve plant profitability through industrial utility optimization.

Keynotes announced today include a pioneer in energy treasure hunts, Bruce Bremer, Eastman's Manager of Global Natural Resource Management, Sharon Nolen, President of the Compressed Air & Gas Institute, Gary Gillespie, Corporate Energy Engineering Lead on the energy team for General Mills, Leslie Marshall, Ball Corporation's Manager of Demand Side Energy – Sustainability, Doug Barndt, and Nissan North America's Senior Energy Engineer, Brett Rasmussen.

"Best Practices EXPO & Conference is becoming a premier destination for technologies, ideas and innovations in compressed air, vacuum, blower and cooling systems. We are pleased to bring strong programming that represents a diverse group of pioneers in industrial energy and water conservation measures," said Rod Smith, Publisher, Smith Onandia Communications and producer of Best Practices Expo & Conference. "The depth and breadth

Doug Barndt, Ball Corporation

of knowledge these speakers bring to the event is an excellent indicator that this is going to be a great conference."

Attendance to the Keynotes is included in the free exhibit hall pass and registration is now open. The conference program is organized into 4 Tracks, Quality & Safety Management, Facility Maintenance & Reliability, Energy Conservation / IoT Monitoring, and Water Conservation / Energy Management. There will be Spanish interpreters on-site for the Energy Conservation/ IoT Monitoring Track.

Keynotes

Doug Barndt (Ball Corporation) – Doug Barndt started the energy management program for Ball North American Packaging businesses in 2006. He has worked with plant operators to implement hundreds of capital projects ranging from compressed air, lighting, ventilation, drive power, process optimization, etc., to performance metrics and low/no cost measures, for existing and new operations.

Bruce Bremer (Bremer Energy Consulting Services) – Bruce Bremer is the former Corporate Manager of Facility Engineering at Toyota Motor Engineering and Manufacturing in North America. He currently advises companies and organizations in developing competitive

Bruce Bremer, Bremer Energy Consulting Services

INDUSTRY NEWS

approaches that reduce the economic and environmental impact of energy by building a culture of continuous improvement through programs such as, treasure hunts, energy workshops, and long-term energy strategies. He also serves as a Strategic Advisor for the U.S. EPA ENERGY STAR Industrial Program.

Gary Gillespie (Gardner Denver/Compressed Air & Gas Institute) – Gary Gillespie joined Gardner Denver, Inc. in May of 1981 and currently serves in the role of Vice President, General Manager for the Americas. In that capacity, he has responsibility for all Compressor, Blower, Vacuum and Industrial Pump products including six plant operations located in Brazil, Canada and the United States. Gary also serves as the President of the Compressed Air & Gas Institute.

Leslie Marshall (General Mills) – Leslie Marshall specifically works with teams at food processing plants by strategizing initiatives and capital projects to reduce their energy consumption and greenhouse gas emissions. Through their hard work and dedication, General Mills' North American processing facilities have exceeded their 20% energy intensity reduction commitment four years ahead of their target date.

Gary Gillespie, Gardner Denver and the Compressed Air & Gas Institute

Sharon Nolen (Eastman) – Sharon Nolen has spent 30 years at Eastman where she has held a variety of leadership positions in Process Engineering, Plant Engineering, Corporate Quality, Information Technology, and Utilities Division before assuming leadership of the Worldwide Energy Program in 2010. Under her leadership, Eastman has been recognized by EPA for eight consecutive years as an ENERGY STAR® Partner of the Year. Sharon is Eastman's representative for the Department of Energy's (DOE) Better Buildings, Better Plants Challenge Program.

Leslie Marshall, General Mills

Sharon Nolen, Eastman

Brett Rasmussen, Nissan North America

Brett Rasmussen (Nissan North America, Inc.) – Brett Rasmussen has over 15 years of experience in Aerospace engineering and over 16 years as a Utilities/Energy Engineer for the automotive industry. He is instrumental in Nissan's Canton plant receiving the prestigious Energy Star for superior energy performance. The Canton plant was first industrial facility in the state of Mississippi that is Energy Star labeled and has been for 12 years in a row.

Best Practices EXPO & Conference is co-sponsored by the Compressed Air & Gas Institute and TVA EnergyRight® Solutions for Business + Industry.

About Best Practices EXPO & Conference

Best Practices EXPO & Conference is an event devoted exclusively to optimizing the technologies powering modern plant automation. The event hosts more than 100 exhibitors and a 96-session conference program featuring industry leaders who have profitably deployed energy and water conservation measures. For more information of Best Practices EXPO & Conference, please visit www.cabpexpo.com.

INDUSTRY NEWS

Festo Website Completely Redesigned

Festo unveiled today its first complete website redesign in more than 10 years – www.festo.us. The company's 30,000 products and accompanying engineering tools are now accessible more easily, quickly, and efficiently than ever before. A responsive design seamlessly adapts webpages to the customer's device – phone, tablet, laptop, or desktop.

With the new Festo website, products are more easily, quickly, and efficiently accessible.

"Festo is world-renowned for its innovative, cost-effective, and reliable automation solutions, and we've rebuilt our website to live up to those same standards," said Michael Zakrzewski, Vice President of Market Management – North America. "With the new website, we are taking the opportunity to strengthen and modernize how we represent our products and solutions to improve the level of online experience for our customers."

Product selection streamlined

Key enablers of faster product selection include an "every click counts" design strategy that reduces the number of clicks to navigate the site and the "easy product selection" design that allows users to quickly narrow down a product portfolio based on the features and associated accessories that are most important for the application. Filter functionality allows the customer to quickly pinpoint product, price, availability, and shipping. There is easy access to "how-to" materials such as tutorials, videos, CAD models, and technical documentation. Advanced search capabilities, category pages, and streamlined product detail pages round out the ease of use functionality.

Easy ordering

Ordering from Festo has never been easier. The new site allows customers to track availability, net prices, and shipping dates in real time. Shopping carts can be saved, shared, and will accept part and project quotations. Customized personal accounts maintain the customer's order history, repeat orders, and specified delivery requirements. There are more payment options to choose from, including credit card, PayPal, and invoicing.

Festo offers subassemblies and components in these areas:

Pneumatic actuators	Servo-pneumatics
Electromechanical drives	Motors and controllers
Grippers	Handling systems
Vacuum technology	Valves
Valve manifolds	Motion Terminal
Sensors	Image processing systems
Compressed air preparation	Air supply components
Electric cables and connectors	Control technology
Software	Process automation
Ready to install solutions	Function specific systems

The company serves the following industry segments:

Automotive	Electronics
Electromobility	Assembly and test
Semiconductor and electronics	Solar and flat panel
Food processing and packaging	Biopharma and cosmetics
Chemical	Water technology
Medical technology	Laboratory automation
Process automation	Textile
Machine tool	Woodworking
Printing, paper, and converting	Metal extraction and mining-process engineering

About Festo

Festo is a leading manufacturer of pneumatic and electromechanical systems, components, and controls for process and industrial automation. For more than 40 years, Festo Corporation has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performing, more profitable automated manufacturing and processing equipment. For more information on Festo solutions, call 800-993-3786 and visit the new Festo website at www.festo.us.

QUALITY, SAFETY & RELIABILITY

A Strategic Approach to Efficient and RELIABLE COMPRESSED AIR SYSTEMS

By Kurt A. Kniss, P.E., C.E.M., Shaw Industries, Inc.

There is much emphasis placed on compressed air systems because of their inherent inefficiency. There are many ideas and suggestions available that can be used to improve efficiencies, but usually only on a singular basis. But much can be done with the supply side of a compressed air system with the mindset of strategically moving forward with sustainable improvements.

When it comes to sustainability, we think nowadays of conservation, earth friendliness and being able to continuously use the resource in question without declining our existing fossil fuel reserves. Sustainability also means setting up a system and operating it consistently in the manner in which it was designed. Additionally, it means following through with planned and program-generated maintenance, as well as a routine set of maintenance tasks that will ensure maximum life of the air compressor with minimum unplanned downtime and maximum efficiency.

As a corporate engineer responsible for supporting operations, I write this article from the perspective of the plant/maintenance engineer who is responsible for the on-line operation of the compressed air system. This article can also help suppliers of compressed air systems gain some understanding of how their customers prioritize plant operations.

Compressed Air System Elements – Demand Side

A strategic approach to sustainable improvements starts by having a clear understanding of the overall compressed air system. Let's split the system into three basic elements which will be the demand-side, distribution system and supply-side. Let's first review the demand side.

The demand side of a compressed air system essentially describes how and where compressed air is consumed. Examples of devices using compressed air include air hoses, hand tools and pneumatic controls. Compressed air is also used to power cylinder and actuators that make any number of end-use machines work. The demand side of compressed air also factors in machine (pneumatic) controls, and air motors. Together, these machines typically determine the minimum air pressure needed throughout the plant. Changes to supply pressure can be complex and time consuming because they can affect production and/or quality performance of your plant.

"When deciding to make improvements in a compressed air system it's often best to start with a system evaluation."

— Kurt A. Kniss, P.E., C.E.M., Shaw Industries, Inc.

Here are two primary issues you might encounter:

- Validation trials – These are controlled periods of time where pressure is reduced and operating parameters are monitored in earnest to help determine validity. These trials can take a long time to perform and need the buy-in of many parties. Your own plant operations staff may be reluctant to support these efforts because they would rather not expose themselves to any more chance of production interruptions (unless they can see a price tag associated with this insurance).
- OEM warranty and/or performance concerns, etc. – Changes in supply pressure can be complex. Equipment providers are often reluctant to guarantee their system will work at lower pressures. They have provided conservative estimates previously, which have accounted for resiliency to system losses that are beyond their control.

Compressed Air System Elements – Distribution System

Let's look next at the compressed air distribution system. Its job is to transport the compressed air from its point of production (air compressors) to points of use. It consists primarily of the piping system, which encompasses headers, system piping and valves. Common issues include:

- Pipe sizing, spurs installed in the past, poor planning, etc. – The older your facility is, the more likely it is that equipment has been changed, added and/or deleted. Many times a compressed air supply was simply tapped to an existing pipe without looking upstream. The piping between the compressed air supply and your load might be a much longer (pipe) distance than thought because of how it was originally routed for past installations. There might already be significant load on that particular run in other areas.

A STRATEGIC APPROACH TO EFFICIENT AND RELIABLE COMPRESSED AIR SYSTEMS

- Air leaks – This is a constant issue in almost every plant. When making a survey and actually measuring flow, the leaks can be a significant part of that demand and can be an opportunity to reduce demand on the system and increase efficiency.

Compressed Air System Elements – Supply Side

The supply side of a compressed air system describes the components that generate, condition, store and centrally control the flow/pressure of compressed air. Typical components include:

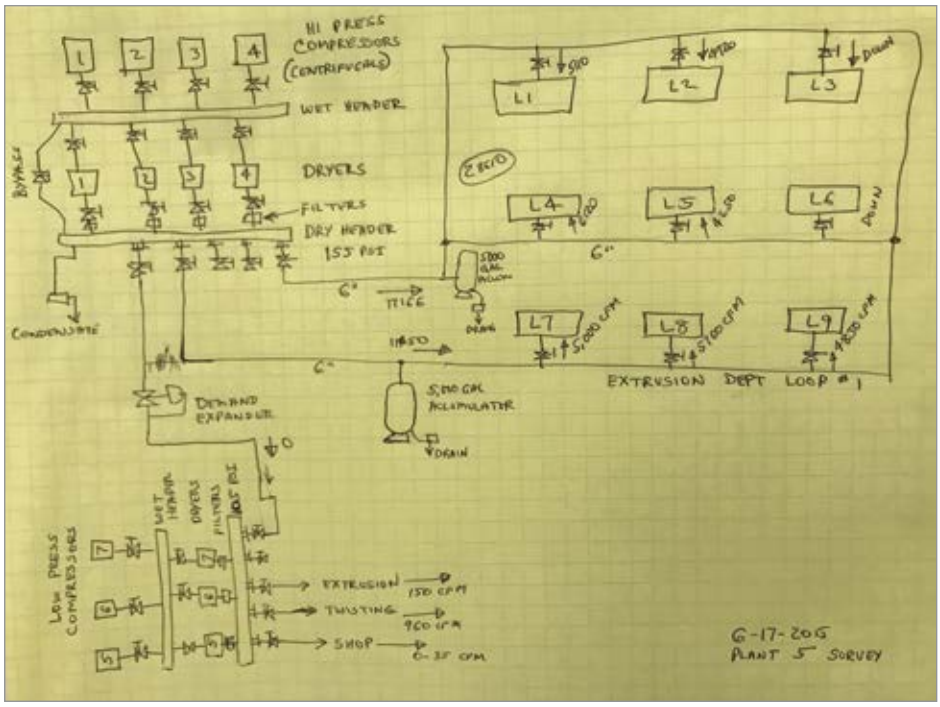
- Air compressors
- Wet header
- Air dryers
- Dry headers
- Filters and separators
- Receiver tanks
- Central controls

The overall efficiency of the system often depends on the plant's compressed air load and load variations, especially when multiple air compressors are involved. Your system most likely demands different amounts of air at different times of day. For example:

- A machine or process might have a surge of demand when starting up in order to fill cylinders, tanks, etc.
- There might be air hoses used at the end of a shift for cleaning the area (not the best practice but often a reality).
- Different processes might operate at different times of day, each with a different demand.

If you're wondering why it's important to have a thorough understanding of the complete compressed air system at your plant, consider the following:

- Compressed air as an energy source is less than 30% efficient when compared with the electricity used to drive the air compressor.
- Energy is typically the most expensive component in operating an air compressor throughout its useful life.



Shown is a typical compressed air system sketch, which has been mocked up based upon publicly available information.

- While gaining traction, efficient operation of compressed air systems still represents an enormous opportunity for cost savings and reliability gains.
- New air compressor and control technologies present a host of opportunities to improve system performance and reliability.

Start With a Compressed Air Evaluation

As with many initiatives, the key question is where to begin. When deciding to make improvements in a compressed air system it's often best to start with a system evaluation. Here are suggestions to implement a thorough and beneficial compressed air system evaluation.

As a first step, make an overview diagram of the compressed air system. This sketch might take days to create depending on the size and complexity of your system but it is important and it will be worth the effort once it's finished (Compressed Air Best Practices Magazine and Compressed Air Challenge offer helpful examples.)

The diagram should include:

- A list all equipment, such as air compressors, dryers, headers and piping. List the sizes of the air compressors, as well as the size of piping. Include important data, such as the quantity of all equipment and the condition of the equipment.
- Document demand load points. Where does the air go and how much goes where? It is good to know what percentages of total plant air are going to which processes, or departments.
- Details about airflow, including:
  - The total amount of air being produced for your plant.

- Where it goes, as mentioned above. Perhaps draw a map of how much air is used and how much is distributed to each department, or plant area.
- Airflow by time of day and/or day of the week.
- Load factor, including variation from minimum flow to maximum flow. Your plant demand varies by time of day. Perhaps a different data set is necessary for each shift or other particular times of day.

- Plant system pressure. What determines the system pressure setpoint? As described above, it is important to understand why system pressure is at the current level.

Create "Current-" and "Future-State" Diagrams

The next important step is to make a "current state" diagram simplified to just the air compressors, piping and demand areas of the plant. This way you can see where air comes from and where it goes. The diagram can be split into areas of the plant where flow can be measured and also designated points with specific demand for compressed air, or process areas.

It is also important to evaluate system performance. Doing so involves the use of an ammeter or a kilowatt meter to measure the power to the air compressor and comparing it with the actual airflow being delivered to the plant. Common ways to document performance are horsepower (HP) per cubic feet per minute (cfm) or cfm per kilowatt (kW), such as HP/100 cfm, or CFM/HP, or CFM/kW. It can also be documented by liters per minute per kW.

It is also very important to calculate cost in order to justify changes you want to make. Operating cost, just in energy, can be calculated by multiplying hours per week times the kW demand, times electricity cost per kilowatt hour (kWh). If you have trouble with these numbers, a vendor can often help and they are normally quite straightforward with calculations and data provided.

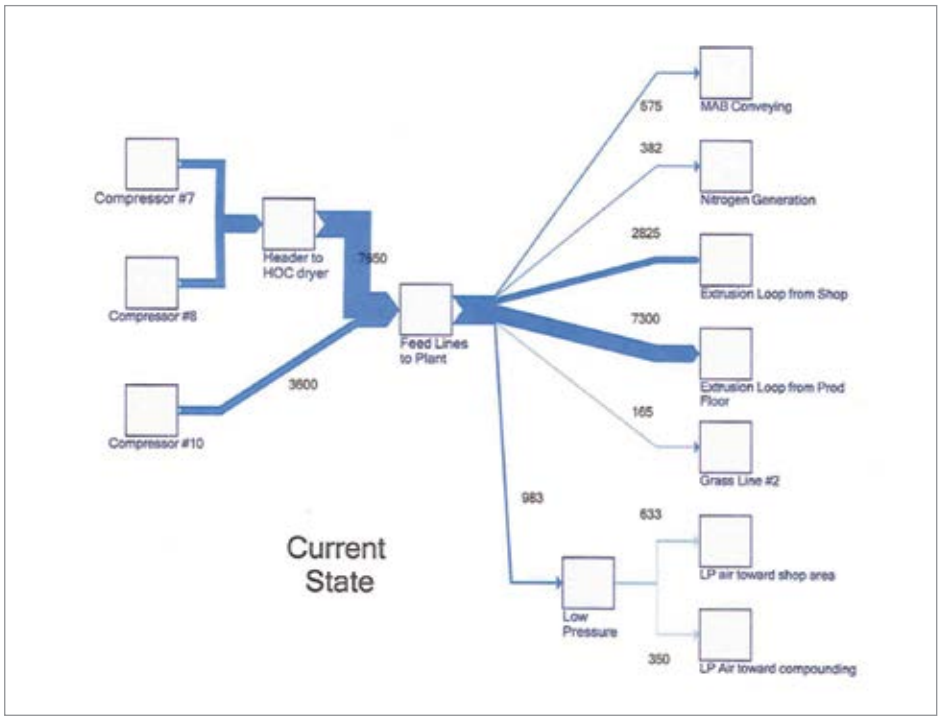
The next step is to prepare a "future state" diagram that shows optimum equipment in place, including air compressors, dryers, filters, piping and end-use devices.

This diagram can be designed with the help of a vendor, or service provider, or a consultant hired to conduct the compressed air audit. If you decide to hire a consultant to do the job, any work you do in advance will be valuable in giving him/her preliminary information gathered in the first part of an audit. If you want to justify the expense up front, be prepared to make the business case for the audit without concrete recommendations to improve the system. Also, be prepared to follow through on the easiest measures for costs savings to help pay for the audit. Chances are you will find ways to save that will pay much more than the cost of the audit.

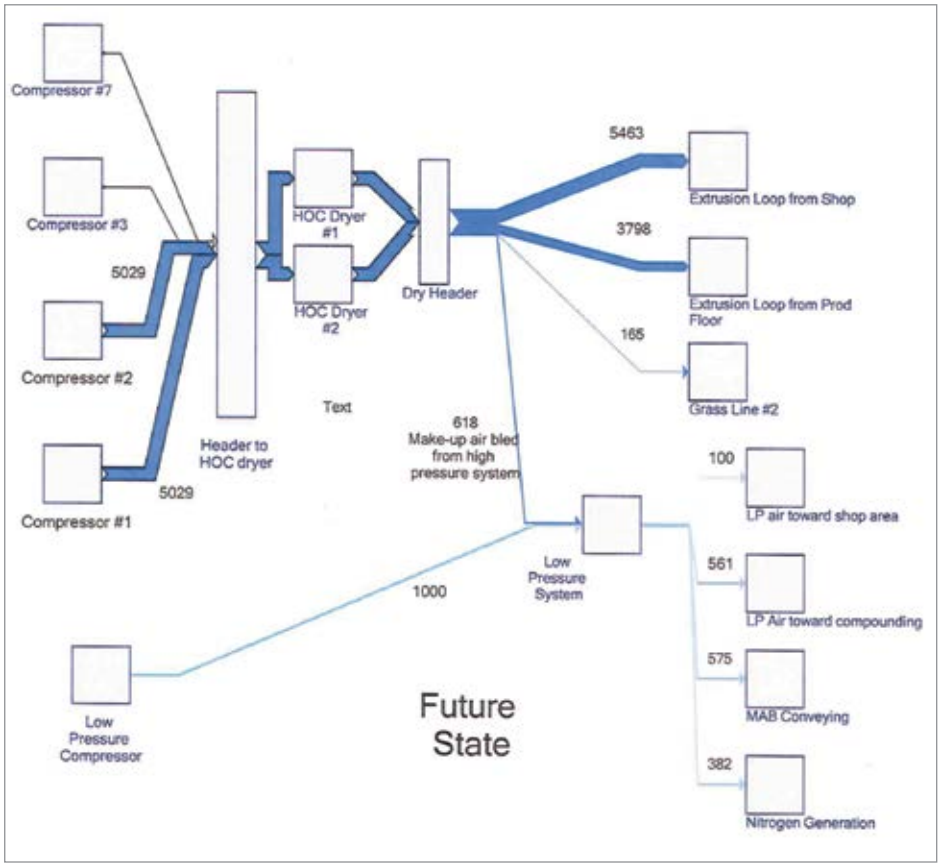
Regardless of whether you hire a consultant, the future-state diagram, allows you to calculate the new operating cost in energy using the same formula described above with lower HP input values to deliver the same air. You might also have eliminated some air demand for which you can calculate an energy reduction savings.

You can also use the information in the diagram to reference monetary values when

A STRATEGIC APPROACH TO EFFICIENT AND RELIABLE COMPRESSED AIR SYSTEMS



Depicted is a mockup of a current-state diagram based on publicly available information.



Depicted is a mockup of a future-state diagram based on publicly available information.

seeking capital funds. Again, the exact procedure of how this is done varies from company to company. You might have an informal process or one that is regimented and multi-faceted. Keep in mind this is a quick overview of what you can do and a rough guideline of how to do it.

Evaluate Distributors of Compressed Air Systems

Another important aspect of a reliable and efficient compressed air system has to do with the company selling and servicing the system. When evaluating companies, place more emphasis on the service department rather than the sales department. Ask yourself key questions as part of your approach, such as:

- Are your current air compressors being serviced reliably?
- Do you have many unplanned breakdowns?
- Do you already have a maintenance contract with a compressed air system firm?
- Are you confident in your supplier regarding reliability, timeliness and cost?

Get into a partnership with the company you have doing your service. If they do not perform, find another! Look at their reliability first, then examine parts availability, pricing, etc. Use the service reputation as the determining factor when purchasing, not price. You will spend many times the initial price on energy and maintenance during the life of your new air compressor.

As my grandfather used to say, "The sales department sells you your first car, the service department will sell you the rest!"

The Time to Start is Now

As a plant engineer or maintenance engineer, you are responsible for keeping compressed

air in the lines for use in the plant. You are also probably responsible to some extent for the amount of energy used.

Addressing your compressed air system can be a good opportunity to reduce the electric bill at your facility, depending on the value of your system improvements. If you are successful in getting a project completed, look at your electric bills and communicate any measurable differences internally to enhance the success of your project and to increase the likelihood of similar investments in the future. Be prepared to communicate your findings clearly and to address common questions. For example, reductions resulting from the effort may erroneously be attributed to previous quality issues or disruptions. The time to get started is now. BP

About the Author

Kurt A. Kniss, P.E., C.E.M., is an Innovation Engineer with the Equipment and Process Innovation Group at Shaw Industries, Inc.

About Shaw Industries

Shaw Industries Group, Inc. is more than a flooring company – we are 22,000 people united in our vision of creating a better future for our customers, for our people, for our community and for our company. We provide carpet, resilient, hardwood, tile and stone, laminate, synthetic turf and other specialty items for residential and commercial markets worldwide. We meet diverse customer needs through an expansive portfolio of brands, including: Anderson Tuftex, Patcraft, Philadelphia Commercial, Shaw Contract, Shaw Floors, Shaw Hospitality, Shaw Sports Turf, Southwest Greens , USFloors/COREtec and more. Headquartered in Dalton, Georgia, Shaw is a wholly owned subsidiary of Berkshire Hathaway with more than $6 billion in annual revenue and representation throughout the United States, as well as in Australia, Belgium, Brazil, Canada, Chile, China, France, India, Mexico, Singapore, United Arab Emirates, and the United Kingdom. For more information, visit www.shawinc.com.

To read more ***Energy Manager/ Sustainability*** articles, please visit www.airbestpractices.com/energy-manager

PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

SUMIRIKO TENNESSEE SAVES ENERGY & Boosts Sustainability with Compressed Air System Upgrade

By Mike Grennier, Compressed Air Best Practices® Magazine

SumiRiko Tennessee's 440,000-square-foot manufacturing plant in Midway, Tennessee.

Environmental sustainability and waste reduction are of great importance for automotive parts manufacturer SumiRiko Tennessee, Inc., which is why it decided to upgrade the compressed air systems at its plants in Midway and Tazewell, Tennessee.

In a strategic approach to improving its management of compressed air, the company initiated an upgrade of its compressed air system at its Midway plant. In so doing, SumiRiko Tennessee saves 2.1 million kWh and $100,000 in energy costs per year at the plant. Additionally, lower energy use resulted in the reduction in CO_2 of 800 tons per year. With a utility rebate, the project paid for itself within two years.

Verification of results at the Midway plant subsequently led to a similar compressed air system upgrade project at the Tazewell facility. The project there resulted in energy savings and reductions in CO_2 similar to those achieved by the Midway operation. The combined savings for both plants is 3.6 million kWh and $200,800 in electrical costs per year. Together, the two plants have reduced CO_2 output by 1,683 tons per year.

The following describes the compressed air system project at the Midway plant and the positive outcomes.

Committed to Environmental Protection

The $215 million Midway plant, which began operation in 1997, manufactures anti-vibration,

> "We are committed to the protection of the environment and the conservation of natural resources, as well as quality. We knew a better approach to compressed air would be one of the best ways to meet our goals."
>
> — Carroll Buckner, Maintenance Engineer at SumiRiko Tennessee's Midway

high-pressure hoses and soundproofing products for makers of the world's top automotive brands. The plant is both IATF 16939:2016- and ISO 14001:2015-certified.

The plant uses two main production processes, one of which is dedicated to the production of hoses, while the second process is focused on anti-vibration products. Key operations include rubber mixing; metal preparation, such as media blasting, phosphate cleaning and adhesive coating; and metal production areas, including stamping, welding, painting, aluminum die casting, aluminum milling and assembly. The Midway plant employs approximately 850 people, the Tazewell plant employs approximately 750 people and both plants operate three shifts, five days per week – and also on Saturdays when dictated by customer requirements.

Carroll Buckner, Maintenance Engineer at SumiRiko Tennessee's Midway, said the company's continual improvement and Kaizen efforts led to the decision to address energy costs associated with compressed air. He said the plant also wanted to continue to ensure its compressed air system supported its goal of achieving 100% customer satisfaction.

"We are committed to the protection of the environment and the conservation of natural resources, as well as quality," Buckner said. "We knew a better approach to compressed air would be one of the best ways to meet our goals."

SumiRiko Tennessee (www.us.sumiriko.com) is also a member of the Tennessee Department of Environment and Conservation's Tennessee Green Star Partnership program. The voluntary program recognizes companies in Tennessee committed to sustainable best practices. (Read more about the program at www.airbestpractices.com/sustainability/energy-incentives/incentive-program-profiles/shining-spotlight-manufacturing-sustaina.)

Shown is one of five rotary screw air compressors used to supply compressed air to power production areas at SumiRiko Tennessee's Midway plant.

SUMIRIKO TENNESSEE SAVES ENERGY & BOOSTS SUSTAINABILITY WITH COMPRESSED AIR SYSTEM UPGRADE

Compressed Air for Production, Wet Blasting & Painting

As with most manufacturing plants, compressed air plays a vital role at the Midway facility.

The plant's compressed air system includes 14 air compressors located in various locations of the facility. The system powers pneumatic valves and cylinders used to actuate 850 machines and numerous assembly cells. The plant also relies on compressed air for its wet blasting and adhesive coatings operations, as well as painting for various parts.

Production areas of the plant requires 5,556 cfm of air to maintain pressure, while the wet blast machines alone require approximately 1,035 cfm of air. Plant-wide, the peak demand for air is 6,591 cfm.

Before the compressed air project, the main compressed air system used for production areas consisted of three, direct-drive 200-horsepower (hp) rotary screw air compressors, each of which is rated to deliver up to 880 scfm at 125 psi, and one direct-drive 300-hp rotary screw unit rated to provide up to 1,206 scfm at 125 psi. Each air compressor package is equipped with a built-in refrigerated air dryer and filtration to provide clean, dry air. The original system also includes a 1,600-gallon receiver tank for compressed air storage.

The plant's original compressed air system dedicated to wet blasting operations includes six 75-hp rotary screw air compressors, each of which is rated to provide up to 365 scfm at 125 psi, and another two 100-hp rotary screw compressors, each of which is rated to provide up to 496 scfm at 125 psi. The original system also uses a 1,000-gallon receiver tank. The wet blasting operations do not require dryers for dry air.

Bucker said any loss in air pressure anywhere in the plant is unacceptable since it threatens the ability to meet production goals. The production and assembly areas are excellent examples of the need for reliable and consistent compressed air at the proper pressure, he said.

"If a sensor detects a drop in pressure below the level required on any given machine, it triggers a machine shut-down. It's absolutely vital for the system to deliver sufficient air at the proper pressure to the thousands of cylinders and valves in order to achieve our cycle times, which in turn, allows us to maintain production goals and our commitments to customers," he said.

In addition to reliable air at the required pressure, Midway must have clean and dry compressed air for production and painting processes, Buckner said.

"We can't allow contaminants or moisture to get into the valves and cylinders used throughout the plant to maintain uptime and to ensure our machines operate at peak performance," he said. "We also count on clean dry air for electrostatic and other painting processes. It's essential for the paint to properly adhere to surfaces of the parts we're producing and for those parts look the way they need to look."

The Midway plant's five wet blasting operations also dictate the delivery of reliable compressed air. For wet blasting, compressed air is used in combination with liquid to blast an abrasive media on metal parts prior to the curing and adhesive process, and in advance of assembly. Clean parts are critical for adhesion. Reliable air is also essential for wet blasting since it powers machines involved in the process and also conveys parts from one step to the next.

Shown is the 300-hp VSD air compressor installed at SumiRiko's Midway facility to help hold down costs of compressed air delivered to production areas.

Audit Focuses on Compressed Air System Optimization

While reliable and clean, dry air is essential at the Midway facility, SumiRiko Tennessee knew it needed to optimize the compressed air system to lower energy costs and reduce its carbon footprint.

"We were running all of our air compressors at full capacity, 24 hours per day and five days a week to maintain pressure throughout the plant at 98-100 psi," Buckner said. "We would then manually turn off some of the units on weekends, but we knew we were producing more pressure and using more energy than we needed."

A compressed air audit of conducted by iZ Systems, based in Macon, Georgia, demonstrated the plant could achieve its goals through a combination of system upgrades, as well as measures aimed at reducing compressed air demand. Changes would also further increase the reliability of the system.

Following the audit recommendations, the plant added a Variable Speed Drive (VSD) 300-hp air compressor to the main compressed air system. The unit, which is rated to provide up to 1,607 scfm at 125 psi, is also equipped with a refrigerated air dryer and filtration. In addition, the plant installed a 5,000-gallon receiver tank for additional compressed air storage. It also installed a pressure flow controller to better regulate airflow and made modifications to the piping system to accommodate the changes.

The plant also upgraded the compressed air system for wet blasting operations. It installed an additional 1,000-gallon receiver tank to the system for additional compressed air storage. It also upgraded the system so it could provide backup compressed air to production if needed. To do so, it added a cycling refrigerated air dryer to the system, and also installed a control valve and modified the piping so clean dry air could be produced and routed to production areas if and when needed.

Automated Control System Drives Efficiencies

The compressed air equipment upgrades at the plant support the need to ensure the availability of compressed air at the proper pressure – yet SumiRiko Tennessee also focused on a better method of control of its compressed air systems.

SUMIRIKO TENNESSEE SAVES ENERGY & BOOSTS SUSTAINABILITY WITH COMPRESSED AIR SYSTEM UPGRADE

Toward that end, the plant installed a master control system to automatically monitor and balance the operation of all 14 air compressors used for both the production areas and wet blasting operations.

Now the system automatically controls the air compressors so they operate at peak efficiency levels and deliver the right amount of air to meet demand, resulting in energy savings since not all of them operate at full capacity at all times during normal plant operations. Importantly, the compressed air system is no longer working overtime to provide compressed air at unnecessarily high pressure.

"We're saving substantial energy since the control system manages the output of the air compressors in conjunction with the additional receivers without under-or over-working any of them as they supply the plant with compressed air at 90 psi," Buckner said. "We're also no longer guessing which compressors to manually turn off when demand is low. Our investment in the control system is something we needed to do."

Lowering Demand for Compressed Air

Another must for SumiRiko Tennessee's Midway plant was to lower demand for compressed air where possible.

The plant did so by eliminating the use of expensive compressed air to dry off hoses after they've been extruded and cooled off

As part of its compressed air system upgrade at its Midway plant, SumiRiko Tennessee installed a 1,000-gallon receiver tank to provide additional compressed air storage for its wet blasting operation.

in vats of water. Before the compressed air upgrade project, the plant used compressed air delivered at 98-100 psi and routed through ball valves to blow off the hoses ahead of the powder-coating process.

Based on the compressed air audit, however, SumiRiko Tennessee took a less energy-intensive approach. Specifically, it installed six low-pressure blowers designed to deliver 15-20 psi each for the hose-drying application, in turn, eliminating open blowing with compressed air.

"We're no longer wasting compressed air on the process," Buckner said. "The electric motors on these blowers certainly consume a lot less energy and cost a lot less to operate than making compressed air using 200- and 300-hp air compressors."

Buckner said the plant also began to more proactively address compressed air leaks. Shortly after the completion of the audit, it fixed enough air leaks to reduce demand by 300 CFM. The plant has also implemented a program to regularly identify and fix air leaks.

"You're going to experience leaks at any plant where you have thousands of valves and cylinders, many of which are connected with fittings and plastic tubing that can be as small as six millimeters in diameter – addition to all of the other places where leaks normally occur," Buckner said. "Nonetheless, we're committed to regularly fixing compressed air leaks since it's an area where we know we can eliminate waste."

Achieving Quality and Saving Costs

Following the completion of the compressed air system upgrades and measures to reduce demand for compressed air, the amount of energy used for compressed air at SumiRiko Tennessee's Midway plant dropped from 10,520,243 to 8,396,389 kWh per year.

By saving 2,123,854 kWh in energy the plant's annual electric bill is $100,000 less. The project has also allowed it to reduce it CO_2 emissions by 800 tons per year. Additionally, a utility rebate from Tennessee Valle Authority of $104,000 led to a payback in less than two years.

It didn't take long for the SumiRiko Tennessee's Tazewell plant to adopt the same best practices for compressed air after seeing the results produced by the Midway operation. Similar measures taken at the plant allowed the facility to save 1,504,478 kWh per year and reduce is annual electrical costs by $100,800. The project also allowed it to reduce annual CO_2 emissions by 883 tons.

Buckner said the company's approach to compressed air management is all part of SumiRiko Tennessee's commitment to sustainability and waste reduction as it continues to produce quality automotive components.

"We've definitely learned you don't have to run all your air compressors around the clock to meet production goals," Buckner said. "This has been a successful project that gives us the ability to meet our customers' needs and do it in a way that protects the environment. We're looking forward to even more improvements." BP

All photos courtesy of SumiRiko of Tennessee.

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QUALITY, SAFETY & RELIABILITY

Reliability: Should Compressed Air MONITORING BE COMBINED WITH CONTROL?

By Tim Dugan, P.E., Compression Engineering Corporation

Many OEMs of air compressors, dryers, sensors and master controls are integrating monitoring features and capabilities into their components. It would seem a no-brainer to keep it simple and use those sensors and systems for both control and monitoring. What could be simpler?

While there are many individual stories that can be told by each of these equipment and component vendors that show it is easy and useful to do that type of data and control integration, there are problems that are not being addressed. The problems have to do with system reliability and integration. Things need to be simple and robust enough to work reliably for their primary purpose, which might either be control or monitoring. And integration issues need to be carefully addressed so the data side can't trump the control side, and the control side can't trump the data side.

Before you purchase an integrated control and monitoring system for compressed air, you need to understand some basic issues specific to your plant (or your customer's plant). Specifically, people and problems. What people are the internal customers of the monitoring and controls? What are their concerns, tools and limitations? And what problems can happen in the real plant world, and what consequences to reliability are there?

General industry's most scarce asset is people. Who are the internal customers of a compressed air control system, who I will call "Controls Customers," and who are customers of a compressed air monitoring system, or "Monitoring Customers?" From my experience, they are very different people in typical industrial organizations.

Internal Customers of Compressed Air Controls

In general industry, a control system for compressed air is not generally seen as part of production automation or process control. It is usually seen as part of an internal utility, and managed by the utilities team. In some plants, this is team is called "Facility Management," which includes Facility Engineering (design and support of changes to buildings and processes) and Maintenance (keeping utilities and processes repaired). In others, Maintenance is the Controls Customer. In large process plants, the customer might be called "Utilities."

What are the major concerns of the Controls Customer? **Reliability** is their primary concern. If plant air needs require an additional air compressor to come online, they need to know that will happen every time. If needs reduce and it's no longer needed, they have little concern to turn it off. That is addressed by the next customer we will discuss. The Controls Customer is spooked by complex controls that they can't predict. They prefer algorithms that operate in predictable patterns. If "X" occurs, "Y" happens.

"Before you purchase an integrated control and monitoring system for compressed air, you need to understand some basic issues specific to your plant (or your customer's plant). Specifically, people and problems."

— Tim Dugan, P.E., Compression Engineering Corporation

If "A" fails, "B" backs it up. They also prefer simplicity because they have learned the hard way that the more points of failure, the more failure will happen.

What kinds of monitoring does a Controls Customer want to look at? **Real-time** monitoring of machine health. They want to know the current value of any process variable that could shut the machine down, and any that affects the output that they need.

Why am I bringing up these Controls Customers first? Because they really don't value long-term monitoring very much, if at all. They have no time for energy management or performance issues, though they typically care about it.

Internal Customers of Compressed Air Monitoring

With the advent of Energy Management Control Systems (EMCS) in HVAC and building management systems (BMS), a new category of internal customers started requiring performance information from the plant's systems. These systems are offered to pretty much every new commercial building as a standard practice. In industrial firms that have EMCS's in their buildings, often EMCS systems existed before the compressed air control system was installed, if there even is one.

Who looks at the trend data? Who is the customer of the EMCS? Typically, a person responsible for building and/or utilities performance. The energy engineer, utilities manager, or intern who supports them would typically be the customer of the EMCS. Since compressed air monitoring systems are so infrequently installed in the United States, that person is likely going to be the customer of a compressed air monitoring system. Why not the Utilities or Facility department that owns the equipment? Although it seems logical, those staff members are not accustomed to using trend data for performance optimization. And they aren't generally even at their desks long enough to do so if they did have the inclination and skills. The Facility department puts in the EMCS but rarely looks at it.

Figure 1: A typical PLC-based control system screen.

RELIABILITY: SHOULD COMPRESSED AIR MONITORING BE COMBINED WITH CONTROL?

What are the concerns of the Monitoring Customers? In a word, **performance.** They want to see that the system is working optimally and providing the required output at the minimum energy input. They look at macro-level data, and compare current performance to previous months and years, and in comparison, to a baseline and a benchmark. Compressed air is just one important part of a big picture they look at.

Understanding the Potential Problems

There are two types of potential problems with combining control and monitoring systems, reliability and integration. This article will discuss reliability. The next article in this two-part series will discuss data integration issues.

There are three sources of reliability problems in any compressed air system: Murphy, Bubba and "the Powers that Be." Murphy says the smallest item that was the last thing the designer thought of will be your first problem that will shut your whole system down. Bubba will never read instructions and will do things to your system that the designer never dreamed. And the Powers that Be are the Powers that Be. Things happen out of your control you can just never anticipate.

How do you minimize the impact of these three reliability problems? Have a simpler system with fewer points of failure that can provide close to ideal performance, reliably. I'll provide examples, starting with a real example of a reliable control system.

A sawmill used a PLC-based sequencer with three fixed-speed air compressors. Only one process variable was needed to control the air compressors: pressure, which is provided by an almost unbreakable simple component: a pressure transmitter. It is intolerant to temperature, vibration, and contamination. The PLC was an industry-standard unit, built for an industrial environment, unlike a PC or most EMCS components. It can endure higher temperatures, voltage spikes and dips, and more. As shown in Figure 1, the control system displayed which stage the system was in, and what would be next if load went up or down. The control system did not do any trend logging. Why? The reliable hardware software available in the acceptable price range for the customer did not have that functionality.

Energy Company Uses Too Many Process Variables

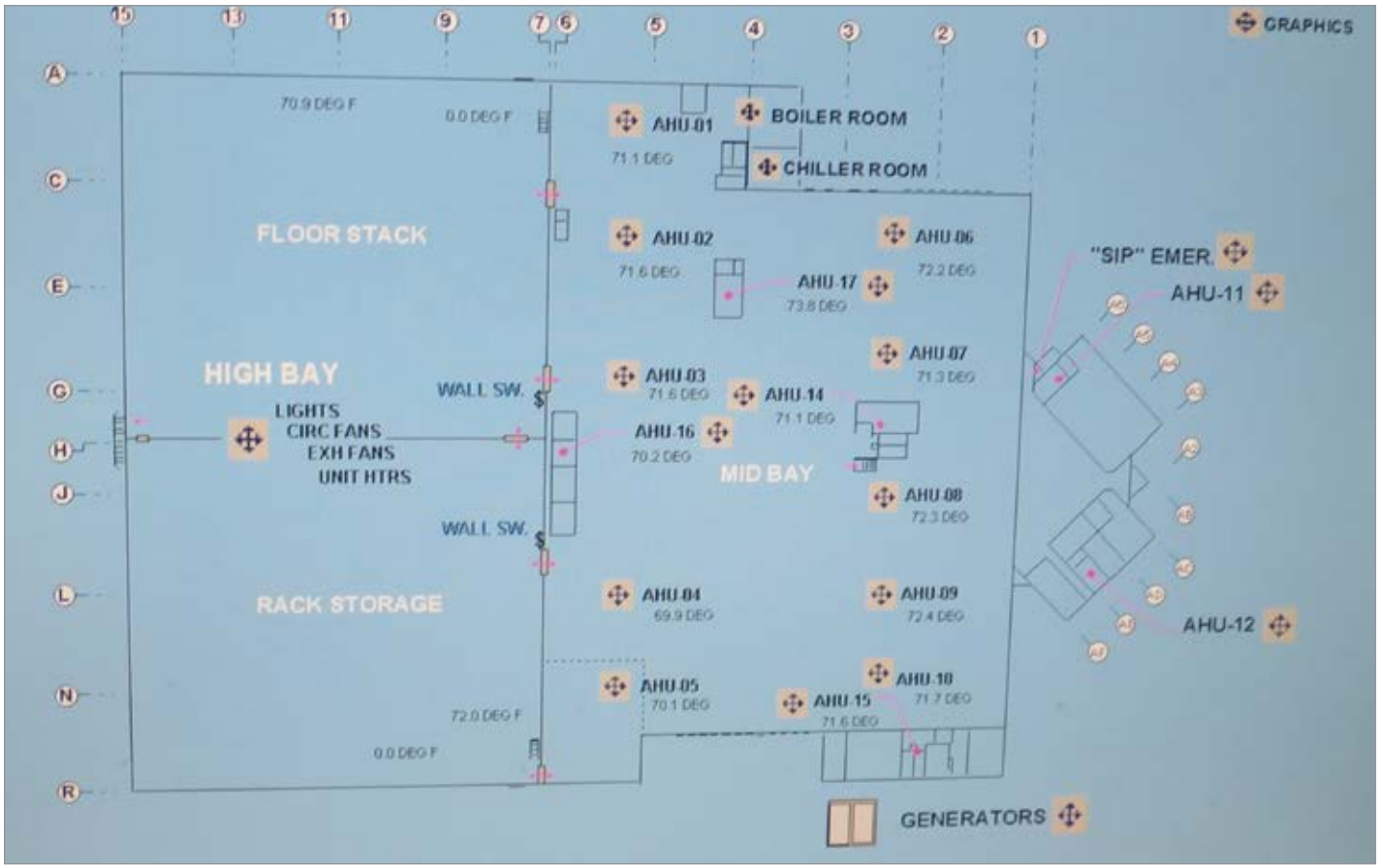
Another example of an unreliable control system is one that tried to use too many process variables, in ways that can be unpredictable. I audited a system at an energy company with a custom master controller that used a combination of flow, motor current, and two pressures to control four air compressors and a booster. The flow meter was an inexpensive thermal mass meter that could read high if the dryer malfunctioned (wet air pegs these meters). Current was used to estimate percent load on an air compressor. And a flawed algorithm with 27 different inputs (many combinations thereof which were illogical) was used to set up air compressor staging.

Bubba and Murphy could both have a heyday with this system. This "flow-based" system attempted to control different combinations of air compressors in different flow ranges. It had a flawed algorithm that had no allowance for flow meter drift or air compressor local controls being misadjusted. Recall the primary problem in the Boeing 737MAX fiasco – reliance on one flaky sensor that can jam.

Flow should be used for monitoring, not control. A "flow-based" control system I recommended in a previous article for some large systems would use calculated flow, based on a reliable air compressor percent flow metric like speed or current. I saw this energy company's attempt at flow-based control about seven years after I wrote that article. Maybe they designed it after they read it! To read the previous article, visit www.airbestpractices.com/system-assessments/compressor-controls/compressor-sequencer-problems-and-solutions.

Unfortunately, flow meters can fail in many more ways that pressure transducers, and can read inaccurately even if not failed, based on installation issues, vibration, temperature, and fluid quality. A control system that uses them as a process variable is unreliable. And one that has too many operator inputs is too prone to being "hacked," resulting in erratic, unreliable operation.

Another reliability issue I warn about is the use of the EMCS network backbone for industrial control. EMCS systems are typically run over the building general Ethernet, often the same network used for office computers. Although reliability is important for that network, the consequences of it going down are usually not catastrophic. The office might get warm, the energy engineer might not see performance for a while, or an engineer might have to change



Shown is a typical EMCS screen for an HVAC system.

RELIABILITY: SHOULD COMPRESSED AIR MONITORING BE COMBINED WITH CONTROL?

computers temporarily. I have seen the EMCS network at an aerospace company have constant problems with hubs that converted Modbus signals to Ethernet. They failed often, and took down banks of sensors when they failed. If that system had been used for air compressor control, the plant would have gone down.

System Monitoring Recommendations

When considering how to add monitoring to your compressed air system, consider the people and problems associated with the complexity of mixing controls and monitoring. Align the technology with the people and tools available, and keep the points of failure to a minimum. Here are some recommendations, not hard rules:

1. For small and mid-sized systems, consider simply adding a flow meter, power (or current) meters, pressure transducer and dewpoint meter to a simple, permanently installed, separate data-logging and trending system rather than attempting to integrate monitoring and control. You can get a lower-cost monitoring system installed quickly this way. You can also get the monitoring system installed earlier, and use it for commissioning. There are many options for portable data-loggers, but you need a permanent logging system, which is very different. It should have an Ethernet connection and the ability to be accessed remotely and to integrate in external databases. Several products are available. Two I am aware of are from VP Instruments and Airmatics.

2. If you have an engineering function within Facilities or Maintenance that regularly looks at data trends and uses tools like Excel to analyze and display it, you have an internal Monitoring Customer for compressed air monitoring. If you don't, I would not recommend a monitoring system at all, unless an outside party can help as explained below.

3. If you have an EMCS already, you have both a system and a Monitoring Customer. Consider having separate monitoring and control systems for compressed air. A reliable sequencer, offered by your OEM or an expert third-party, can do a good job of control with the least number of failure points. Then, add compressed air sensors to your EMCS and develop monitoring screens on the EMCS, and data trending as well. Use a compressed air expert's design for that monitoring system.

4. If you don't have either a local engineer who can look at and analyze data or an EMCS, but management needs performance information, consider a monitoring system that is "cloud-based." Most new air compressor and dryer suppliers are offering low-cost remote monitoring. Your supplier should be capable of using those systems and providing service via that data.

5. For large systems, consider hiring an integrator who can custom design a control and monitoring system that does the best of both, using plant standards for both, serving the separate Control and Monitoring customers. A compressed air expert should guide the integrator. BP

For more information, contact Tim Dugan, President of Compression Engineering Corporation, tel: 503-520-0700; email: Tim.Dugan@comp-eng.com, or visit www.compression-engineering.com.

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PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

Control Strategies for Efficiently Operating MULTIPLE VFD AIR COMPRESSORS

By Ron Marshall, Marshall Compressed Air Consulting

By far the most important development in the world of screw type air compressors has been the introduction of variable speed control using electronic variable frequency drives (VFD's). Systems that run with at least one air compressor at part load can almost always operate more efficiently if a well-controlled VFD is added to the system. But what if a system has two or more VFD units? This article discusses the challenges in controlling multiple VFD air compressors with some suggested solutions.

Why Use a VFD Air Compressor?

Millions of dollars of research and design work has been spent in optimizing screw type air compressors in the years since they have been developed. Innovations in rotor profiles, changes in element rotational speed, optimization of internal flow passages, upgrades to motor efficiency and many more changes have improved screw air compressor efficiencies over the past years.

The introduction of the Compressed Air and Gas Institute's (CAGI) Performance Data Sheets certainly helps air compressor purchasers determine how much power the machines they are considering buying will consume. These data sheets show specific power, a sort of "gas mileage" rating, among other important parameters, to enable comparisons to be made. These data sheets contain important information users need to be aware of when operating both fixed-speed and VFD air compressors in single or multiple configurations.

Consider a sample 100 horsepower (hp), 125 psi-rated, air-cooled oil-injected air compressor (data not shown). This air compressor model delivers its full airflow at pressures up to 125 psig, but it was tested at 115 psig. At this pressure it delivers its measured 494 acfm of flow while it was consuming a total of 89.9 kW, at a specific

MODEL DATA - FOR COMPRESSED AIR			
1	Manufacturer:		
2	Model Number: 100 - 125 psig / 460V/3ph/60Hz [X] Air-cooled [ ] Water-cooled [X] Oil-injected [ ] Oil-free	Date: Type: # of Stages:	5/16/2019 Screw 1
3*	Rated Capacity at Full Load Operating Pressure[a, c]	494	acfm[a,c]
4	Full Load Operating Pressure[b]	115	psig[b]
5	Maximum Full Flow Operating Pressure[c]	125	psig[c]
6	Drive Motor Nominal Rating	100	hp
7	Drive Motor Nominal Efficiency	95.0	percent
8	Fan Motor Nominal Rating (if applicable)	1.3	hp
9	Fan Motor Nominal Efficiency	75	percent
10*	Total Package Input Power at Zero Flow[e]	21.7	kW[e]
11	Total Package Input Power at Rated Capacity and Full Load Operating Pressure[d]	89.9	kW[d]
12*	Specific Package Input Power at Rated Capacity and Full Load Operating Pressure[e]	18.20	kW/100 cfm[e]

Figure 1: An excerpt of a 100 hp VFD air compressor CAGI data sheet shows the efficiency at five points of the speed curve of this 125-psi rated air compressor. The highlighted ratings are more efficient than the fixed-speed air compressor mentioned in the article. This curve has a pronounced reduction in efficiency near minimum speed.

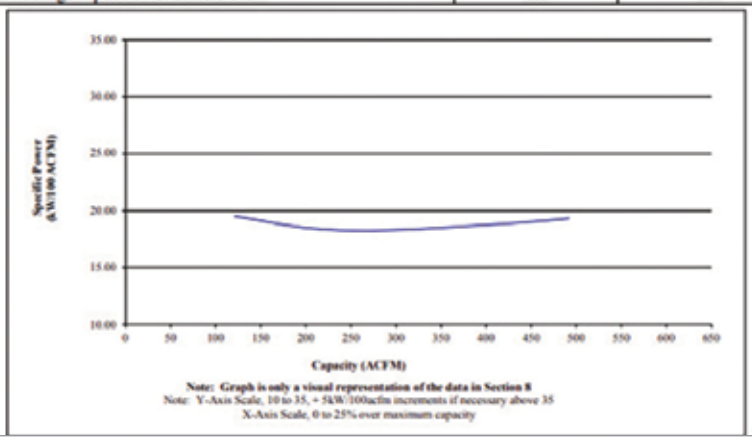
MODEL DATA - FOR COMPRESSED AIR				
1	Manufacturer:			
2	Model Number:	125 psig / 460V/3ph/60Hz	Date:	5/16/2019
	[X] Air-cooled [ ] Water-cooled		Type:	Screw
	[X] Oil-injected [ ] Oil-free		# of Stages:	1
3	Rated Operating Pressure		125	psig[b]
4	Drive Motor Nominal Rating		100	hp
5	Drive Motor Nominal Efficiency		95.0	percent
6	Fan Motor Nominal Rating (if applicable)		1.3	hp
7	Fan Motor Nominal Efficiency		75.0	percent
8*	Input Power (kW)		Capacity (acfm)[a,d]	Specific Power (kW/100 acfm)[d]
	95.0	Max	492	19.31
	80.4		426	18.87
	53.9		295	18.27
	38.3		208	18.41
	23.6	Min	121	19.50
9*	Total Package Input Power at Zero Flow[c,d]		0.0	kW
10				

Figure 2: An excerpt of a 100 hp VFD air compressor CAGI data sheet shows the efficiency at five points of the speed curve of a different model air compressor. The highlighted ratings are more efficient than the fixed-speed unit mentioned in the article. This curve has a flat bathtub-shaped curve that is more efficient in the mid-range of speeds.

power of 18.2 kW per 100 cfm. It is important to understand these numbers are valid only at full airflow, and at test discharge pressure of 115 psig. If operated at 125 psig this fixed-speed air compressor will consume about 3% more power and deliver slightly less flow. Not reported on this sheet are the operating characteristics at partial loads.

Figure 1 shows the test data for a 100 hp VFD controlled, air-cooled oil-injected air compressor from the same manufacturer. We can see the unit has been tested at 125 psig discharge pressure, 10 psi higher than the fixed-speed air compressor, and that there are five test points somewhat equidistant between points between minimum and maximum speed.

We can see that this air compressor does not have a constant specific power through its full range of operation; there is a decrease in efficiency as the main motor speed reduces. The shape of this curve has implications if this air compressor is to be operated in a system with multiple VFD air compressors.

An observant reader might notice something interesting in that this particular VFD air

CONTROL STRATEGIES FOR EFFICIENTLY OPERATING MULTIPLE VFD AIR COMPRESSORS

compressor has higher flow, consumes more power, but has better efficiency at some parts of its curve than the comparison fixed-speed air compressor previously mentioned. This shows how the very commonly stated myth that VFD air compressors are always less efficient than fixed-speed air compressors at full load due to the drive losses is not always the case. If, however, we take a look at Figure 2, showing a different VFD air compressor of a different design, but from the same company, we see the curve is bathtub shaped, with only the middle part of the curve being more efficient than the fixed-speed air compressor. This shows us that all VFD air compressors are not alike; there are many characteristic curves, each slightly different than the others. These differences mean one type of VFD air compressor may need to be controlled differently than another.

Better Part-load Efficiency with VSD Control

For the fixed-speed air compressor, as stated previously, the manufacturer never reported part load efficiency. If we want to create the characteristic curve we must take various factors into account, like effective storage receiver size, pressure bandwidth, blowdown time, and unloaded power consumption and calculate it ourselves.

Figure 3 shows average power through the full range of operation of a typical load/unload fixed-speed air compressor with 20-second blowdown, 10-psi wide pressure band and one, two, five and 10 gallons per cfm of storage. We see on the specific power curve at the bottom of this figure that if this air compressor ran at an average loading of 40% with two gallons per cfm storage, it would have a specific power about double the full load value, or about 36 kW per cfm, well above any of the worst specific power numbers on any of the numbers in Figures 1 and 2. We can see the fixed-speed air compressor is less efficient than VFD at light loads, but is more efficient than the air compressor in Figure 2 at the highest flows of the curve. These calculations show the biggest advantage of VFD air compressor control, which is much better part load efficiency compared to load/unload control.

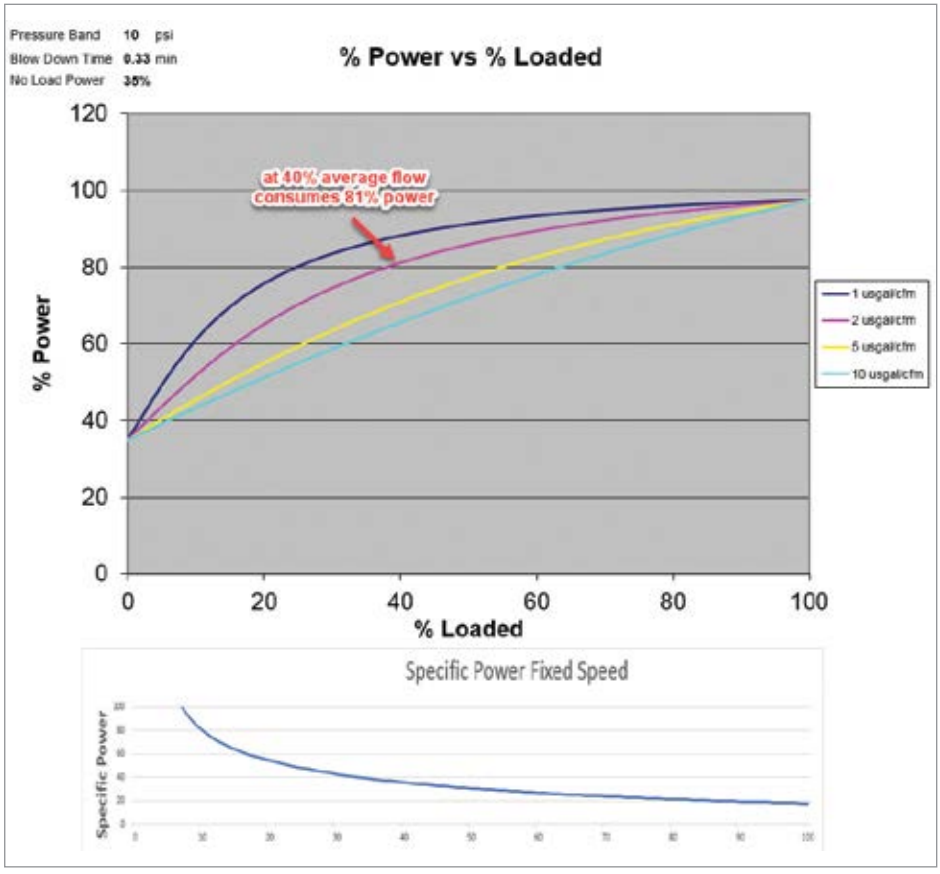


Figure 3: Depicted is power versus flow for load/unload fixed-speed air compressors with various storage receiver sizes. The most common size is about two gallons per cfm of air compressor capacity. The specific power curve at the bottom is for this size storage receiver. Except for the upper range of operation, part-load operation is much less efficient than VFD control.

Typical Multiple Air Compressor Control

The typical air compressor control strategy with multiple fixed-speed units, using coordinated local control, is by setting up the air compressors in cascaded overlapping pressure bands as shown in Figure 4.

With this scheme when only one air compressor is required to satisfy the system flow, the unit with the highest pressure setting runs in part load, with the others timing out and turning off with automatic control. If the load increases where two air compressors are required, the system pressure pulls down to the load/start point of the second unit, and it will then become the trim machine, carrying part load, with air compressor No. 2 loading and unloading. The same operation continues if three air compressors are required; the two units with the highest settings would go to full load, and the third air compressor would become trim. The opposite happens as the load decreases.

This scheme is adequate if all the air compressors have the same part load efficiency, but the system typically suffers

from higher than desired average pressure during light loads, and lower than desired pressure during high flows.

A problem happens if a VFD air compressor is introduced to the system. With VFD control, the desired condition is that the variable air compressor is always the trim unit, with the fixed-speed air compressors running fully loaded or off. This means the control scheme can't be set to the typical cascade arrangement where all the air compressors share the trim duty one at a time. A different arrangement is needed, where the VFD target setpoint is nested within the overlapping pressure bands of the fixed-speed air compressors. This new scheme requires the VFD to be larger than the base units by about 30% or an undesirable control gap will develop where the air compressors will fight for control. This problem often causes operators to correct the situation by installing more than one VFD in a cascade-coordinated system. But this can also cause undesirable results.

Consider the condition where the system pressure is at the redline as shown on Figure 4 and air compressors No. 1 and No 2 are VFD units. The bottom of the pressure bands are the target pressures of the VFD. As such, the air compressors will try to speed up or slow down to keep the pressure constant at that setting. As the system flow drops off, air compressor No. 2 will reach its minimum speed limit, usually its least efficient point, and the system pressure will continue to rise. If the flow drops enough air compressor No. 1 will also reach its minimum speed, also its least efficient point. Since the pressure bands are overlapping, air compressors No. 1 and No. 2 will both be running at minimum speed, about 20% of full load capacity. In this condition 20% times two equals only 40% of one air compressor. This means one unnecessary VFD air compressor will be running. If both air compressors happen to have a curve like the one in Figure 1 then the result is significantly lowered system efficiency.

One solution to this problem is to stack the pressure bands of the VFD air compressors so they don't overlap, but this means when the plant flow increases to where two air compressors are required, one of the VFD units will be at full load, the other at part load. Depending on the characteristic curve of the air compressors, as shown in the curve in Figure 2 for example, it may be undesirable to have the first unit run at full load. In this scenario there will be two distinct pressure levels, one at the target of air compressor No. 1, the other at the target of air compressor No. 2. When running at the air compressor No. 1 target setting, the system pressure will be unnecessarily high, wasting power and causing higher than desired flow due to artificial demand.

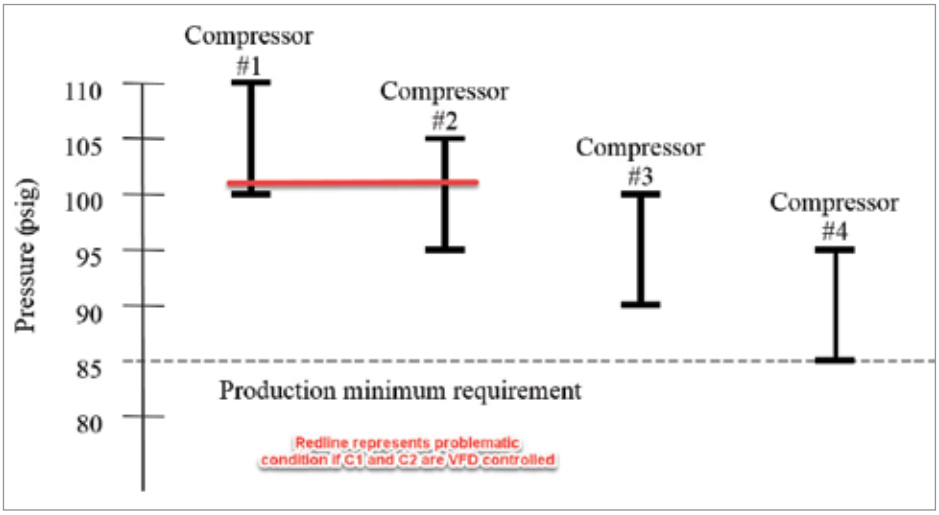


Figure 4: Shown is typical cascaded control used with multiple fixed-speed air compressors. If used on systems with multiple VFD units, some undesirable conditions can arise like at the redline point where two VFD air compressors will be running at minimum speed, where one could handle the flow. (Source: Compressed Air Challenge.)

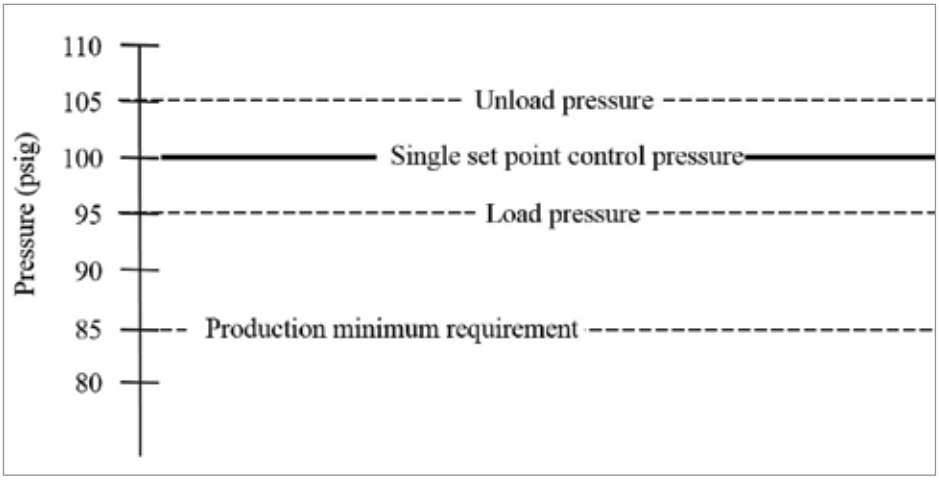


Figure 5: A central controller will enable the lowest pressure operation and will orchestrate the operation of the air compressors within a single narrow band, and preferably, with VFD air compressors, controlled at a single target point. (Source: Compressed Air Challenge.)

CONTROL STRATEGIES FOR EFFICIENTLY OPERATING MULTIPLE VFD AIR COMPRESSORS

Intelligent Control with Single-Pressure Band

To avoid coordination problems, it is best to employ an intelligent system controller to orchestrate the proper operation of the system air compressors, such as in the scheme in Figure 5 where a single-pressure band is used for all air compressors.

In general, in any single system only one properly sized VFD air compressor is required for optimized control. With this condition, the VFD air compressor always needs to be in the trim position taking partial load, with all other fixed-speed air compressors being fully loaded or off. Most modern central controllers have the capability to implement this control method, and if the sizing of the VFD air compressor is correct, adequate control will be achieved with good efficiency. But some conditions can arise that could cause less than desirable operation. These are:

- The trim VFD air compressor always running at minimum speed.
- The VFD air compressor running on an inefficient part of its curve.
- The system airflow always running on the edge of the capacity of two air compressors, causing undesirable starting and stopping of the air compressors as the load changes.

In systems with these conditions some special intelligent control capabilities are required, with design requirement of making multiple size combinations of VFD and fixed-speed air compressors available to the controller. Some specially designed controllers are available that can use the air compressor size combinations to mix and match machines to keep system operation optimized. These controllers typically have the following characteristics:

- The system is capable of controlling both fixed-speed and VFD air compressors at a single target setpoint.
- The various air compressor efficiency, airflow and power characteristics are programmed into the controller.
- The controller calculates total system flows based on air compressor status.
- The controller compares system flows and finds the optimum combination of air compressors to best satisfy the airflow.
- Some machine learning may be available where the controller recognizes repeating conditions, for example at a certain time each weekday, and anticipates the need for a certain combination of air compressors to avoid large pressure peaks or valleys.
- The best controllers of this type have monitoring systems that allow the operators to track system KPI's to ensure optimal efficiency is being achieved.

For example, in Figure 6, the pressure and amp plot shows how an intelligent system controller is coordinating the operation of two VFD air compressors of different sizes and characteristics (there is a third fixed-speed spare).

There are low-load periods where it makes sense to run only one-size VFD air compressor

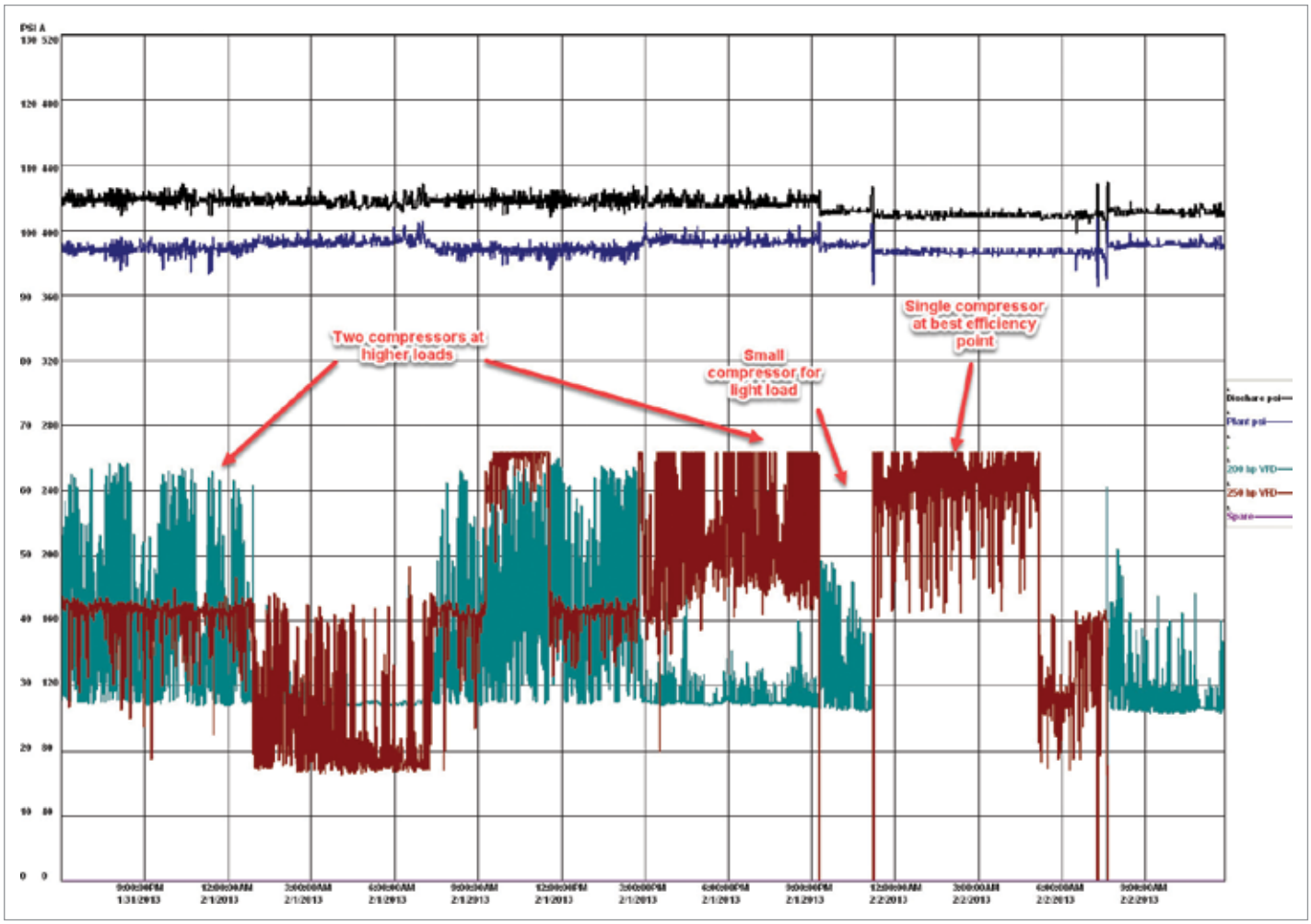


Figure 6: An example operation shows the coordination of a system of three air compressors, two of which are VFD-controlled. The air compressor characteristics are programmed into the controller and allow the optimal operation of one, or the other, or both air compressors as conditions change.

or another size unit. The controller automatically makes this happen, but watches the system flow, and may swap out a larger or smaller air compressor as required. If the flow increases to where two air compressors are required, the controller will allow the air compressors to share the load in the middle part of the variable speed bands, where the efficiency is best, often somewhere between 40 and 80 percent flow (but depending on the air compressor curves).

Not all VFD Air Compressors are Alike

In most systems the presence of one or more VFD air compressors leads to better efficiency compared to a system of fixed-speed air compressors. This is due to the excellent part load efficiency of the VFD air compressors. But it is important to realize that all VFD air compressors are not alike and there are many different characteristic curves.

The best type of control is through central intelligent air compressor control where the best combination of air compressors, and best operating range, is automatically selected depending on loading conditions. Knowing the characteristics of the air compressors, this type of system keeps system specific power low by running the air compressors more efficiently, in the best loading condition, reducing the system pressure, thereby reducing air compressor power and artificial demand. BP

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

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

SHOW REPORT
Compressed Air Technology at the
AICD CONFERENCE & EXHIBITION 2019

By Rod Smith, Compressed Air Best Practices® Magazine

2019 AICD Board Members are ready to "Invade the Industry"! Michael McCulley, Sal Calvo, Dave Nosal, Kasey Gould, Phil Kruger, Dave Gaitsch, Brent Pifer, AICD President Lisa Lewis, Bart Frush, Jeff Brennan and Randy Olson (left to right).

Joe Ghislain and Steve Briscoe man the booth for the Compressed Air Challenge.

The 2019 AICD Annual Meeting and Exhibition was held May 18-21 at the Renaissance Orlando at Sea World in Orlando, Florida. The membership of the Association of Independent Compressor Distributors came together under the theme of "Invading the Industry"!

The members of the AICD (Association of Independent Compressor Distributors) send owners and senior management to the event. AICD member companies are independent companies selling and servicing air compressors in North America. "The AICD Board is pleased to announce we have added 18 member companies in the past year alone," said AICD President Lisa Lewis (Michigan Air Solutions). "Vendor participation is at an all-time high as we've added 13 new exhibitors and special networking events for vendors to interact with AICD members."

There are AICD member companies from Canada, Mexico and the United States. These members benefit from meeting once a year and building relationships with people they can call with compressed air industry related questions during the year.

Here is a good example. AICD Vice President Sal Calvo (MidState Air Compressor) commented, "Developing service technicians is a challenge for every company in the compressed air industry. One of the great values of AICD membership is we are receiving insights and sharing training resources developed by members."

The Conference

The AICD has always had a strong conference format aimed at helping senior management, at air compressor sales and service companies, better manage their business. Speakers normally include economists with market forecasts, leadership and sales management gurus, and compressed air industry professionals with very tailored information for our market. This year was no exception and the 2019 line-up is below.

- J.R. Gillette, The Economy and Your Business
- Mike Abacherli, Insurance-Are You Covered?
- Jay Fagan, Growing Your Business by Mining Your Clients
- Warren Wright, Managing and Motivating the Millenial Employee
- Celebrity Speaker Kris Paronto, Benghazi Survivor-Lessons for Leadership in a New World

I took something away from each presentation to help me manage my small business. It was a thrill to hear Kris Paronto speak. It's incredible what some people have done and experienced in their lives.

The event excels in providing organized social events and downtime where members and exhibitors have time to socialize and get to know each other better. Whether it's at the annual golf tournament (no gator bites and no serious sunburns reported) or the Grand Finale Party (with the Golf Awards!) – there's always something to do.

The Exhibition – Air Compressors and Lubricants

The exhibition portion had at least 70+ companies exhibiting and during the hours allocated, I only had a chance to visit (rapidly at that) a sampling of the booths. My apologies go out to all the booths/exhibitors not mentioned or photographed here.

The Compressed Air Challenge had a booth manned by Joe Ghislain and CAC President Steve Briscoe. They reported they keep adding Sponsors and "Fundamentals and Advanced" training classes to the calendar and that they've just released end user awareness training.

Hertz Kompressoren continues to build their U.S. presence and team. Bob Groendyke introduced me to two new regional managers and said their HPC Booster (up to 580 psi) and their VSD rotary screws (5 to 400 hp) are driving their growth. They will also be introducing an oil-free rotary screw later this year. It's also notable their rotary screws are now certified by CAGI's Performance Verification Program.

Mike Kropp, David Smith, David Raffin, Bruce McFee, Steve Van Loan, Jason Radliff and Brian Stober at the Sullivan-Palatek booth (left to right).

Derrick Taylor and Michael Heine at the PneuTech booth (left to right).

CoAire's Roeland Meyer next to their 5 hp direct drive scroll air compressor.

SHOW REPORT: THE 2019 AICD CONFERENCE & EXHIBITION

Craig Thomann, Robert Groendyke and Jay Clark at the Hertz Kompressoren booth (left to right).

Matt Smith, Tony Montalto, Scott Folsom and Gordon Clark at the FS-Curtis booth (left to right).

Fehmi Zeni, Tara Bost and Steve George at the Ozen Air Technologies booth (left to right).

Sullivan Palatek's product line has grown to an impressive range of lubricated (5-450 hp) and oil-free rotary screws (75-350 hp). I recommend visiting their new website, www.sullivan-palatek.com to see these plus their electric construction, portable, and offshore product lines. President Steve Van Loan also mentioned their OEM air end business is very solid. Good for them!

PneuTech displayed their RK Series rotary screw air compressors. They showed me a tank-mounted 20 hp unit with integrated dryer and standard features like Wye-Delta starter, TEFC motor, and ambient intake air filtration. I've been very impressed by the service-friendly packages this firm supplies.

CoAire displayed a direct drive 5 hp scroll air compressor. Roeland Meyer explained to me they are working to launch 7.5 hp and 10 hp airends soon. They said this will position them with a uniquely extensive scroll line, complementing their 3.5 and 5 hp airend models. In addition, CoAire has invested in significant warehousing capabilities in Texas.

SA Performance had some really cool foam airend give-aways to combat stress! On a more serious note, David Rosenthal said their lubricants, "focus on OEM equivalents and not on aftermarket replacements." They also do airend rebuilds in Forsythe, Georgia.

FS-Curtis had a very positive vibe going saying their breadth of product offering is getting attention from distributors. They offer single and two-stage rotary screw air compressors from 4 to 350 hp. The RS Series is the unenclosed line while the NX Series has a standard sound attenuating enclosure. They of course continue with their strong industrial reciprocating air compressor line. In addition, Matt Smith told me FS-Elliott is now introducing new water and air-cooled centrifugal air compressors down to 150 hp!

ISEL explained their focus on their Universal 10,000 hour air compressor lubricant to me. A unique and largely ester-based formulation, they explained it's top-off compatible with any air compressor lubricant and their top seller. I had one distributor owner tell me this is his go-to lubricant!

Ozen Air Technologies exhibited their OASC Series (4-132 kW) rotary screw air compressors featuring NEMA TEFC premium efficient motors and a Poly-V belt tensioning system. as well as their OABC D Series boosters capable of 25 to 75 bar pressures.

Tamturbo announced a new model to their lineup of oil-free turbo air compressors. Hannu Heinonen said new TT225 and TT325 models are

coming soon for the 70-130 psig medium pressure range. These oil-free variable turbo compressors are also offered for low pressure (40-70 psig) applications. This can be a very interesting solution for pneumatic conveying applications.

The Exhibition – Compressed Air Purification, Piping and Measurement

BEKO Technologies continues to grow their desiccant air dryer business in North America. Commenting they ship 80 to 800 cfm models from stock, Adrian Fernandez showed me some of the many desiccant dryer option packages offered including; filter bypass, low ambient package and -100 ˚F (-73 ˚C) dewpoint. Their refrigerated dryer program is also based on fast deliveries with 10 to 6,000 cfm shipping from stock.

JORC continues to grow with their total focus on condensate management products. Darren de Bie reported business is brisk for their full range of oil-water separators and condensate drains. I've long been a fan of their AIR-SAVER® product featuring timer-controlled 1" and 2" ball valves. The valves open gradually when re-pressurizing the line. I visited a plant last month where again I saw a great need for this in-line timer-controlled valve which can keep a plant from leaking compressed air during down periods or shifts, by simply cutting the air supply. Perhaps this should be a standard product in most 1 or 2 shift operations?

It appears the aluminum piping business at Applied System Technologies is booming. Mike Cranford says they are moving into a Charlotte warehouse which is three times larger and has 1 million linear square feet of pipe in stock with all the fittings required. When asked why the growth he pointed at their Lifetime Warranty (launched in February 2018) on all pipe and fittings as well as being the only supplier of 8" and 10" aluminum pipe (Wow!). It's really cool aluminum can be used for headers now. Having recently visited a plant with leaks at each drop, I found their technical details such as the imbedded water trap for piping drops and their deep insertion depth for fittings very practical and useful.

Clean Resources introduced their new Smart-Pak Series oil-water separator featuring aftermarket protection, for service companies, due to the electronic signature which opens the valves. I also found it interesting (and very positive) that they encourage customers to return the used (oil) cartridges to them and they will pay the recycling fee. Ultimately they hope return volumes to grow to where they can do oil recycling themselves.

Hannu Heinonen, Timo Pulkki and Mike Batchelor at the Tamturbo booth (left to right).

Russ Jones, Felipe Gonzalez and Adrian Fernandez at the BEKO Technologies booth.

Richard Dean (John Henry Foster), Anthony Yacucci, Darren de Bie and Brian Antony (JHF) at the JORC booth.

SHOW REPORT: THE 2019 AICD CONFERENCE & EXHIBITION

Mike Cranford, Doug Romoser (West Coast Compressor) and Chris Canape at the Applied System Technologies booth (left to right).

David Schlukebier, Molly Powers, Chad Timmer and Bart Frush (Modern Compressed Air) next to the new Clean Resources Smart-Pak Series.

Mike Lewis, Jay Francis, Brian Wood and Vic Zanchetta at the SPX FLOW booth (left to right).

Kingston Valve has been manufacturing valves since 1908 (amazing!) in sunny Southern California and continue their two-day deliveries on all sorts of valves used in the compressed air industry. These include captured exhaust safety valves and air-actuated angle valves used in desiccant air dryers and nitrogen generators.

SPX FLOW is very pleased by the market penetration of their new phase-change refrigerated dryers. Jay Francis showed me a really cool 3D training device to better understand the "phase-change" refrigeration/heat exchanger system. It's really impressive how far the industry has come with cycling dryers and SPX FLOW is all-in on this exciting new technology. They are also gaining a lot of traction, in large air flow applications, with their high-flow modular refrigerated dryers.

Mikropor gave a sneak peak at their new MBS Series Breathing Air Purification Systems. Models range from 5 to 1250 cfm. For those of you working hard to keep pressure drop down for clients, I suggest you ask Mikropor about their refrigerated dryers – they've done some innovative things.

During the show I learned Denver-based Puregas is part of Altec, Inc. Altec is a significant company and a leading supplier of "trucks with boom cranes" to the electric utility and telecommunications market. Altec is investing in Puregas and they've acquired MACAIR. Expect some noise from this firm! They plan to build a full line of industrial "Made in Colorado" compressed air purification products.

I was also impressed by Midwest Control who explained their broad offering of valves and compressed airline accessories. They have an amazing array of important safety and reliability components important to a compressed air system.

Conclusion

Once again, the AICD exceeded expectations – plus every one had a great time. I hope this report provides a taste of what happened – there's no way to cover the whole event and do all the exhibitors justice in these short pages.

For AICD membership information contact Dave Gaitsch, Membership Recruiter, at email: memberinfo@aicd.org. The 2020 AICD will be held May 16-18 in Savannah, Georgia. For more information, please contact Kasey Gould, AICD Administrator, tel: 409-860-9961, email: admin@aicd.org, or visit www.aicd.org BP

To read more about ***Compressed Air Technology,*** please visit www.airbestpractices.com/technology

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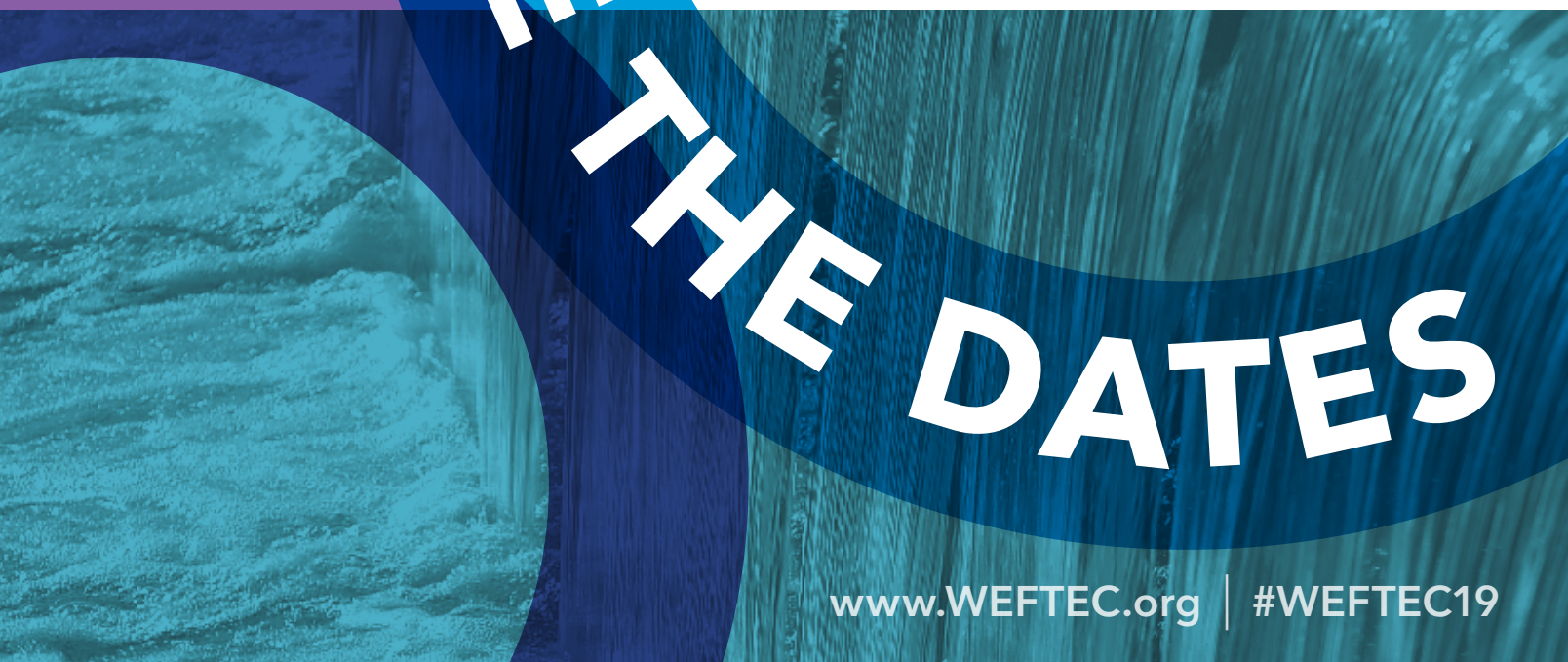

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TECHNOLOGY PICKS

New Kaeser Oil-Free FSG Series Models Now Available

Kaeser's new redesigned FSG series oil-free rotary screw compressors are now available with i.HOC® (integrated heat of compression) dryers and IE4 class drive motors. Available in both fixed speed and variable frequency drive from 250-450 hp, these reliable units feature a number of customizable options for exceptional energy efficiency and air quality.

New Kaeser FSG series oil-free rotary screw air compressor.

Kaeser's i.HOC dryers use the heat generated by compression to regenerate desiccant, eliminating the need for any additional energy in the drying process – even when air demand varies or in challenging environments. Full flow regeneration, along with an additional patented process, reliably provides pressure dewpoints to -22 °F. The i.HOC oil-free compressors also feature a built-in heat recovery option and are designed to be space efficient without sacrificing serviceability.

FSG units come standard with Sigma Control 2™. This intelligent controller manages the entire drying process, while automatically adjusting to changes in air demand, maintaining consistent pressure dew points. Additionally, it offers unsurpassed compressor control and monitoring with enhanced communications capabilities for seamless integration into plant control/monitoring systems and the Internet of Things (IoT).

For more information, visit us.kaeser.com/oilfree. For more information or to be connected with your local authorized Kaeser representative, please call (877) 417-3527.

Gardner Denver Launches 75HP and 100HP Electra Saver Compressors

Gardner Denver's engineering ingenuity began in 1859. More than 150 years of success has built a legendary brand with legendary compressors. The legend continues with the introduction of the Electra Saver G2 and Electra Saver II G2 75HP and 100HP compressors. Founded on slow-speed, 1800rpm design principles and featuring state of the art controls, varying capacity controls (Saver II G2 – load/no load and inlet modulation; Saver G2 – Turnvalve (variable displacement), super-sized bearings and up to 40% larger airends than the competition, the Electra Saver G2 and the Electra Saver II G2 are the compressors to exceed your demands. For further information, please visit: www.gardnerdenver.com/gdproducts.

About the Gardner Denver Industrials Segment

Gardner Denver Industrials Segment delivers the broadest range of compressors and vacuum products, in a wide array of technologies, to end-user and OEM customers worldwide in the industries it serves. The Segment provides reliable and energy-efficient equipment that is put to work in a multitude of manufacturing and process applications. Products ranging from versatile low- to high-pressure compressors to customized blowers and vacuum pumps serve industries including general manufacturing, automotive, and waste water treatment, as well as food & beverage, plastics, and power generation. The Segment's global offering also includes a comprehensive suite of aftermarket services to complement its products.

Gardner Denver Industrials Segment, part of Gardner Denver, Inc., is headquartered in Milwaukee, Wisconsin, USA. Gardner Denver was founded in 1859 and today has approximately 6,500 employees in more than 30 countries. For further information, please visit: www.gardnerdenver.com/gdproducts.

About Gardner Denver

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

Gardner Denver Electra Saver G2 compressor.

TECHNOLOGY PICKS

FLIR Announces New EM54 Environmental Meter

The FLIR EM54 environmental meter.

FLIR Systems, Inc. announced the multi-purpose FLIR EM54 environmental meter for heating, ventilation, air conditioning, and refrigeration (HVAC/R) measurements. The FLIR EM54, based on hygrometer technology, identifies deviations from ambient relative humidity levels, which can cause static hazards at manufacturing sites and discomfort in homes and offices. This high-quality, easy-to-operate meter helps users quickly and accurately identify symptoms of clogged HVAC/R filters, duct leaks that reduce airflow, and overloaded systems.

The highly accurate FLIR EM54 is ideal for inspecting ducting, electrical motors, thermal equipment, and other system components in residential, commercial, and industrial facilities. Equipped with an external vane anemometer for wide-range, high-resolution air velocity measurements, the FLIR EM54 allows users to check air speed at duct inlets and outlets quickly and precisely. This allows for simplified duct airflow calculation and efficient troubleshooting.

The EM54 includes a Type-K contact temperature probe to allow users to check electric motors and thermal equipment components for proper operating temperatures. The EM54 also calculates wet bulb and dew point temperature.

The FLIR EM54 environmental meter features an intuitive set of function keys, making it easy-to-use, and easy-to-read with a backlit multi-function display, a MIN-MAX-AVG recording function, and a programmable auto power off timer. The rugged, multi-purpose diagnostic tool comes with a three-year limited warranty.

To learn more about the FLIR EM54, visit: www.flir.com/em54.

About FLIR Systems, Inc.

Founded in 1978, FLIR Systems is a world-leading industrial technology company focused on intelligent sensing solutions for defense, industrial, and commercial applications. FLIR Systems' vision is to be "The World's Sixth Sense, creating technologies to help professionals make more informed decisions that save lives and livelihoods. For more information, please visit www.flir.com.

More Robust VPFlowScope 3-in-1 Flow Meters

VPInstruments announced the VPFlowScope electronics platform has been upgraded providing more robust protection against static discharges and short-circuiting. We implemented a new, ultra-robust Modbus transceiver circuit, which can hold up to ±60V on A and B lines. It can also allow a larger common mode range of ±24 Volts, which makes biasing of your RS485 network less critical. This transceiver was already in use in the VPFlowScope M and has now been integrated into the complete VPFlowScope product line, including the VPFlowScope Probe, DP, and In-line.

Features:

- Protection from overvoltage line faults up to ±60V
- ±15kV ESD interface pins
- Extended common mode range: ±24V
- Guaranteed fail-safe receiver operation

Background

In many industrial devices, for example, compressor controllers and sensors, RS485 transceivers are easily blown by static discharges, especially when connecting wires for the first time without any protection. Therefore, static protection is very important. We also experienced that one of the most common wiring errors is to reverse data and power lines. Connecting the 24V power supply across the

VPFlowScope 3-in-1 flow meter.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

data lines of any traditional RS485 port will result in the transceiver chip going up in smoke, which means the end of your VPFlowScope.

All VPFlowScope products are now protected with the new integrated overvoltage protection. The new transceiver will protect your VPFlowScope against incorrect connection to the 24V power commonly found in building automation installations, and the data lines will withstand connection to 24V power indefinitely. The protection is rated for a maximum of ±60V.

About VPInstruments

VPInstruments offers industrial customers easy insight into energy flows. We believe that industrial energy monitoring should be easy and effortless, to enable insight, savings and optimization. VPInstruments' flow meters are calibrated on state-of-the-art calibration facility. Our calibration equipment is maintained under our ISO 9001 Quality Management System and is traceable to National Standards. Let us open your eyes and start saving energy. For more information, visit www.vpinstruments.com.

Mann+Hummel Introduces StarBox Series of Air/Oil Spin-on Separators

Clean air, energy and resource efficiency, reduced operating costs and predictive maintenance through digital components. These are the benefits offered by the new technologies presented by the filtration specialist MANN+HUMMEL. The focus of the developments in the industrial business is on filtration, systems competence and proximity to customers worldwide.

StarBox^{XT} and StarBox^{2} are the new spin-on separators from MANN+HUMMEL for air/oil separation of compressors. The separator series ensures clean compressed air and at the same time reduces the energy consumption of the plants. The new series are:

- StarBox^{XT} for superior separation efficiency

The StarBox² is designed for low pressure drop.

- StarBox^{2} for particularly low pressure drop

Both separators are designed for a wide flow range in order to make their advantages available over the entire working area even in compressors with a Variable Speed Drive (VSD).

The StarBox^{XT} is the new standard series. It offers a stable and reliable function in different operating ranges as well as a reduced oil consumption by approximately 30%. Energy-saving compressors with variable drives are

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also optimally supported. MANN+HUMMEL has developed a new sealing concept for a secure maintenance. Scratching of sealing surfaces with subsequent leakage or shearing of sealing elements during filter replacement is excluded by the design. The new StarBox^{XT} series can be used directly on existing compressors and is immediately ready to perform with all its advantages.

The innovative StarBox^{2} offers decisive advantages in relation to energy consumption. MANN+HUMMEL developed the spin-on separator series especially for stationary and mobile compressors up to a performance of approximately 55 kW. The StarBox^{2} reliably separates the oil from the compressed air while managing to reduce the power consumption. This allows StarBox^{2} to impress in comparison to other spin-on separators with a pressure loss which is up to 25 percent lower. This is made possible by an improvement in the flow characteristics in the connection area and a new sealing concept. At the same time, they improve the assembly safety.

About MANN+HUMMEL

MANN+HUMMEL is the leading global expert for filtration solutions. The company group with its headquarters in Ludwigsburg, Germany, develops solutions for motor cars, industrial applications, clean air in interior spaces and the sustainable use of water. In 2018 the group achieved sales of approx. 4 billion euros worldwide with more than 20,000 employees at more than 80 locations (preliminary figures). The products manufactured by the group include air cleaner systems, intake manifold systems, liquid filter systems, plastic components, filter media, cabin filters, industrial filters and membrane filters. Further information about MANN+HUMMEL is available at www.mann-hummel.com.

Festo Introduces a Harsh-Environment Filter Regulator

Festo introduces the PCRP filter regulator for harsh process industry environments, including oil and gas. The PCRP filter regulator series withstands corrosive atmospheres, has a wide temperature range, features resistance to explosive atmosphere ratings, and delivers reliable pressure control at high flow rates. PCRP regulators also feature an all-in-one regulator and filter space-saving design.

Festo PCRP filter regulator for harsh process industry environments.

The PCRP 316L stainless steel housing meets the National Association of Corrosion Engineers (NACE) MR0175 standard for corrosion resistance – including hydrogen-sulfide environments. These filter regulators deliver dependable pressure control at flow rates from 1,920- to 4,115-l/min. Operating range is from 1- to 20-bar. Two pressure regulation ranges are available, 0.5- to 7-bar and 0.5- to 12-bar. The series temperature range stretches from -76° to +176 °F (-60° to +80 °C). These units are suitable for outdoor environment.

The PRCP is rated for use in explosive atmosphere, zones 1, 2, 21, and 22. Patented seal technology protects against back flow and ensures reliable exhausting with no special components required. The PCRP series is available in sizes ¼" and ½" with G or NPT threads. For more information, call 800-993-3786 and visit the Festo process automation landing page.

About Festo

Festo is a leading manufacturer of pneumatic and electromechanical systems, components, and controls for process and industrial automation. For more than 40 years, Festo Corporation has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performing, more profitable automated manufacturing and processing equipment. For more information visit www.festo.com.

New Ashcroft 1140 Budget Friendly Gauge

Ashcroft 1140 series differential pressure gauges are the budget friendly solution in applications that do not require all stainless steel protection. These gauges feature a sturdy glass filled nylon front case that allows the window to be easily removed and cleaned. No additional hardware is required for either direct or panel mounting. Designed for either liquid or gas media, Ashcroft® 1140, 1141, 1142 and 1143 DP gauges offer static pressure capacities of up to 6000 psi and ranges from as low as 0-10 inH20d up to 0-150 psid. Dials scaled in flow are also available.

For more information, please call 203-385-0635 or visit www.ashcroft.com.

Ashcroft 1140 Series differential pressure gauge.

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