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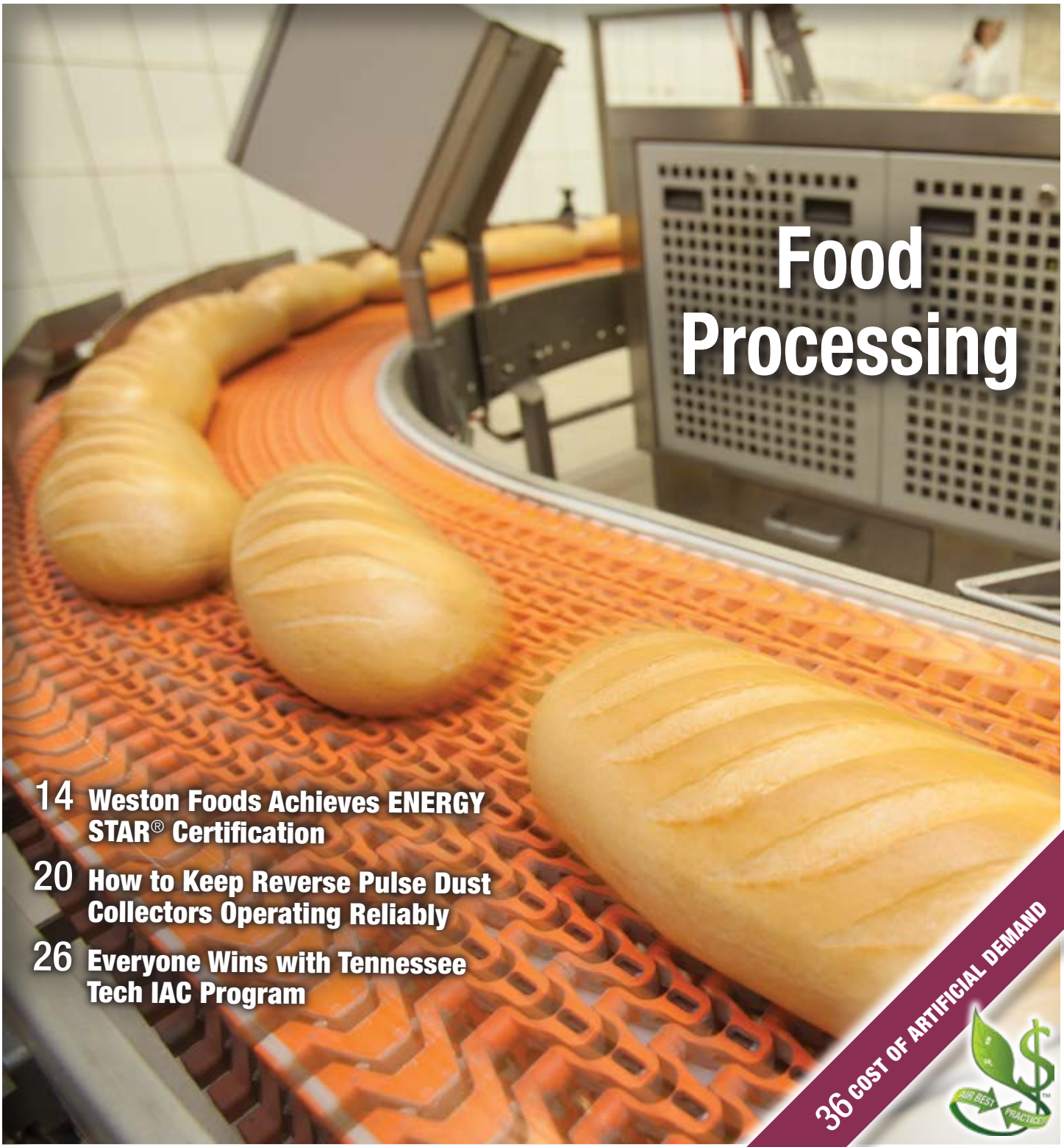

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FEATURES

QUALITY, SAFETY & RELIABILITY FEATURES

PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION FEATURES

COLUMNS

FROM THE EDITOR | Food Processing

Are you ready for the Fall season? We are and hope to see you at our 2nd Annual Best Practices Expo & Conference. Please visit www.cabpexpo.com to register and view the amazing line-up of speakers and exhibitors waiting for you at the Music City Center in Nashville!

Quality, Safety and Reliability

Reverse pulse type dust collectors are present in most food processing plants. Ron Marshall sends us an excellent article detailing the reliability and efficiency solutions he provided to multiple Canadian plants including a protein products processor using 15 dust collectors totaling 100 blast valves.

Tim Dugan provides us with Part 2 of his two-part article series titled, "Reliability: Should Compressed Air Monitoring be Combined with Control?" After focusing on different internal customers and potential problems in the first article, this feature focuses on building practical systems that address both controls and monitoring.

Artificial demand is a term not well understood by many. We are very pleased to publish an article by Hank van Ormer titled, "Eliminate the Cost of Artificial Demand with Proper Storage and Piping." This is the kind of article I'd recommend saving and sending around to your colleagues in different plants.

Productivity, Sustainability & Energy Conservation

Darren Borden, from Weston Foods in Etobicoke Canada, told us in Mike Grenniers' article, "As far a compressed air is concerned…we're walking on the fruit because it represents such a major opportunity for energy reduction." Awarded the ENERGY STAR® certification for 12 bakeries in Canada and 4 in the U.S., Weston Foods sets an example for us all.

It's been a real pleasure getting to know Dr. Glenn Cunningham, P.E., the Program Director for the Tennessee Tech University Industrial Assessment Center. Launched in 2006, their free system assessments have provided manufacturers with $27.5 million in recommended cost savings all while preparing students for careers! I can personally tell you Dr. Cunningham is an expert in compressed air systems. I hope you enjoy Mike Grenniers' profile of their excellent program.

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

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INDUSTRY NEWS

Atlas Copco has Acquired Medical Gas Supplier MGES Inc.

Atlas Copco has acquired the operating assets of MGES Inc., a service supplier of medical gas solutions including distribution and service of medical gas systems. The company is based in Houston, Texas, and serves the Houston and San Antonio area. The company services, sells and completes small installations of piped medical gas equipment, which includes medical air systems, vacuum systems, pipeline equipment and laboratory equipment.

"The acquisition gives us the ability to expand our local support to our healthcare and laboratory customers in the Houston and San Antonio, Texas area", said Vagner Rego, Business Area President Compressor Technique. "It allows us to increase direct sales and services in one of the fastest growing regions in the US".

The purchase price is not material relative to Atlas Copco's market capitalization and is not disclosed. The business will be integrated into BeaconMedaes LLC, which is part of the Medical Gas Solutions Division in Compressor Technique Business Area.

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.

Sauer Compressors USA Honored with Defense Security Service Award

Sauer Compressors USA announces the company was one of 51 facilities that received the 2019 James S. Cogswell Outstanding Industrial Security Achievement Award, the most prestigious honor the Defense Security Service may bestow to cleared industry partners of the Department of Defense.

The award recognizes large and small companies for establishing and maintaining a security program that far exceeds the basic National Industrial Security Program requirements; and providing leadership to other cleared facilities in establishing best practices while maintaining the highest standards for security. Of the more than 13,000 cleared facilities, less than one percent are annually selected to receive this award.

To be considered for this award, Sauer Compressors USA was required to have a minimum of two consecutive superior industrial security review ratings, which shows a sustained degree of excellence and innovation in their overall security program management, implementation, and oversight. "We are honored to receive the Cogswell Award in recognition of our dedication and focus on security excellence. This is a clear reflection of Sauer's commitment to providing the best possible service to our customers while always maintaining the highest security standards in the industry," said Don Eaton, Sauer Compressors USA's President and Chief Executive Officer.

Johnny Moore and Ashley Sylvester accepting the James S. Cogswell Outstanding Industrial Security Achievement Award

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INDUSTRY NEWS

The award was established in 1966 in honor of late Air Force Colonel James S. Cogswell, the first chief of industrial security within the Department of Defense. Cogswell was responsible for developing the basic principles of the Industrial Security Program, which includes an emphasis on the partnership between industry and government to protect classified information. This partnership ultimately ensures the greatest protection for the U.S. warfighter and our Nation's classified information.

About Sauer Compressors USA

Sauer Compressors USA Inc. specializes in the manufacturing of medium and high-pressure air and gas compressors for naval, commercial maritime, offshore, research & development, and demanding industrial applications. Rated for continuous duty, all compressors have been field tested in the most demanding applications and extensively refined to provide true 24/7 reliability supported by the Sauer Lifetime Warranty. With a reputation for reliability and life cycle product support, Sauer Compressors is the global leader in the medium and high-pressure compressor markets. For more information please go to www.sauerusa.com or reach out to sales@sauerusa.com.

Zorn Compressor & Equipment Announces Addition of New Facility

Zorn Compressor & Equipment, a Midwest leader in compressed air and vacuum solutions, announced the opening of their seventh branch location. The new office will meet the increased demand for high-quality compressed air equipment, parts and services in the Chicago Metro market and is located at 10216 Werch Dr., Woodridge, IL 60517.

The new "Chicago South" branch joins the existing Gurnee, IL facility along with the five locations in Wisconsin: Milwaukee, Madison, Green Bay, Wausau, and Eau Claire. All Zorn offices are full-service brick and mortar facilities with localized sales, service and technical support.

"Zorn has been serving customers since 1965 and our new Chicago South location expands our strategic vision to deliver extraordinary compressed air solutions and unparalleled service to more customers" said Matt Zorn, President. "We're excited to represent world class equipment lines from leading manufacturers as well as local service and optimization services to better serve the strong and growing Chicago Metro market."

According to Jeff Carlson, Vice President & General Manager, "compressed air is a vital utility for our customers, and most are unable to function without their compressed air supply. Our customers depend on us and we work to have the resources they need, when and where they need them. Whether it's our expertise in system design, our comprehensive maintenance programs that minimize downtime, or our fast response when repair service is needed, our customers have come to expect the best from Zorn Compressor."

"The addition of the Woodridge office, along with our other six branch offices, allows us to better meet the needs of our existing customers and service new customers and industries", said Frank Melch, Vice President of Sales.

For more information about the new Chicago South office located in Woodridge, IL, visit www.zornair.com or call 630-410-8888 to talk to a local Account Representative.

About Zorn Compressor & Equipment

Since 1965, Zorn Compressor & Equipment's award-winning compressed air solutions have helped thousands of companies around the Midwest increase their compressed air efficiency by providing world class equipment lines from leading manufacturers, as well as turn-key installations, equipment service, parts, lubricants, rentals, and system audits. Zorn's comprehensive product offerings, coupled with our engineering expertise, provide our customers with the ultimate value in performance, efficiency and technology. At Zorn we believe relationships matter. Our guiding principal, compressors are our business, people are our focus, illustrates our special connection with our customers, our deep bond with our employees and our place in the community. Please visit www.zornair.com to find out more about Zorn Compressor & Equipment's customers, people, partners and solutions.

Zorn's Corporate Headquarters, Pewaukee, WI.

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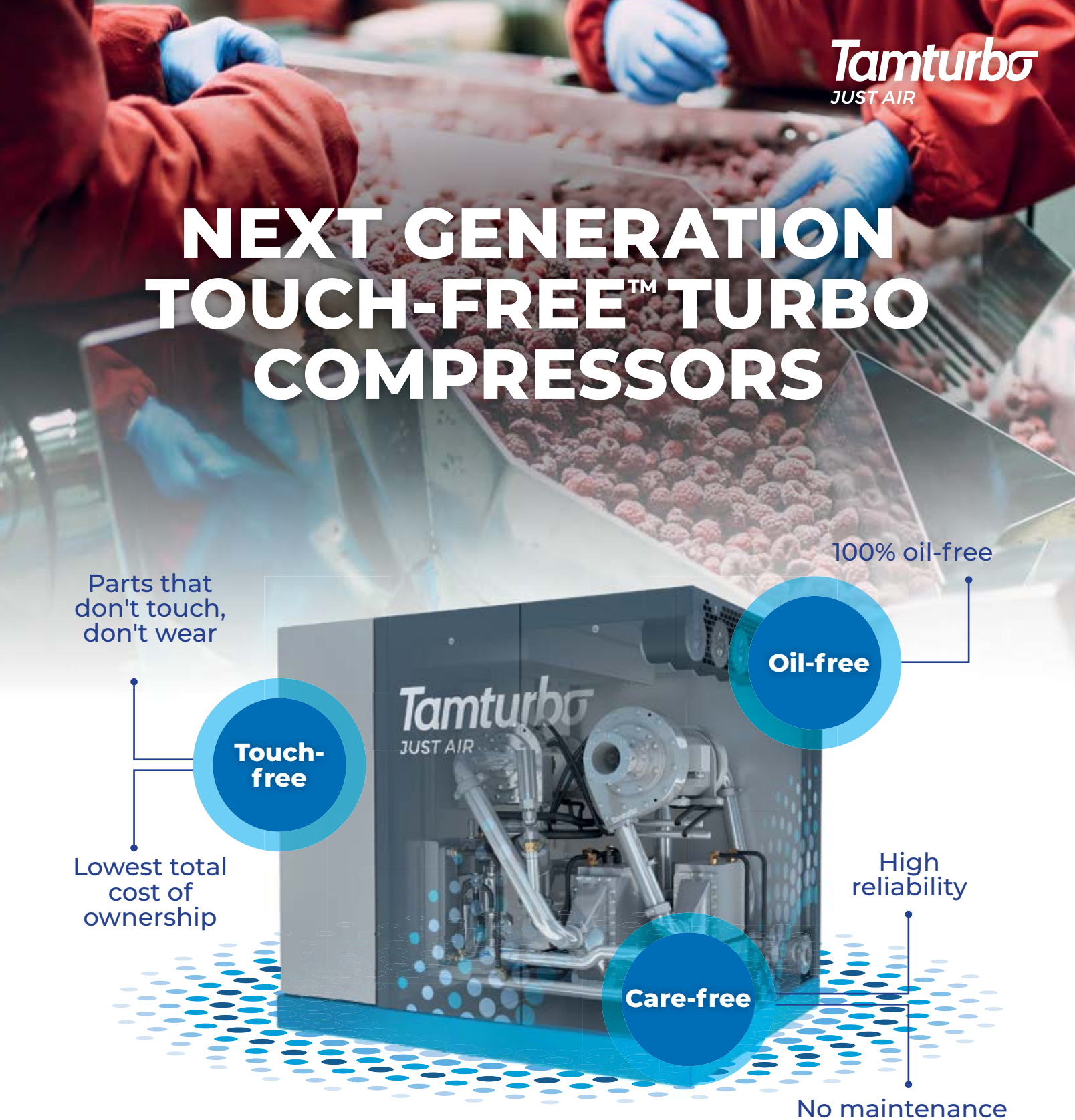

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INDUSTRY NEWS

J&J Snack Foods and Grain Craft Partner with Energy Trust of Oregon

Energy savings can come in unexpected places in industrial or manufacturing facilities. That's what J&J Snack Foods and Grain Craft discovered when they started working with Energy Trust of Oregon to take a closer look at how they use energy.

J&J's food processing plant in Weston, Oregon, creates 13 million pounds of sandwich pockets and 5 million pounds of raised dough products every year – and that requires a lot of energy. J&J turned to Energy Trust for ideas on how to reduce energy costs, including the use of compressed air, one of their biggest energy systems.

"We discovered we had quite a few compressed air leaks we didn't know about," said Richard Boyer, Plant Manager. It turned out that using compressed air to remove their scrap dough was a big energy waster. "That was a costly and unnecessary use of compressed air, so we've redesigned our conveyor belt to remove the dough another way. We did all the work in-house."

J&J also started rethinking processes it has been doing for years, such as using compressed air to create compressed fiberboard slip sheets for use on all its pallets. Gerard Law, Vice President of Operations, questioned why that was standard practice when only about 80% of products require a slip sheet. The answer: "We've always done it that way," he said.

As a result, J&J cut down on its use of slip sheets, delivering even more compressed air savings.

Grain Craft's flour mill in Pendleton, Oregon, found energy savings in the mill's air compressor room: A window that was boarded up now has a fan to bring in cool outside air, and is saving energy by allowing air compressor motors to operate at a more optimal temperature. Additionally, employees have identified and repaired compressed air leaks and set up a regular leak-detection and repair program.

"Watching Energy Trust and our own employees uncover opportunities to improve efficiency, I saw how easy it is to overlook little changes that could add up to significant dollar savings," said Kyle McCormack, Head Miller.

J&J Snack Foods produces 13 million pounds of sandwich pockets and 5 million pounds of raised dough products every year.

About Energy Trust of Oregon

Energy Trust of Oregon is an independent nonprofit organization dedicated to helping utility customers benefit from saving energy and generating renewable power. Their services, cash incentives and energy solutions have helped participating customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista save $3.2 billion on energy bills. Their work helps keep energy costs as low as possible, creates jobs and builds a sustainable energy future. To learn more about energy efficiency for industrial facilities, visit www.energytrust.org/industry.

Alliance Names Four Innovators as 2019 Stars of Energy Efficiency

The Alliance to Save Energy announced it would be awarding Alabama Power, Ingersoll Rand, OhmConnect, and Pepco Holdings its 2019 Stars of Energy Efficiency, celebrating their accomplishments in pioneering new ways to use energy more effectively. The awards reflect a new emphasis on reducing energy use through integrated and automated technologies, on-demand efficiency opportunities that can better balance electrical grid loads, and corporate leadership in speeding the deployment of efficiency solutions.

"Energy efficiency isn't just about sealing the leaks or replacing old equipment, it's increasingly about smart systems that work together to maximize savings, help reduce strains on the grid and support the integration of renewable energy sources," said Jason Hartke, president of the Alliance to Save Energy. "These are companies that are at the forefront of the newest active efficiency technologies and are committing to deliver more energy savings."

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INDUSTRY NEWS

Alabama Power, a subsidiary of Southern Company, will receive the Star of Systems Efficiency Award for developing the 62-home Smart Neighborhood™ in suburban Birmingham featuring emerging energy-efficient technologies and building measures, all connected to the Southeast's first community-scale microgrid. Homes in the community are around 39 percent more efficient than standard new homes in the area and are equipped with technology to allow residents more control over systems and features, along with increased comfort. Alabama Power is using data from the neighborhood to provide greater understanding of energy management and insights into how homes can be built and function more efficiently.

"We appreciate this great recognition from the Alliance to Save Energy for Smart Neighborhood, which is an important part of Alabama Power's commitment to find new and better ways to serve our customers," said Alabama Power CEO Mark Crosswhite. "As we continue to keep customers at the center of everything we do, we're excited about the opportunities to use technology and innovative solutions to transform our business."

Ingersoll Rand will be honored with the Star of Doubling Down on Efficiency Award for setting and surpassing bold greenhouse gas reduction goals. Since 2014, the company has reduced the greenhouse gas emissions of its operations by 45% and its energy intensity by 23%. By producing efficient products, including building HVAC and energy management, transport refrigeration, personal transportation vehicles, hand tools, air compressors, fluid pumps, and material handling equipment products, it has also reduced its customers' GHG footprint by more than half. Ingersoll Rand and its strategic brands Trane® and Thermo King® announced its newest sustainability commitment for 2030 which includes reducing its customers' GHG footprint by 1 billion metric tons of CO2e, achieving carbon-neutral operations, realizing a 10% reduction in absolute energy consumption and more.

"We're honored to receive the Star of Doubling Down on Efficiency Award in recognition of our reducing greenhouse gas emissions and energy intensity across our operations and business," said Michael Lamach, chairman and CEO of Ingersoll Rand and leading brands Trane and Thermo King. "Sustainability is foundational to who we are. In 2014, we set ambitious sustainability targets that transformed the industry and how we serve our customers and communities. Our next generation 2030 targets – which include an ambitious goal to reduce emissions from our products by one gigaton while reducing energy used to produce systems – will continue to lead innovation toward an energy-efficient and cleaner environment."

OhmConnect will receive a Star of Dynamic Efficiency Award for its innovative energy platform that is reducing strain on the electrical grid and paving the way for everyone to get smarter about their energy usage through gamification. OhmConnect pays its customers to save energy when the grid is stressed. The service, with more than half a million participants in the U.S. and Canada, sells the aggregated reductions of electricity during moments of peak demand as virtual power to the energy markets. The platform encourages participants to make easy, tangible behavioral changes, like turning off lights, as well as automated actions through connected

smart devices like thermostats. To date, OhmConnect has offset more than two million pounds of carbon and paid its users more than $10 million, and it is set to expand in the U.S. beyond its California base.

Matt Duesterberg, CEO of OhmConnect, said: "We're helping people understand and even have fun by being mindful of their energy use to save money – and reduce the need for dirty 'peaker' power plants. Using energy more effectively isn't just about using less, it's about using it more strategically – at the times when it's the least expensive and better for the planet."

Pepco Holdings will be presented with the Star of Dynamic Efficiency Award for demand-side management programs at Delmarva Power and Pepco. These programs are leveraging smart thermostats to help customers save money and energy during peak energy usage periods. The Thermostat Optimization Program makes slight temperature setpoint adjustments to participants' heating and cooling schedules to create approximately 100 kilowatt hours in household energy savings annually – all with minimal impact on their comfort. The Bring Your Own Device Program allows customers to participate in demand response with any eligible thermostat. Participants receive up to $40 in annual bill credits for allowing Delmarva Power or Pepco to reduce air conditioner run times on peak demand days.

"We are committed to providing programs and services that transform the way our customers use energy," said Dave Velazquez, president and CEO of Pepco Holdings, which includes Delmarva Power and Pepco. "These important programs are providing all customers with cost-effective, energy saving opportunities for their homes and businesses. We are honored to receive this award, which recognizes just how effective our programs have been at helping customers save money and energy."

About the Alliance to Save Energy

Founded in 1977, the Alliance to Save Energy is a nonprofit, bipartisan alliance of business, government, environmental and consumer leaders working to expand the economy while using less energy. Our mission is to promote energy productivity worldwide – including through energy efficiency – to achieve a stronger economy, a cleaner environment and greater energy security, affordability and reliability. For more information, visit www.ase.org.

Weston Foods' Achieves ENERGY STAR® Certification with COMMITMENT TO SUSTAINABILITY

By Mike Grennier, Compressed Air Best Practices® Magazine

As a leading North American bakery company Weston Foods ensures its numerous facilities productively and cost-effectively produce high-quality baked goods. But it doesn't stop there. It goes the extra mile to optimize and manage its utilities to conserve energy and protect the environment.

The company's efforts have not only helped it profitably grow and achieve environmental sustainability, but also gained recognition in the form of the Environmental Protection Agency's ENERGY STAR® certification – making it only the second company in Canada other than General Motors to earn the certification.

Darren Borden, P. E., CEM, Energy Management Engineer, Corporate Health, Safety and Environment, at Weston Foods, said it was only a matter of time before the company earned the certification at numerous bakeries.

WESTON FOODS

"We've been ENERGY STAR-certifiable for years based on our long-term program of energy management and efficiency improvements, but we decided to take a more focused approach with energy measures – especially with our compressed air systems. As far as compressed air is concerned, we're not just picking the low-hanging fruit – we're walking on the fruit because it represents such a major opportunity for energy reduction."

Compressed Air Key to Multiple Baking Processes

Headquartered in Etobicoke, Toronto, Canada, Weston Foods (www.westonfoods.com) bakes products in more than 50 facilities across Canada and the United States. The company's products, which are sold throughout North America, include such baked goods as loaf bread, rolls, donuts, cakes and cookies.

The company bakes products in facilities ranging in size from 50,000 to 200,000 square feet. The bakeries normally operate 24 hours a day, seven days per week alternating between production, sanitation and maintenance activities.

Weston Foods uses compressed air to power pneumatic controls and cylinders used in virtually every aspect of production, whether it's conveying materials, spraying liquid toppings on baked goods, powering grippers to move trays and products, or pneumatic vibration to break up powders in baghouse operations to name only a few applications.

Before Weston Foods began its compressed air efficiency initiative, a typical compressed air system at a Weston Foods bakery consisted of three direct-drive rotary screw air compressors with each 75-horsepower (hp) machine rated to produce 300 scfm at 125 psi. Each system also included dryers and filters to produce clean, dry compressed air of the highest quality. However, the makeup for compressed air systems at the facilities would soon begin to change.

Holistic Approach Starts with Systems Assessments

When Borden joined the company in 2005 he knew the company could do more with compressed air energy reduction based on his extensive knowledge of compressed air. In addition to having direct experience with compressed air systems, Borden worked with the EPA and Duke University on the ENERGY STAR certification program and helped introduce it to Canada. A bakery, he said, is different than other types of manufacturing operations.

"A bakery is not like an automotive manufacturing operation where I worked before joining Weston Foods," Borden said. "Despite the differences, the opportunities for energy savings at any bakery are as plentiful as those at any automotive facility, if not more."

At Weston Foods, Borden took a holistic approach to compressed air energy reduction in keeping with the company's commitment to continuous improvement, covering not only energy reduction but also continued increases in productivity, reliability and waste reduction.

The process for improvements in compressed air started with data collection and system assessments, which included:

- An evaluation of each bakery's compressed air load and diverse compressed air applications.
- Identification of problems areas, such as pressure bottlenecks and potential issues with unreliability.
- Mapping of compressed air systems' airflow, pressure and power to identify opportunities for improvement.
- Analyses of compressed air system components distribution systems.

WESTON FOODS' ACHIEVES ENERGY STAR® CERTIFICATION WITH COMMITMENT TO SUSTAINABILITY

The assessment process also included exploration of all options for improvements, including the potential for lower rates from local utilities based on demand-side management programs and incentives that accompany them. This includes utility tariff rates commonly used in Canada.

"Before making investments, we look at the tariff rate for a given bakery and determine whether operating under a different tariff rate would be most cost-effective for the facility," Borden said. "Ultimately, saving energy does not necessarily always mean saving costs."

Comprehensive Compressed Air System Upgrades

Following the compressed air system assessments, Borden and the engineering teams addressed a host of areas for improvements and implemented a series of comprehensive compressed air system upgrades.

Among the main initiatives at the bakeries is a targeted approach to reducing artificial demand.

"Artificial demand consists of all of the things that add to load to the air compressor above and beyond what the air distribution system is supposed to do," Borden said. "At many companies, artificial loads are usually driven by the need to keep capital expenditures down. As such, efficiencies of equipment aren't always considered as part of the purchase."

Weston Foods' efforts to reduce artificial demand involved a range of upgrades to compressed air system components, including:

- Piping upgrades, such as larger diameter piping, to reduce restrictions in airflow.
- The addition of compressed air receiver tanks in drawdown areas.
- Replacement of timed-solenoid condensate drain valves on air receiver tanks and compressed air filters with electronic level sensing drains to prevent the loss of compressed air.
- Installation of differential gauges on air compressor filters to pinpoint when the filters needed to be replaced to increase compressed air efficiency and reduce energy consumption.
- Identification and repair of leaks caused by any number of issues, ranging from pinholes in rusted pipes to missing or damaged O-rings in piping connections.

Weston Foods also went beyond lowering artificial demand to save energy in other substantial ways, including the use of air compressors as energy savers. Where applicable, bakeries integrated a heat recovery system into the compressed air system's cooling circuit and used recovered heat for various processes. It also added air ducting to leverage compressed air exhaust air for space heating.

Other methods of energy reduction ranged from eliminating inappropriate uses of compressed air to using electric-powered devices instead of devices powered by compressed air where applicable.

Better Compressed Air System Control

Another part of Weston Foods' comprehensive approach to compressed air energy reduction

involved a better method of controlling and operating its air compressor systems.

In the past, most bakeries operated two fixed-speed air compressors at nearly full capacity for three full shifts to meet demand for process air. In addition, the third air compressor would normally run at full capacity, or turn off, for approximately 30 minutes during every hour of production. The air compressors also provide low-pressure air during times when the bakeries halt production and implement sanitization and routine maintenance procedures.

The bakeries normally operated the air compressors on continuous mode using a cascade setpoint scheme. However, the strategy involves setpoints cascaded over a 10-psi range. As such, the first compressors to operate would run at elevated pressure to maintain the control scheme. Borden, however, decided to implement a better method of control.

"With big pressure swings in the bakery, we can have an air compressor trying to start up and shut down at the same time, which means the unit could eventually trip. There are only so many starts per hour these machines can do. It also consumes a lot of energy when all three air compressors are running flat out," Borden said.

To improve reliability and save energy, each bakery converted one of its three fixed-speed air compressors to a Variable Speed Drive (VSD) unit. In addition, the system controller now dynamically matches compressed air supply with demand and operates only the needed units. Typically, the two fix-speed air compressors serve as base-load machines while the VSD air compressor serves as a trim unit to meet the variable demand requirements during production. The facilities also use the VSD unit on non-production days to supply compressed air where and when needed.

WESTON FOODS' ACHIEVES ENERGY STAR® CERTIFICATION WITH COMMITMENT TO SUSTAINABILITY

"If you're a compressed air systems company, one way to lose a bid when working with us is not to offer us a VSD air compressor," Borden said to emphasize the importance of the technology.

The Value of Thermal Mass Cycling Dryers

In addition to the use of VSD technology on air compressors (as well as other equipment), Borden is a proponent of thermal mass cycling dryers on compressed air systems where applicable.

Before Weston Foods implemented compressed air efficiency measures, it used desiccant dryers in addition to filters to deliver high-quality compressed air throughout the facilities. However, it now uses thermal mass cycling dryers at various bakeries in place of desiccant dryers given the energy-savings opportunity they offer.

"With a desiccant dryer, you're using about one quarter of your compressed air power to dry the air, which is something I consider to be a 'purposeful' compressed air leak," Borden said. "Some people go with refrigerant dryers, but I don't think they make a lot of sense when you've got a varying load. The best type of dryer for our application is a thermal mass cycling dryer."

Borden said the energy savings of thermal mass cycling dryers is hard to overlook since it cycles the refrigeration compressor on and off when needed and uses a stored thermal storage medium to dry the compressed air.

"The dryer says, 'Okay, we're going to run on the premise that the air mass running through the dryer is going to vary, but we're going to let it cool the air with a thermal fluid rather than an unrestricted use of a refrigeration compressor,'" he said. "Just to put it into

perspective, this means we could conceivably eliminate one 100-hp air compressor on system with five, 100-hp air compressors because we no longer need it to keep the desiccant dryer regenerated. That's a huge energy savings."

A Company to Watch

To date, Weston Foods earned the ENERGY STAR certification for 12 bakeries in Canada and four bakeries in the United States.

Each ENERGY STAR-certified operation has reduced its total energy consumption for compressed air by approximately 20% and achieved a similar savings in electric utility costs. Additionally, many energy-saving measures involved local utility rebates, resulting in equipment payback periods of less than two years.

Borden continues working with all Weston Foods bakeries to implement energy-reduction measures across all plant systems. Whether it's a compressed air system, chiller system, or any other energy-user, Borden said energy-reduction often starts with the right mindset when it comes to capital expenditures and operational expenditures.

"When we're planning to add any new equipment to the bakery, I will recommend the most efficient system based on the lowest cost from the perspective of the utility rate structure and available rebates – and the lowest operational expenditure," Borden said.

For Weston Foods, the approach suggests the company will continue to set an excellent example of how large-scale bakeries can lower energy costs and continue to cost-effectively and reliably deliver high-quality baked goods. BP

To read more ***Food Industry*** articles, please visit www.airbestpractices.com/industries/food

QUALITY, SAFETY & RELIABILITY

How to Keep Reverse Pulse Dust Collectors OPERATING EFFICIENTLY AND RELIABLY

By Ron Marshall, Marshall Compressed Air Consulting

To compressed air auditors, and unknowing customers, reverse pulse type dust collectors often represent a challenge to compressed air energy efficiency, and sometimes throw a wrench into the works by causing huge air pressure fluctuations, high transient flows and just plain large leaks. This article discusses this type of dust collector, often installed in food processing plants, and gives some real-life examples of problematic installations. Some suggested measures are mentioned to ensure your dust collectors keep running in a trouble-free manner.

Particle Filtration Basics

Any process that throws off a stream of particles needs to have some sort of filter installed to prevent these suspended solids from being sent outside, or to the plant environment, by the ventilation system. A very popular way to filter a stream of air is to use cartridge or bag-type filters. As the filters collect the material they become loaded on the outside surface with a cake of the filtered particles. As more and more material is deposited on the filter media, the build-up causes restrictions in the flow of the ventilation air. To remove the build-up some cleaning method is required.

Some filter designs use mechanical shakers, or low-pressure blowers, but a very popular cleaning method is the reverse pulse design using a blast of compressed air for cleaning each bag. The filter media is arranged in rows and columns like a grid, for example using six filter bags for each of six rows with two such manifolds as seen in Figure 1.

Figure 1: The typical dust collector, in this case located outdoors, has manifolds providing some storage capacity from which blast valves are connected. In this there are case six valves for each manifold. This particular dust collector had one undetected failed valve that was consuming 200 cfm, which would cost $38,000 per year if left unrepaired.

Blast valves with diaphragm actuators designed for quick actuation are connected to long pipes running along the top of each row of filters, with nozzles arranged to blow into the center of each bag or cartridge in the row.

The cleaning action is controlled by an electrical control board that sends either a pneumatic or electrical signal to each blast valve in turn, based on the adjustable settings of the control board timers. The control board is set to blow for a certain duration every so many seconds, and once finished, it will start all over again unless interrupted by a stop signal. Most control boards have some sort of provision for differential operation, stopping the cleaning cycle if a secondary differential gauge detects a low differential across clean filters. This is an energy-efficiency measure designed to reduce the consumption of compressed air if the bags don't need to be cleaned.

There are a variety of blast valve sizes available depending on the force required to clean the bags. These are selected by the dust collector manufacturers since these valves need to be of significant size to let the required cleaning pulse of compressed air through quickly, with enough force to pop the bag and to fully knock the cake of material off the filter elements. When these blast valves actuate, they cause very high flows, usually at a rate of many hundreds of cubic feet per minute, but typically only for a fraction of a second, around 100 to 400 milliseconds. But if the valves fail in the open position they can cause real havoc by consuming many hundreds of cubic feet of air for days or even months at a time if undetected.

Common Problems Caused by Dust Collectors

In large industrial plants it is common to see many reverse pulse dust collectors, often representing hundreds of blast valves, all with a definite lifespan. Like any machines these are subject to occasional mechanical failure and/or human intervention, both of which commonly cause problems. When these blast valves fail closed the filters will clog, causing problems with the associated process, but if the valves fail open this can cause quite a disturbance to the compressed air system, and in some cases can take down the plant due to low pressure if the failure consumes more than the available air compressor capacity.

Some common problems:

- Valves failing open or leaking.
- Valves failing closed.
- Pulse duration extended by operating personnel to attempt better cleaning.
- Pulse frequency increased to attempt better cleaning.
- Manifold volume too small to provide the required pulse strength.
- Manifolds leaking due to failure of welds.
- Pneumatic circuit freeze-up during cold outdoor conditions, causing the need for expensive desiccant dryers that continuously purge.
- Associated desiccant dryers failed or running uncontrolled.
- Failed control boards or pneumatic components causing skipped valves.
- Connector hoses between blast valves and blow pipes failed.
- Differential controls failed, poorly adjusted, or turned off, causing the dust collector to run unnecessarily, even when the associated ventilation fan is off.

HOW TO KEEP REVERSE PULSE DUST COLLECTORS OPERATING EFFICIENTLY AND RELIABLY

Figure 2: A 60-gallon receiver was added to each problematic dust collector to provide more available compressed air volume per cleaning pulse. The extra storage provided a noticeable increase in pulse strength, popping the bags better for cleaning.

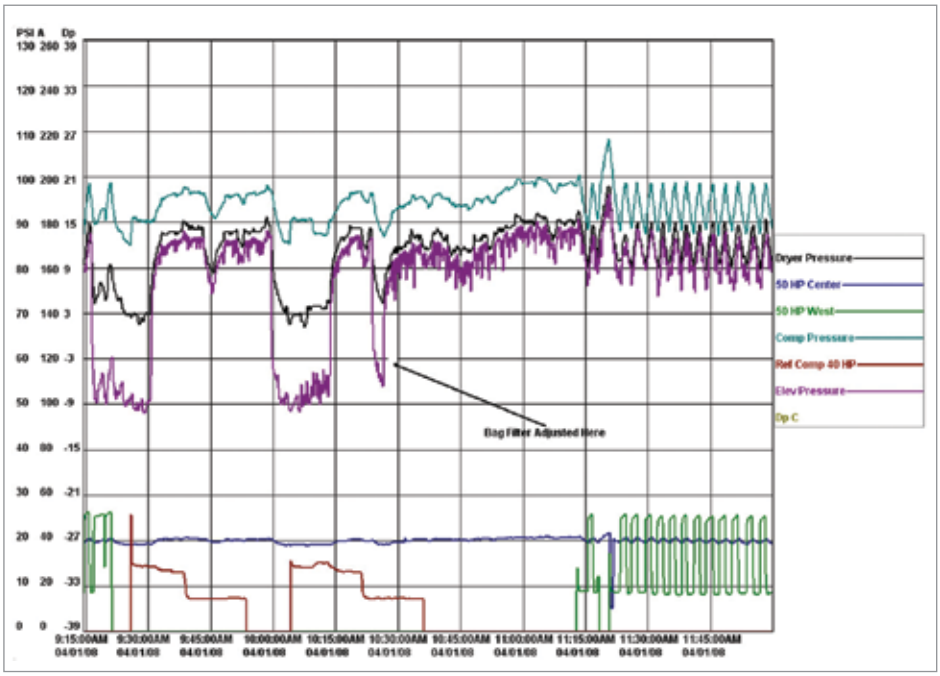

Figure 3: The high flow from a misadjusted dust collector caused a large pressure gradient across the plant (light blue is air compressor discharge pressure, purple is final plant pressure of only 50 psi). An extra air compressor is seen operating to feed this abnormal flow (red line). After the dust collector was returned to normal the pressure gradient was significantly reduced and the extra air compressor unloaded and turned off. For a larger diagram view, type article name into finder tool at www.airbestpractices.com

A few of these problems can cause the failure of the associated process, but most cause a significant increase in compressed air system operating costs. Some stories of failures follow:

Protein Products Processor

A food products processor had 15 different dust collectors as part of their processing lines totaling 100 blast valves, which represented most of the plant compressed airflow. At first, the blast valve pulse duration and frequency was kept within manufacturers specifications, but as time went on the plant started to have problems with the bag filters clogging so the blast duration was lengthened and pulse frequency increased. The original plant used one 100 horsepower (hp) air compressor and a heatless desiccant air dryer, with a second 100-hp air compressor installed as backup. But with the adjustments to the dust collectors, the compressed airflow increased to higher than the capacity of the main air compressor so the backup was started.

This presented a problem because the desiccant dryer was only sized for one air compressor, now two were running, exceeding the dryer capacity. The dryer desiccant fluidized due to the high velocity airflow in the desiccant beds and the desiccant beads rubbed together causing high levels of desiccant dust carryover. This clogged the outlet filter of the dryer causing low plant pressure. The low pressure, and the moisture carry-over from the overloaded dryer, contaminated the dust collector filters causing more clogging problems.

A survey of the dust collectors was done and the problem identified. This particular processor had all their dust collectors inside a heated building so no desiccant dryer was required. The dust collectors were readjusted back to the original settings and the second air compressor was returned to standby service. On some troublesome dust collectors small,

60-gallon storage receivers were installed (Figure 2) to help increase the power of each pulse. This made a noticeable difference in the cleaning action.

Cooking Oil Processor

A cooking oil processor was experiencing widely fluctuating plant pressure, happening at regular intervals, that loaded the air compressors and caused low-pressure failures of plant process machines. During a compressed air audit the dust collectors were inspected and one was found to have excessive pulse length. In an attempt to fix a clogging problem in the dust collector, someone had adjusted the pulses so the blast valves operated for about 13 minutes every 30 minutes. Needless to say the hundreds of cubic feet of compressed air that flowed caused the local

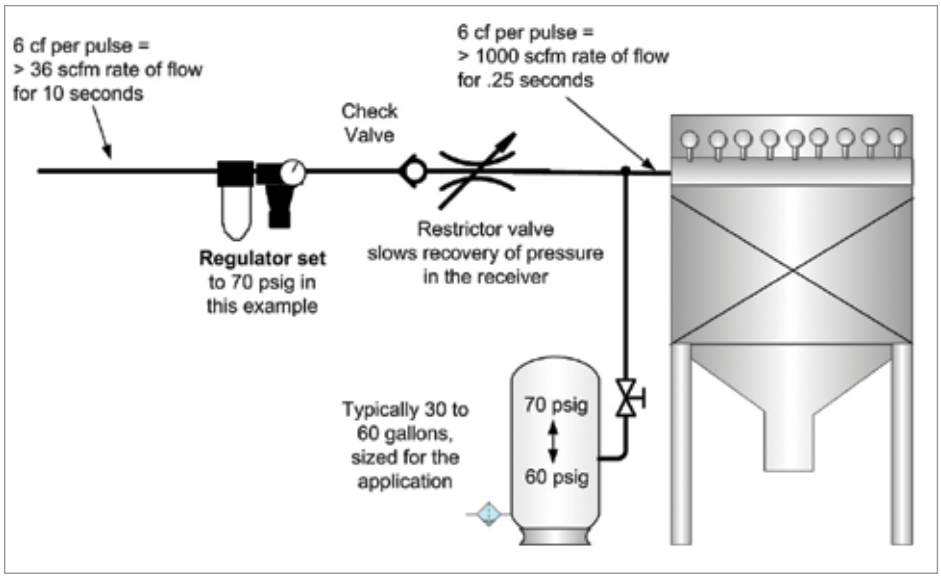

Figure 4: A good way to mitigate the high flow of air that rushes into a dust collector at each pulse is to install a needle valve before the additional storage tank. The valve is set to fill the receiver just before the next pulse. As such, it greatly reduces the peak flow. The check valve keeps the air in storage exclusively for the dust collector. The regulator reduces the pressure at the dust collector to minimum, saving compressed air consumption. Source: Compressed Air Challenge.

HOW TO KEEP REVERSE PULSE DUST COLLECTORS OPERATING EFFICIENTLY AND RELIABLY

pressure to fall to 50 psi and an extra air compressor to load. Figure 3 shows the pressure profile before and after adjusting the dust collector to normal operation.

Garment Manufacturer

A garment manufacturer had a compressed air system with two large 200-hp air compressors. Near the air compressors was a large dust collector that filtered cotton fluff. The pulse from the dust collectors was large enough to fluctuate the pressure at the air compressor discharge enough to cause an extra unit to start and run. The additional electrical loading caused about $15,000 per year in extra electricity costs.

Figure 5: This flow-restricted receiver was installed at the garment plant to solve the problem of transient airflows that were starting a second air compressor.

Sophisticated dust collector control panels can make sure the dust collector cleaning system is working correctly and compressed air consumption is held to a minimum.

The dust collector was retrofitted with a small 60-gallon storage receiver equipped with a needle valve fill adjuster. The dust collector cleaning pulses now use the air in storage at a fast rate, just as before, but the compressed air volume is now replenished slowly through the needle valve. This eliminated the fluctuations in pressure that starts the air compressors. It also protects against blast valve failure, as even a wide-open valve would have the flow restricted, saving the plant from pressure problems.

Figure 4 shows the system diagram of the dust collector retrofit, while Figure 5 shows the installed receiver and needle valve. Pulse strength increased high enough to allow operating pressure to be reduced to 60 psi, saving compressed air.

Farm Implement Manufacturer

A farm implement manufacturer had about 20 dust collectors in the plant and about 60% of them were outdoors in occasional freezing conditions. Each outdoor dust collector had an individual desiccant dryer that ran 24 days, seven days per week even when the dust collector was off, consuming costly compressed air worth a total of about $12,000 per year. Even with good quality air the dust collector blast valves would fail open in cold weather, caused by a split rubber diaphragm. An audit found one failed dust collector consuming about 200 cfm at a cost of $38,000 per year. Figure 1 shows the dust collector.

Aerospace Company

An aerospace company had many media blasting stations with reverse pulse cartridge filters located above the stations. Additional dust collectors were located outdoors in sometimes freezing conditions. During an audit a machine room was inspected and a suspicious noise was heard. The dust collector had a failed internal blast valve consuming 200 cfm, which represents about one third of the plant compressor capacity, costing $35,000 per year in operating costs. The company was in the process of adding another air compressor.

At the same plant, during a survey of dust collectors, a compressed air auditor noticed three of seven valves connected to one dust collector had failed in a way that the valves did not operate. This caused poor cleaning of the dust collector, something that baffled the maintenance department since a contractor was supposedly maintaining the filters every month. The valves were repaired and the dust collector cleaning improved, so much so that the filter differential fell low enough that

the differential pressure control turned off the pulses 70% of the time, saving significant compressed air. This is illustrated in Figure 5.

Metal Foundry

A metal foundry was found to have a large compressed airflow of over 1,000 cfm, even during non-production hours. The staff called in a leak auditor to assess the situation. After an extensive search a dust collector on the roof of the plant was found to have a large crack in the blast valve manifold. A flow measurement showed this failure was consuming 550 cfm of air worth $86,000 in extra electrical costs per year.

Fiberglass Plant

A fiberglass plant had a leak audit done as part of an air compressor replacement project. After the new more efficient air compressor was installed it was found than the plant has about 70 cfm of compressed airflow, even with no production in the plant. The leak detection work done during plant production hours found only about 15 cfm of leakage, but nothing that substantial. The auditor waited until production was finished and repeated the leak audit. He found some downdraft sanding tables had substantial leakage of the reverse pulse dust collectors installed within the tables. The fan noise during production masked the leakage, making it hard to hear even with an ultrasonic leak detector. Poor welding of the dust collector manifolds caused the manifold seams to fail, causing leakage.

Tips to Improve Reverse Pulse Dust Collection Problems

Here are suggestions to remedy problems commonly associated with reverse pulse dust collection:

- Avoid adjusting the dust collectors from default values.
- Add storage receivers to increase pulse strength.
- Add needle valves to the inlet feed to the manifolds to reduce flow during pulses.
- Maintain blast valve diaphragms regularly.
- Ensure electronic controls are working and the pulse sequence is normal.
- Ensure each dust collector operates on differential pressure control and turns off when the ventilation fan is not running.
- Consider installing flow meters on dust collector compressed air inlets to detect problems.
- If possible avoid using compressed air-powered filter cleaners.

Monitoring and Maintenance: A Best Practice

These brief examples provide evidence that reverse pulse dust collectors can be troublesome and costly to your compressed air system. It is best if these are properly maintained and carefully monitored to ensure efficient operation and prevent problems. BP

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

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PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

EVERYONE WINS WITH TENNESSEE TECH

University Industrial Assessment Center Program

By Mike Grennier, Compressed Air Best Practices® Magazine

Students of Tennessee Tech University examine equipment at a manufacturing plant as part of the school's Industrial Assessment Center program.

Small- and medium-sized Tennessee manufacturers across virtually every industry strive to reduce energy consumption while maintaining peak production and profitability, yet it's not always easy. Fortunately, help is readily available through the Tennessee Tech University Industrial Assessment Center (TTU-IAC).

Launched in 2006, the TTU-IAC program provides manufacturers in the state with free energy, productivity, and waste assessments – including best practices for compressed air systems, and blowers and vacuum, as well as cooling towers and chillers. The assessments to date have provided manufacturers in the program with $27.48 million in recommended cost savings, equaling 3.82 trillion British thermal units of energy savings.

The initiative is a win for both manufacturers and engineering students who make sustainability and cost-efficiencies in manufacturing a priority, said TTU-IAC Program Director Dr. Glenn Cunningham, P.E.

"The program gives our students real-world experience in manufacturing and really opens their eyes about energy costs and the potential savings," Cunningham said. "At the same time, manufacturers appreciate the assistance and opportunities to save energy."

Typical Savings of $100,000 Per Year Identified

Manufacturers in Tennessee eligible to take advantage of the free IAC assessments must be a U.S. company with yearly energy bills greater than $100,000 and less than $2.5 million and be located within 150 miles of an IAC center. The two centers in the state include the Tennessee Tech University in Cookeville, Tennessee, and the University of Memphis, managed by Dr. Jeffrey Marchetta.

Tennessee Tech University Industrial Assessment Center Program Director Dr. Glenn Cunningham, P.E.

Each year, TTU-IAC evaluates applications for assessments from companies throughout Tennessee, as well as the surrounding states. It then works with companies to implement the assessment process, which primarily includes:

- The completion of a pre-assessment form to gather basic information about the plant, including a year's worth of utility bills.
- A pre-assessment analysis of the manufacturing processes and utility bills.
- The assessment itself, which involves a one- or two-day onsite visit at each plant to refine the list of energy-saving opportunities and gather more data.
- A report outlining recommendations regarding best practices and individual energy-saving recommendations.

- Follow-up discussions after two weeks, and again six to nine months after recommendations have been submitted as a check-up and to answer questions.

The national IAC program was originally created by the Department of Commerce in 1976 in response to the oil embargo and rising energy costs. Since then, it has been specifically focused on helping small- and medium-sized manufacturing plants reduce unnecessary costs from inefficient energy use.

The federal program is administered nationally through the Advanced Manufacturing Office under the Office of Energy Efficiency and Renewable Energy at the Department of Energy. Each year, 13 to 14 undergraduate and graduate engineering students participate in the program and annually complete a total of 18 assessments.

Students gain real world experience while participating in the Tennessee Tech University Industrial Assessment Center program.

EVERYONE WINS WITH TENNESSEE TECH UNIVERSITY INDUSTRIAL ASSESSMENT CENTER PROGRAM

Students Help Tennessee Manufactures Gain an Edge

Manufacturers throughout Tennessee have discovered ways to take existing efforts to reduce energy costs to new heights and gain an edge in productivity and profitability, thanks to the Tennessee Tech University Industrial Assessment Center (TTU-IAC) program.

Many manufacturers have also implemented TTU-IAC's recommended energy-reduction measures – including a host of projects involving compressed air systems. Here are just a few examples:

Eliminating Air Compressor Blow-off

A manufacturer of polyethylene terephthalate (PET) bottles in Cleveland, Tennessee, recaptured high-pressure compressed air from bottle testers and fed it back to the low-pressure side of the compressed air system for reuse, resulting in reduced compressed air demand. Yet the TTU-IAC assessment demonstrated the ability to further reduce the amount of energy and costs required for compressed air.

The plant operates three 900-horsepower (hp) centrifugal air compressors, each of which is rated to deliver 3,390 scfm. Before the assessment, the plant typically operated all three compressed air units. However, to prevent them from surging the bypass valves of the air compressor opened and each vented as much as 2,000 scfm of air.

TTU-IAC assessment showed how the plant could better sequence its air compressors to match the supply of air with demand. Now the plant typically only operates two of its air compressors, allowing it to avoid the need to blow off air. Doing so also saves nearly 3.9 million kWh and $172,200 per year in energy costs.

Saving with Low-pressure Blowers

In Crossville, Tennessee, a porcelain tile manufacturer knew it could save energy by using zero-loss drain traps to expel water from its compressed air system. The TTU-IAC assessment, however, revealed how more best practices would help it achieve additional energy-savings.

Before the assessment, the plant used its three, 100-hp air compressors in part to supply air to 21 air knives and slit nozzles to dry and clean tile. The assessment showed the plant could use low-pressure blowers for the application instead of compressed air. In addition, students identified how the plant could eliminate the use of air hoses to clean dust off of machines – and save energy.

The plant later installed a total of 14, one-third hp low-pressure blowers and uses them in place of air knives for drying and cleaning. It also uses induction air knives rather than air hoses for dusting off machines. The initiatives save the plant nearly 111,925 kWh and $14,000 per year in energy costs. Each initiative also paid for itself in less than one year.

Better Compressed Air System Control

Another company that took advantage of the assessments is a maker of automotive components in Murfreesboro, Tennessee.

The plant had implemented a number of best practices before the assessment, including the installation of a Variable Speed Drive (VSD) air compressor to efficiently meet fluctuations in its compressed air load. It also uses waste heat from the air compressor to provide additional space heating. Additionally, heat generated by the air compressors is ducted outside the plant during warmer months to keep HVAC energy costs down.

The TTU-IAC assessment showed the plant it could save even more energy. The plant's compressed air system includes four, 150-hp air compressors. Three are fixed-speed units, while the fourth is a VSD unit. Before the assessment, the VSD air compressor would turn off first when demand for air was low.

After the assessment, however, the plant chose to use two fixed-speed air compressors as base-load units during normal production and use the VSD air compressor as a trim unit to for low-demand periods since it operates efficiently at part load. In addition, the plant now only uses two air compressors during off-production hours. The fourth air compressor serves as a backup unit.

In addition to cost savings achieved by better use of a VSD air compressor, better use of the air compressors gives the plant the ability to more efficiently deliver air where needed. Now, the compressed air system supplies air throughout the facility at 98 psi rather than 103 psi.

The use of the VSD on combination with a better compressed air control strategy saves the plant 353,703 kWh and $23,844 per year in energy costs.

Addressing Compressed Air Leaks

Like other companies in the state, a manufacturer of hydrostatic transmissions in Morristown, Tennessee, had implemented a number of best practices before it brought in TTU-IAC for an assessment. Best practices ranged from the use of zero-loss drains to leveraging the waste heat of air compressors for heating during the winter months and more.

As part of the TTU-IAC assessment, the plant installed electric meters on its two rotary screw air compressors and monitored data over an extended period. It found the air compressors were working a significant amount of the time to maintain systems pressure as a result of air leaks. Subsequently, the plant implemented a leak repair program. Now, the air compressors work less to supply air used for production process, as well as remaining air leaks. The measures allow the plant to save 315,187 kWh and $19,605 per year in energy costs.

Since the program started, TTU-IACs have conducted 221 assessments and provided assessment reports to 180 manufacturers. The average assessment identifies more than $100,000 in energy savings opportunities. Assessments involve all plant systems and utilities, including compressed air, steam, process heating and cooling, HVAC, lighting and more.

Students Learn Invaluable Real-World Experience

The program provides incentives to students interested in a career associated with manufacturing and energy savings. In Tennessee, the program pays undergraduate students an hourly wage to participate. Graduate students earn two years of college tuition and a monthly stipend.

Importantly, students who complete the program earn a certificate in energy assessment expertise. The educational and real-world experience combined also provide a solid foundation for a career in manufacturing, which includes roles as energy managers.

"The program provides insight for students into how energy is bought and sold, and consumed at the industrial level," Cunningham said. "It gives them a lot of practical knowledge they simply can't get in the classroom. Many students who complete the program often go on to rewarding careers, sometimes as energy managers."

Filling the Gap for Manufacturers

Manufacturers benefit equally from the program since small- to medium-sized companies are often unable to dedicate resources to energy-savings initiative, said Cunningham.

"We have no problem getting clients," he said. "These companies don't have a lot of time to spend on detailed assessments that can help them save energy. It's also a major advantage not to have to pay thousands of dollars to have an independent consultant perform an assessment."

Cunningham said students find ample opportunities for plants throughout the state to reduce energy consumption and save costs, in addition to improving the productivity and reliability of production processes. He said students typically identify the biggest opportunities for energy reduction and costs savings with lighting and compressed air systems.

The program offers even more value beyond energy cost savings alone, Cunningham said. "Like elsewhere, Tennessee manufacturers are not just looking to save costs but to gain a competitive edge. By helping manufacturers reduce energy cost, the TTU-IAC program helps them become more competitive. At the same time, students who participate in the program come out ahead by having a solid foundation in manufacturing processes and what it take to effectively and profitably manage the energy they consume." BP

For more information about the Tennessee Tech University Industrial Assessment Center, contact Dr. Glenn Cunningham, P.E., email: GCunningham@tntech.edu, or visit www.energy.gov/eere/amo/industrial-assessment-centers-iacs.

All photos courtesy of the Tennessee Tech University Industrial Assessment Center.

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QUALITY, SAFETY & RELIABILITY

Integration: Should Compressed Air MONITORING BE COMBINED WITH CONTROL?

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

In the first article in this two-part series, I discussed the people who would be internal customers of a compressed air control system and of a monitoring system. They are very different people. Maintenance is the customer of controls and energy engineering is the customer of monitoring. And I discussed potential problems that can occur when combining monitoring and control in the same system. In this article, I will get more specific about building practical systems that address both controls and monitoring.

Since people and infrastructure are the scarce resources, this article is organized around the following scenarios:

1. Plant has an EMCS or SCADA system and a person to look at it.
2. Plant has no EMCS or SCADA, system, but has a vendor with an available auditor.

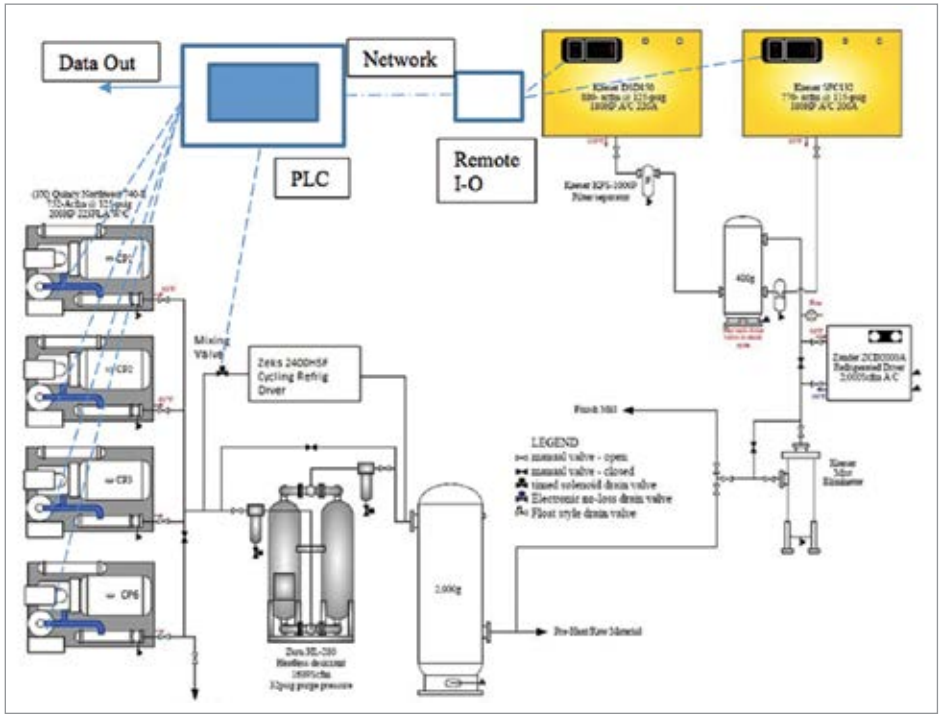


Figure 1. A simplified diagram of a compressed air system with integrated control and monitoring.

> "When plants don't have an EMCS or SCADA system, some prefer the simplicity of having the controller and monitoring system integrated."
>
> — Tim Dugan, P.E., Compression Engineering Corporation

I will not address OEM-specific approaches, or emerging cloud-based data-loggers. A future article will address these, as some new products are coming on the market at this time and haven't been proven yet. I will discuss monitoring done in a "vendor agnostic" way by a third party.

Plant With EMCS or SCADA System and Person to Look at It

Let's take a look at an example project at a cement plant. This is a large plant with multiple compressor rooms and different brands of air compressors, supported marginally by different air compressor dealers. This adds complexity to the control and monitoring issues. And it shows how a controls integrator attempted to do monitoring.

A specialty compressed air integrator had done a good job managing control of six air compressors in two compressor rooms as shown in Figure 1. The integrator also embedded some monitoring functionality into the controller.

The control system, installed in 2012, was based on an Allen Bradley Control Logix PLC, a robust, powerful, industry-standard controller, with a touchscreen display. The PLC received analog inputs from sensors including motor current and pressure; calculated real-time values like power, flow and efficiency (calculated from Amps and speed); and it displayed the operator interface function, not trend-logging. The plant's HMI software performed monitoring, pulling data from the PLC. In general, it was built like a typical large custom integration project with compressed air expertise. However, there was a fuzzy division between monitoring and control.

Long-term operation of a system like this is difficult with changes in staff and type of air

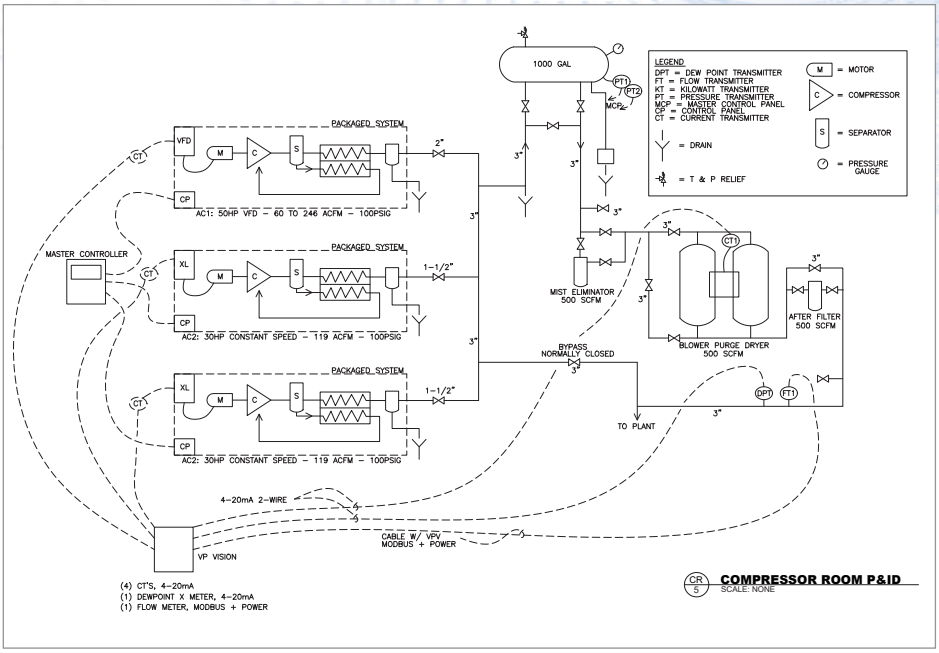
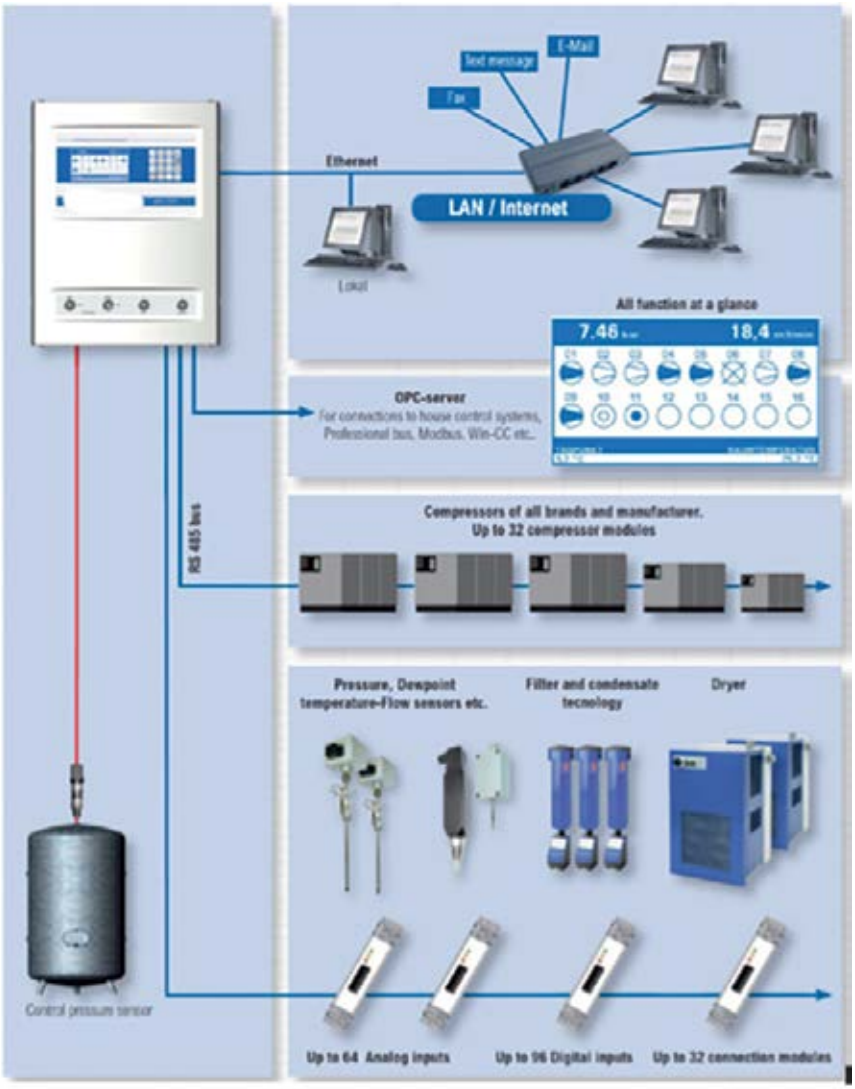


Figure 2: A diagram of a compressed air system with separate control and monitoring. For a larger diagram view, type article name into finder tool at www.airbestpractices.com

INTEGRATION: SHOULD COMPRESSED AIR MONITORING BE COMBINED WITH CONTROL?

compressors. In 2018, the plant decided to replace four of the older air compressors with two new ones from another brand altogether. Fortunately, they did call the integrator back to reprogram and re-commission the system to operate the new units optimally. At that time, the integrator had to change the monitoring calculated values in the PLC. Since the monitoring function was separate from the control panel, and owned by the customer, that data was still available.

Unfortunately, monitoring data being sent to the HMI system was not accurate. Power was not calculated properly on the new Variable Frequency Drive (VFD) air compressor. Additionally, the time stamp on the data was incorrect. It appeared to be off by a factor of about 60, with minutes being recorded as hours. Personally, I would have preferred the analog inputs going directly to the plant SCADA system with transparent calculations, if any. The plant did not trust the power and flow



values coming from the controller/monitoring PLC either.

The strengths of the monitoring/control integration were as follows:

1. Inputs were selected and installed properly. The right things were being measured.
2. Inputs were protected by fuses so they couldn't cause problems with the controller if they failed.
3. There was no local database so the controller did not end up as an "island" of unused data.

The weaknesses in the monitoring system were as follows:

1. Values were being calculated by a PLC. Those formulas were unknown to the user and to the energy engineer, thus not trusted.
2. Changing of the monitoring system could require taking the control system down. This is particularly the case if a new input module was needed, like for remote flow meters. Integrator reprogramming was needed to make changes to the monitoring system. The customer couldn't do it without outside expertise.
3. Air compressor data was not available for two of the air compressors. There was a network interface problem between the German-made air compressors and the master PLC.

Recommendations for improvement are as follows:

1. Separate the monitoring system from the control PLC. Wire current transmitters (CTs) and other monitoring-only transmitters to the plant's analog input modules, and poll the data directly from the HMI. A redundant pressure transmitter needs to be installed since one is used for control.
2. If the plant's analog input modules are not available in the compressor room, patch the raw values directly through to the HMI, and do the scaling and calculations on the plant HMI.
3. Train the plant engineer/technician responsible for HMI programming on compressed air.
4. With the assistance of a compressed air specialist ("auditor"), build an energy management "dashboard" on the plant HMI. Display and trend energy Key Performance Indicators (KPIs) like total power, total flow, and flow/power ratio. With the assistance of the air compressor dealer, another dashboard can be created for maintenance, that show maintenance KPIs like motor current, oil temperature and air outlet temperature. If the air compressor Modbus interface is already wired to the controller, tag the appropriate monitoring values in the PLC, and provide them to the plant HMI. Program some basic analytics into the HMI. It should know if the KPIs have drifted, and alarm at predetermined variances.

INTEGRATION: SHOULD COMPRESSED AIR MONITORING BE COMBINED WITH CONTROL?

Plant With no EMCS or SCADA System, But Has Vendor Support and an Auditor

An example for this scenario is a mid-sized aerospace component manufacturer. They completely upgraded their system, installing new air compressors, storage, filtration, dryer, and master controls. Fortunately, an expert auditor designed the system so it had the correct configuration and controls for efficient and reliable operation, and the best available technology for controls and monitoring that was appropriate for the site as shown in Figure 2.

The local support was good for the equipment and engineering services, but the customer did not have a large enough facility management staff to handle the data-collection side, nor did they have the staff to analyze the data. The local equipment supplier was able to provide a basic master controller, and after much wrangling, got it working. But they were definitely not capable of developing a monitoring system for the customer.

The approach taken on this project was synergistic, matching the best available, appropriate technology to the plant, considering their infrastructure and staff. The elements of the project were as follows:

1. Standard air compressors with Modbus interface. Two smaller units were fixed- speed machines (30 horsepower) and one larger (50 horsepower) was a VFD unit. This followed the design principles discussed in a previous article, which can be viewed at https://www.airbestpractices.com/technology/air-compressors/sizing-vfd-compressors-multiple-air-compressor-systems.
2. Wet-side storage.
3. Mist eliminator.
4. Regenerative (blower purge) dryer, tuned for energy management.
5. Master controller, Allen Bradley PLC-based, target sequencer algorithm.
6. Monitoring system: flow, current, pressure and dewpoint trending.

The monitoring system, which was designed for long-term monitoring, became essential for commissioning the various aspects of the system. Since it was installed before the new equipment was started up, data was immediately available. Temporary data loggers did not have to be installed. This system commissioned and validated the following:

1. Dryer dewpoint demand controls working properly, after cool-down purge turned off and demand controls turned on (The vendor fought this.)
2. Air compressor unloading happening properly. Amps were initially too high when unloaded.
3. Sequencer proper operation.

The monitoring system is simple enough so the staff can be trained to see if it is out of tune, and can contact the outside resources to help at that time. At the current time, the customer has not yet run the Ethernet from the compressor room to the plant Ethernet hub. After that is done, they merely have to hit the

fixed IP address of the monitoring system on a web browser to see all the monitoring data and KPIs. They will also be able to download data.

Recommendations for improvement are as follows:

1. Complete Ethernet connection.
2. Train operators and engineering on use of data collection system.
3. When future upgrades become available, connect the monitoring system data to a cloud-based server via a cellular modem.
4. Provide the compressed air data to the air compressor dealer and auditor, via the cloud database. They can provide analytics and service remotely.

When plants don't have an EMCS or SCADA system, some prefer the simplicity of having the controller and monitoring system integrated. This is typically a European approach, and requires a custom controller, not an open-architecture PLC.

In cases where the customer prefers this approach, you need to use a system with significant experience integrating monitoring and control. We are aware of several integrated control/monitoring systems on the market. Figure 3 is an example of a common system.

Neither of the ones we are aware of have cloud-based monitoring. They are local controller/monitors with the ability to communicate to the OEM for data collection. However, the suppliers support them well remotely so these are a valid option for control plus monitoring.

Recommendations for improvement are as follows:

1. If a plant has an EMCS or SCADA system and a person to look at it a master controller without embedded monitoring is recommended, with the plant EMCS or SCADA system doing the monitoring. Get technical support from a qualified compressed air specialist to set up monitoring properly.
2. If a plant has no EMCS or SCADA system, but has a vendor with an available auditor, use a simple, separate monitoring system. If a standard PLC is not required an integrated monitoring/control system can be a good idea, as long as the firm supplying it has extensive experience.
3. In either case, use suppliers who can integrate remote monitoring into their product, and get that data in front of the right person. 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.

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

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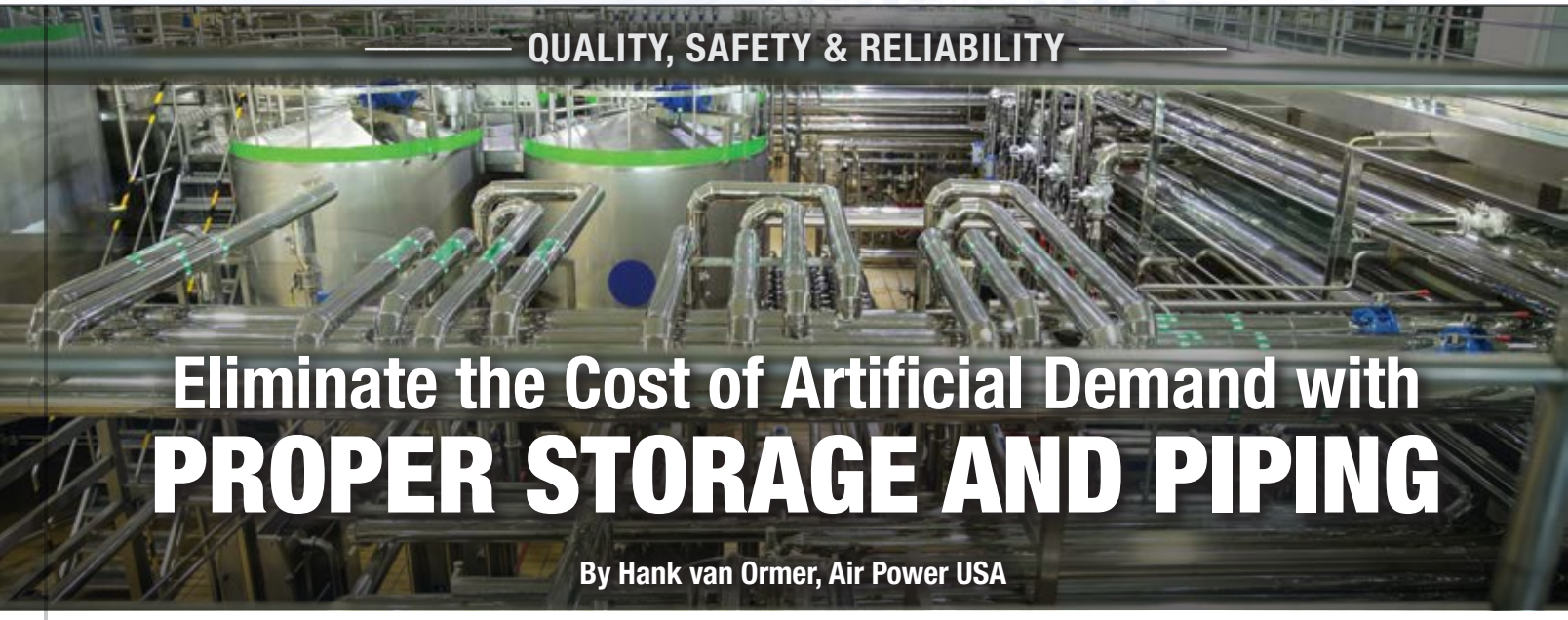

Eliminate the Cost of Artificial Demand with PROPER STORAGE AND PIPING

By Hank van Ormer, Air Power USA

This article reviews the benefits and design considerations of controlling system pressure from the air compressor room to the production headers and selected production processes and areas.

In an earlier article, we stressed the importance of stabilizing the system pressure to each production process at the lowest effective level. The article pointed out that probable savings of reducing the actual pressure to the process is almost **three times** higher energy recovery per psig, than just lowering the discharge pressure of a positive displacement air compressor. This is accomplished by reducing the required airflow with a controlled and stable lowest effective pressure and a corresponding lowest effective flow. Read the earlier article at https://www.airbestpractices.com/system-assessments/pressure/missed-demand-side-opportunities-part-7-importance-system-pressure-contr.

Over the last several decades, the phrase "demand-side control" has become the generic term to describe establishing a "flat line" header pressure using proper storage and an appropriate pressure regulator, or "pressure flow controller." Use of a demand-side controller to control pressure and flow can be implemented at the entry to the production area header(s) and at selected production areas or processes.

Effect of Lower Pressure on Unregulated Flow

A plant's level of demand flow at 100 psig-class system pressure will automatically be reduced approximately 1% per psig of pressure reduction. This reduction is known as "eliminating artificial demand" or "system over-drive." This only occurs when the actual pressure to the process is reduced!

For example, if you have a production process utilizing 1,000 scfm at 100 psig-class "unregulated" entry air pressure and you lower pressure to a **STABLE 80 psig** with a controlled 80 psig entry pressure, there is a probable 20% reduction in flow for this process. The new constant demand would be reduced to 800 scfm and the likely savings for this process translates to 200 scfm at $100 per scfm for a realistic and achievable $20,000 year reduction in annual operating cost for this process.

Is Local Storage Needed at or Near the Process Being Controlled?

Properly sized and applied storage holds the pressure steady when peaks in air demand exceed the basic supply. No matter what controls the process, if the demand in the production exceeds the supply the pressure will fall. Usually this comes with a negative impact on productivity and quality. If it was okay at the lower pressure (and flow), then you are wasting money at what you "think" is the optimum pressure flow.

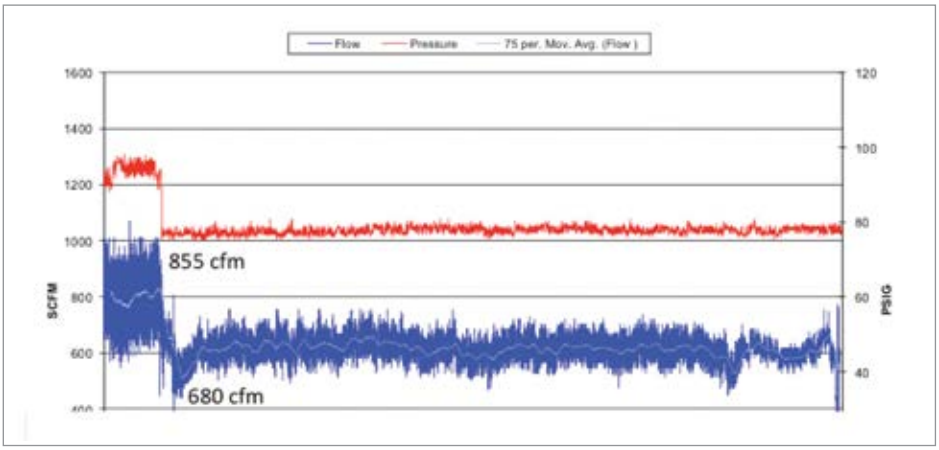

Figure 1.

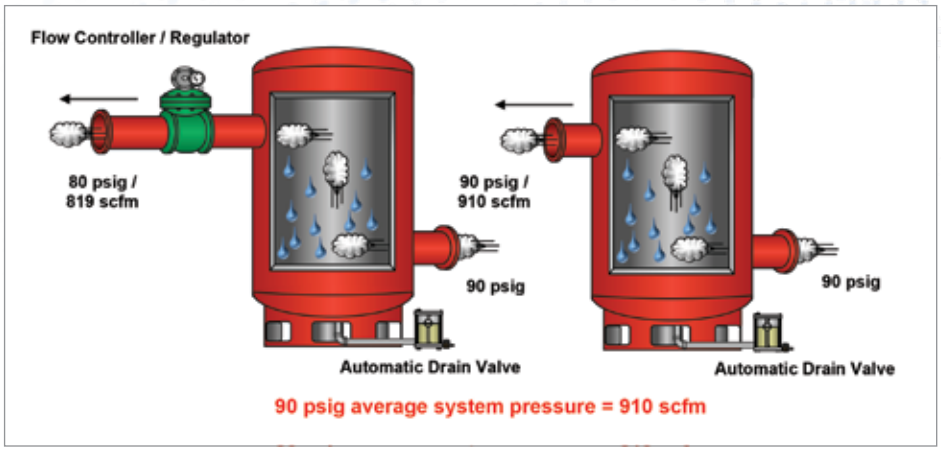

Figure 2.

Full networking control systems and Variable Speed Drive (VSD) controls will also deliver a steady pressure to any system whose **demand does not exceed the supply.** Their performance is storage-dependent if their demand has random or even worse – cyclical peaking. Obtaining pressure stability without proper storage and monitoring is often very difficult.

If the plant system review indicates there is positive economic reason to set up a demand-side control system, then a decision must be made – deciding whether to control the total air distribution piping at the exit from each air compressor room or to establish a secondary demand-side control system at the critical process area(s), or both.

Eliminating Artificial Demand

The use of an effectively sized storage vessel with an appropriate pressure differential between tank storage pressure and the regulated flow pressure from the tank will allow stored compressed air to carry short duration peak loads without losing effective process inlet pressure **for a limited time.** A networking control system or VSD will **not** create a differential pressure band without similar effective storage.

Proper storage with effective regulated control, which maintains a stable pressure and flow at the lowest effective inlet pressure, is the best way to eliminate "artificial demand" or "system overdrive." Artificial demand is air demand generated by excessive pressure with no positive impact on productivity or quality.

Figure 1 taken from a recent audit represents a very effective demand-side control installed at the supply air compressor room exit to a multi-floor plant with all processes utilizing a similar inlet pressure. When reducing the pressure to the production headers from 90 to 78 psig, the flow went from 855 to 680 scfm – 175 scfm of ARTIFICIAL DEMAND. Therefore, a potential reduction in energy cost of $17,500 year at $100 scfm/yr.

Regulator or Pressure Flow Controller?

There is a common misconception that pressure flow controllers are better than regulators "because regulators require 10-12 psig or more pressure loss to perform," but this is inaccurate. Regulators can be correctly applied with fractional pressure loss if required to control flow plus or minus 1-2 psig. We have very successfully controlled flow from 500 to 5,000 scfm with six-inch rotary vee notch valves and a pilot-operated actuator to this limit. There are also some very

ELIMINATE THE COST OF ARTIFICIAL DEMAND WITH PROPER STORAGE AND PIPING

well performing electronic control actuators combined with responsive valves that will operate similarly in a very responsive manner.

The most IMPORTANT best practice for this component is to be sure it doesn't become an "unintended choke" to the required rate of flow. An appropriate guideline is to size at the highest expected rate of flow (or more) at the lowest possible inlet pressure. Usually regulators or pressure flow controllers will have a good performance turndown of 20:1 or 25:1 (check performance when in doubt), but none will pass full compressed air volume at lower inlet pressure than the rating. Be sure of the low inlet pressure limitation. Size all downstream side piping and accessories to handle the expected "rate of flow" at the lower pressure. This includes valves, controls, regulators, etc.

Appropriate Orientation for Storage Receiver and Piping

Figure 2 demonstrates a properly installed air receiver, whether for a complete system demand-side control, a downstream area, or process control.

Compressed air enters the receiver at the lowest possible point and leaves at the highest possible point to allow moisture and other contaminants to fall out. The exit air pressure

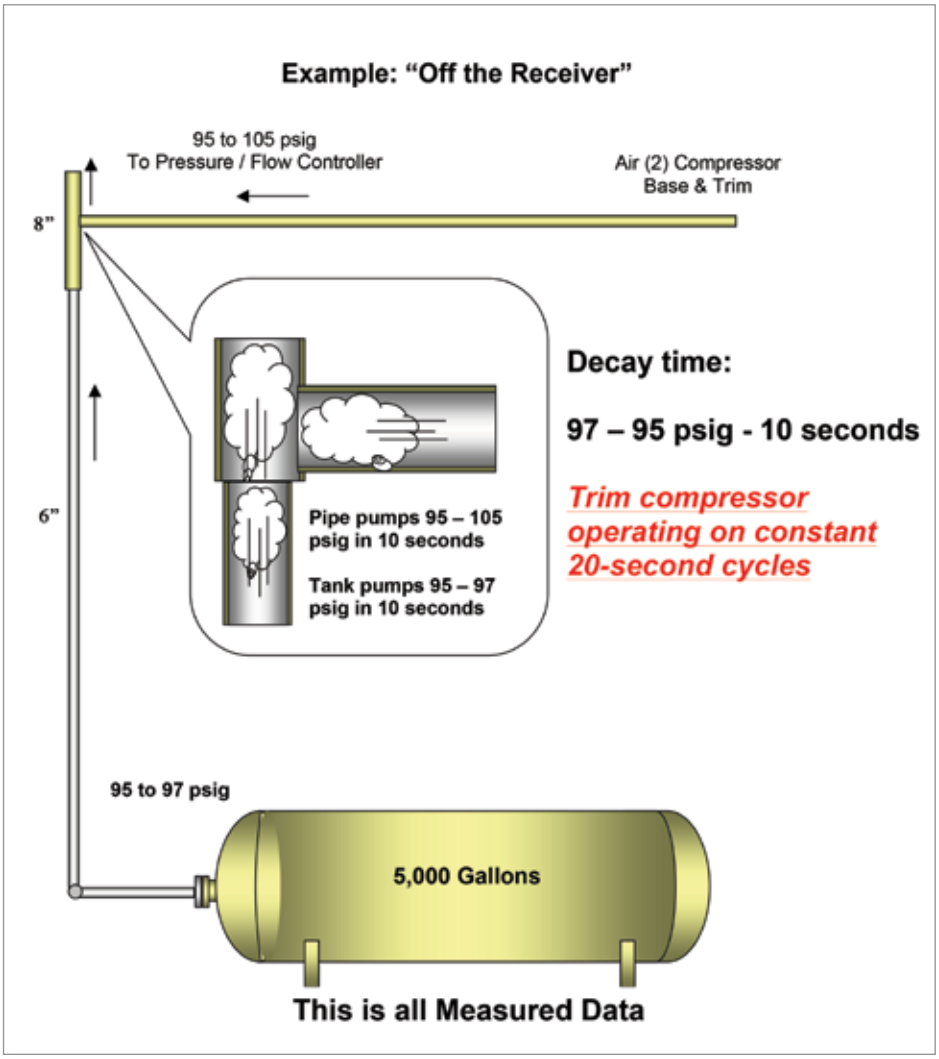

Figure 3A.

is controlled by properly sized regulators/ control value. There is often a three-valve bypass option to allow for service when required, while also avoiding the need to shut down production.

What Size Receiver?

Sizing the receiver to handle peak demand events require accurate data of the "event" to cover. There is no "rule of thumb" to size the air receiver or required effective storage. Basic required information:

- The increased magnitude of demand in scfm.
- Duration of the event in time.
- Duration of the time before any repeat event (time allowed for recovery).
- Local ambient air pressure in psia (i.e. SEA LEVEL = 14.7 psia or 7,000 foot elevation = 11 psia, etc.)
- Allowable pressure drop in the receiver for the duration of the event.

Once sized, the decision will be whether to install the required storage in the air compressor room or near the process or processes.

This information goes into the standard pump-up and decay formulas for storage. Properly selected, this allows the receiver storage to supply the peak demand event at a predetermined fixed rate of flow. The pressure recovery in the receiver is controlled to utilize a longer duration, thus converting a high peak rate of flow to a lower average rate of flow.

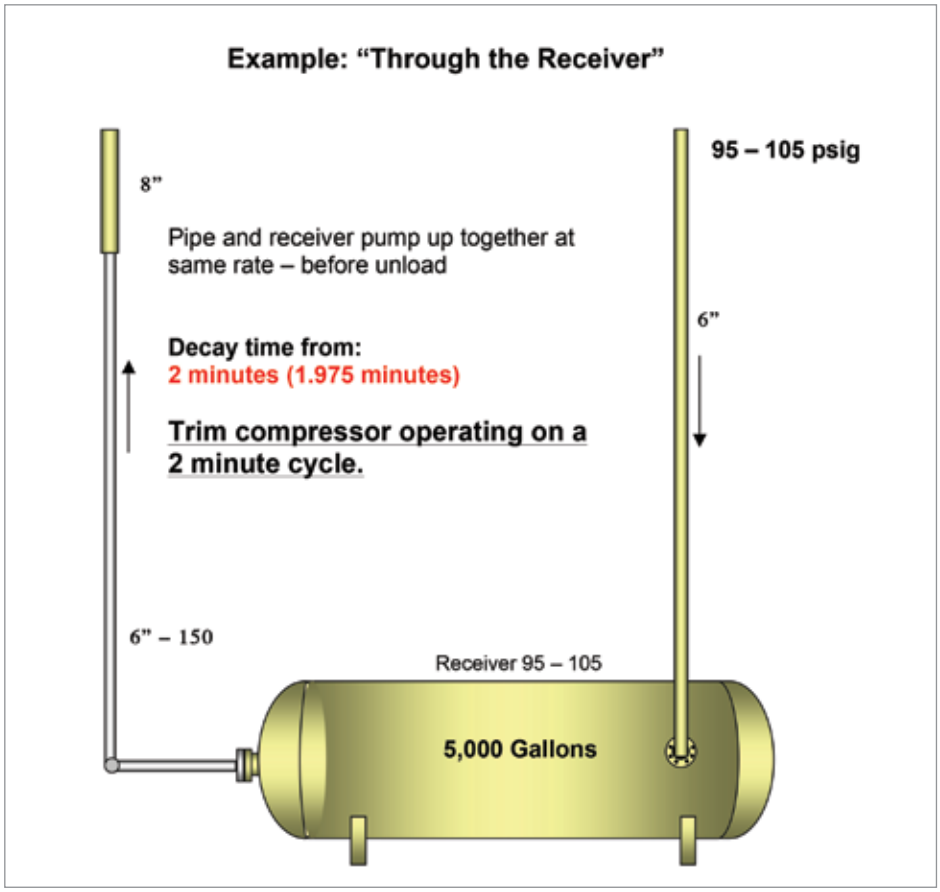

Figure 3B.

ELIMINATE THE COST OF ARTIFICIAL DEMAND WITH PROPER STORAGE AND PIPING

Figure 4. Shown is single-line convector to storage used for a process press. Air is stored to serve as an emergency control and operates if the main air system is disabled.

This will often avoid turning on or loading an additional air compressor, thus reducing the overall net input energy required to produce compressed air.

When there are many process operations spread over a large area using near similar inlet pressures, a well applied central demand-side control system in the air compressor room will often be very satisfactory.

Piping and Storage Orientation for Constant Steady Pressure

There is a tendency for some designers to tie the system air to the receiver storage before the regulator or flow controller using just one line for both air in and out of the receiver.

Figures 3A shows a typical "off the receiver," single line to fill the receiver and the same line to flow to system. Typically, a single line to the receiver does not perform to the fullest potential capability.

There are times when the single point line in and out will work. But often, the fact is the pipe WILL ALWAYS pump up faster than the tank when a trim unit is loading or the base unit loads. The outflow of the stored air from the receiver is often blocked and cannot get to the system. We have identified this type of installation and corrected it many times.

The example shown in Figure 3A demonstrates a single-point connection. When the trim unit comes on a 10-second load/no load cycle is created. This caused significant reliability issues in the air compressor, which disappeared when the cycles went from 10 seconds to two minutes and the piping was two lines – one in and another out as demonstrated in Figure 3B.

We see no benefit in a single-line approach since most receivers come with two or more connection points and the only material labor savings is piping. If you use this single-point

approach be sure it will work appropriately. An example is shown in Figure 4.

Achieving a Well-balanced System

In the context of stabilizing the compressed air pressure in a system and/or to a process at the lowest effective pressure, regulated controlled flow is always a positive plan. It will help to lead to a well-balanced system.

Within this framework there are several options. One is to regulate each process to its lowest effective pressure. Often plants we visit have many point-of-use or process regulators trying to implement this unsuccessfully with many out of adjustment, or even wide-open individual regulators. Another option is to control the main header or sub-header system to a 1-2 psig swing. This can be implemented with VSD controls; a central air management system, or an appropriate regulator/flow controller.

Using storage to convert a short duration of high rate of flow to a low, average rate of flow may keep additional air compressors from loading or starting up. Anytime this can be accomplished it will have a positive effect, with additional operating cost reduction savings and overall system stabilization.

There are several options available to achieve the desired balanced system. Storage and pressure flow controllers can be applied to the appropriate placement in the process. Or, storage and a pressure controller can be applied to the sub-header system using a specific area of the plant. Lastly, storage and a pressure flow controller can be applied to all the air leaving the air compressor room. When this is implemented the plant must be sure the overall distribution system feeding the production area is well balanced with no restrictions.

There are other benefits to a stabilized and balanced air system:

- Production should find a constant, steady pressure conducive to stabilizing demand and increased productivity.
- A steady, fixed pressure may also increase the quality of production operation by fixing the repeatability standards.
- Once the system is stabilized and the flow and pressure are controlled, plant personnel can experiment to find the lowest effective pressure, which will optimize flow demand.
- Storage to cover certain identifiable, larger demand events should be sized by calculation.

No Benefit to Artificial Demand

Artificial demand results in more operating cost with no corresponding benefit. Running at a lower pressure will eliminate artificial air demand without reducing productivity or quality. BP

For more information, contact Hank van Ormer, Air Power USA, tel: 740-862-4112.

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

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TECHNOLOGY PICKS

Kaeser Compressors Announces SFC 18 Variable Frequency Drive

Kaeser Compressors announced the new SFC 18. With an advanced SynRM motor-drive combination, this 25 horsepower (hp) unit delivers 31-156 cfm with superior part-load efficiency, longer service life, and reduced maintenance costs.

Developed in partnership with Siemens and specifically designed to work with Kaeser's SFC models, the SynRM motor-drive combination achieves top tier IES2 classification. This results in better specific performance, especially in the part-load conditions that call for variable speed compressors.

SynRM motors do not use aluminum, copper, or expensive rare earth metals in the rotors. Instead, they are made of electrical steel and feature a special profile. With this unique rotor design, the motors run cooler resulting in lower bearing and winding temperatures and increased motor life. And because there are no magnets in the rotor, motor service is safer and easier.

To further enhance overall sustainability, SFC T models with the integrated refrigerated dryers have been upgraded with R-513A, a non-flammable, non-toxic advanced formulation refrigerant. R-513A has 56% lower global warming potential compared to the current US standard. This, combined with Kaeser's advanced heat exchanger design, reduces refrigerant requirements without compromising dryer performance.

New SFC 18 delivers 31-156 cfm and better performance.

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

New Ingersoll Rand® Next Generation R-Series Compressor Models

Manufacturers require quality air compressors to maintain throughput and achieve energy efficiency goals. Now, light commercial businesses can reap the benefits of industrial-grade equipment with two new Ingersoll Rand® Next Generation R-Series compressors.

The RS11-22kW and RS15-22kW are the first compressors in the Next Generation R-Series line specifically designed for small commercial operations. The RS15-22kW unit includes premium features out-of-the-box and is available with a fixed-speed or variable speed drive (VSD) motor. This model debuts a brand new airend design that produces 20% more airflow compared to previous Ingersoll Rand compressors of this capacity, resulting in more energy savings. The RS11-22kW houses a redesigned cooling system and increases energy efficiency up to 12% compared to legacy UP6 compressors.

"The RS11-22kW and RS15-22kW compressors give smaller commercial businesses the efficiency and reliability of industrial-grade compressors, in a package that meets their unique needs around footprint and total cost of ownership," said Kevin Kosobud, Contact Cooled Portfolio Leader, Ingersoll Rand.

The Next Generation R-Series line is specifically designed for small commercial operations.

What was once an upgrade is now standard on the RS15-22kW ie and ne models.

- The ne (VSD) unit is rated to operate efficiently in temperatures up to 115 °F.
- V-Shield™ technology enhances repeatability. Polytetrafluoroethylene stainless steel-braided oil hoses and O-ring face seals mitigate the risk of oil leaks and pressure loss throughout the compressor system.
- RS15-22kW Total Air System (TAS) packages feature a three-phase dryer, which only requires one power input for the entire system. This saves the expense of a separate power line and simplifies set up. The dryer also has two power settings. The first mode runs continuously to ensure consistent, dry air. The on/off mode helps customers save energy costs based on air demand.
- RS15-22kW controllers have Progressive Adaptive Control (PAC). PAC is a unique algorithm that monitors key performance parameters to indicate when parts require maintenance or if temperatures reach the maximum

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temperature threshold. The controller automatically adjusts the equipment parameters to keep the machines running efficiently.

Manufacturers can customize compressors based on their unique requirements and operating conditions:

- TAS: Both systems are available as TAS packages. TAS compressor packages include air treatment equipment inside the units which provide clean, dry air in an all-in-one package.
- Drain Valves: Customers that purchase RS11-22kW units will have a timer drain included. Electronic no-loss drain valves are available as an upgrade for RS15-22kW compressors. These components automatically drain water from a system.
- Outdoor Modification: Storing equipment indoors isn't always an option for space-limited facilities. The outdoor modification option protects sensitive electric components from moisture and debris. With this rating, compressors can operate in temperatures between 35- and 115 °F.
- Low Ambient: When temperatures dip below-freezing it impacts system efficiency. The low ambient add-on feature includes internal heaters to prevent condensation from freezing.
- Cooling System: This innovative, free-floating system allows heat exchangers to expand and contract to reduce thermal stress. It also increases efficiency and system durability.
- Phase Monitor: The phase monitor prevents a compressor from starting up if it's wired incorrectly, which protects the motor from crashing.
- Power Out Restart On: If a compressor loses power, operators can rest assured that their equipment will automatically turn back on with the previously-defined settings.
- CARE Service Programs: Ingersoll Rand offers a full suite of service programs that support Next Generation R-Series compressors. PartsCARE™ agreements provide customers with five years of additional coverage on their compressor's airend. The program sends scheduled maintenance reminders and delivers genuine OEM parts to keep equipment running at peak efficiency.

Both RS11-22kW and RS15-22kW units are available with a 120- or 240-gallon air storage tank and include Xe-Series controllers.

For more information on the Ingersoll Rand Next Generation R-Series air compressors, visit www.IngersollRandProducts.com/AllAirIsNotEqual or contact your local service representative.

About Ingersoll Rand

Ingersoll Rand advances the quality of life by creating comfortable, sustainable and efficient environments. Our people and our family of brands – including Club Car®, Ingersoll Rand®, Thermo King® and Trane® – work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. We are a global business committed to a world of sustainable progress and enduring results. For more information, visit http://ingersollrand.com.

BOGE KOMPRESSOREN S-4 Oil-Lubricated Screw Air Compressor

The BOGE KOMPRESSOREN S-4 oil-lubricated screw air compressor is designed for use with fluctuating compressed air requirements

BOGE KOMPRESSOREN's S-4 oil-lubricated screw air compressor.

found in dusty environments, making it well-suited for bakeries that rely on compressed air to convey flour. In addition to dusty environments, the S-4 air compressor offers minimum power consumption in the performance range from 110 to 160 kW. Intelligent control also enables performance efficiency and connection to other production areas according to Industry 4.0 standards. At 67 dBA or less up to 200 horsepower (hp), this new generation offers extremely low noise pressure levels.

Compressed air is used to convey the flour, among other things, in flour processing plants. From the silos, the flour is pumped into a conveyor pipe and is transported to the next stage of the process, for example, to the flour scales via the addition of compressed air. Sometimes, the flour to be processed can disperse into the ambient air. The high proportion of dust in the ambient air poses a risk to air compressors since the impurities in the drive, or a blocked cooling system can cause overheating and machinery breakdowns.

To address the challenging conditions, the S4 air compressor comes standard with a TEFC motor and a coupled drive system that is hermetically enclosed. As such, it is protected

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against high dust ingress from the surrounding air. The result is low maintenance and an extremely long service life.

The S-4 air compressor is also fitted with large-size slide out coolers for cool operation and easy access for cleaning. The functional areas of the compressed air system are also designed to be separate and simple to maintain with easy access to all routine service points. To enable an appropriate compressed air supply and energy-efficient machine operation at all times, the S-4 air compressor is fitted with smart conditions and it automatically adjusts to the temperatures and pressure levels.

The system also makes it possible to simultaneously monitor the operating conditions and maintenance intervals of up to four air compressors. The focus control 2.0 control system supports interconnected operation with up to four units without the use of additional higher-level control. The S-4 air compressor also features vibrational isolation decoupling, which contributes to low the sound levels of 67 dBA or less for up to 200 hp models. In addition, BOGE designed a new vertical oil separator with and pre-separation system. The benefits of the design are minimal pressure losses and maximum efficiency for the separating element.

About BOGE

BOGE America is the U.S.-based subsidiary of BOGE KOMPRESSOREN Otto Boge GmbH & Co. KG based in Bielefeld, Germany. Whether for centrifugal air compressors, screw air compressors, high-pressure piston air compressors, scroll air compressors, controls, air treatment equipment, complete systems or individual devices, BOGE meets the most diverse requirements and highest standards – in a precise and customer-oriented manner. BOGE America stocks the various technologies of high-quality air compressors and spares for immediate support to needs. Compressed air systems are designed, sold and serviced through a dedicated network of over 50 distributors in North, Central, and South America. The U.S. operation is also the location for the "Center of Excellence," which offers technical training for BOGE partners. For more information, visit www.boge.com/us.

Yaskawa Creates New Opportunities with Single-Phase Power

The Drives & Motion Division of Yaskawa America, Inc. is pleased to expand the Single-Phase Converter (SPC) product line up to 125 HP at 460V and 60 HP at 230V.

The SPC converts single-phase power to DC power for use by Yaskawa variable frequency drives. The SPC is the solution to the biggest problems facing business owners that power medium sized motors in rural areas. They can be faced with high costs to run three-phase power, limited single-phase motor options, and a wide range of quality issues.

Enabling rural applications such as agriculture, lumber mills, oil & gas, and pumping to utilize three-phase variable speed control offers a host of new possibilities to their businesses. Three-phase motors are typically more efficient than their single-phase counterparts and more readily available. Adding variable speed control of three-phase motors offers a host of advantages: improved process control and quality, minimized energy consumption, and reduced maintenance.

The Single-Phase Converter's active power regulator ensures minimal stress on the power grid, boasting less than 10% current distortion and 0.99 power factor at rated load. Combining a low harmonic solution with a soft starting variable frequency drive typically allows the opportunity to downsize transformers and decrease installation costs. The SPC utilizes the same components found in a variable frequency drive, which significantly reduces maintenance time and expenses.

Jason Wellnitz, product manager for Yaskawa's Single Phase Converter and pump drives, said, "We are proud to continue with Yaskawa's history of introducing innovative products to motor control applications. We listened to our customers and hope we delivered on their needs." The SPC is available in 230 VAC models from 20 to 60 HP and 460 VAC models from 30 to 125 HP.

To learn more about the Single Phase Converter, please visit the product page on www.yaskawa.com or contact your local Yaskawa representative.

About Yaskawa

Yaskawa America's Drives & Motion Division manufactures industrial automation equipment, including low and medium voltage variable frequency drives, intelligent pump drives, servo

Yaskawa Single Phase Converter

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systems and motion controllers, low-voltage industrial controls and spindle drives and motors. The company's Motoman Robotics Division makes industrial robots that can weld, assemble, cut and handle goods for manufacturers. Yaskawa products are used in a wide variety of industries, including packaging, automotive, building automation, pharmaceutical, machine tool, material handling, metal forming, solar, pumping, water/wastewater treatment, agricultural water, plastics, rubber, and textile. Yaskawa America, Inc. employs more than 1,000 people in its headquarters in Waukegan, IL, its manufacturing facilities in Buffalo Grove, IL and Oak Creek, WI, and in offices across the United States. For more information about Yaskawa products visit our website at www.yaskawa.com.

ENMET Introduces the New AirGuard Portable Breathing Air Monitor

AirGuard is a next-generation portable breathing air system which meets NFPA and OSHA Grade D breathing air requirements.

ENMET's AirGuard portable breathing air monitor has a large external color display.

AirGuard provides comprehensive data log records and uses an audio alarm and large external color display to communicate warnings, threats and data collection. It integrates a three-stage filter system which removes oil, water, particulate matter and odors with Carbon Monoxide, differential Dew Point and CFM flow sensors.

AirGuard is available in a variety of CFM capacities, with multi-port line connections and fitting types allowing ease of compatibility with breathing air accessories. AirGuard regulates, purifies and monitors supplied breathing air for both safety and comfort. For more information on ENMET, please visit www.enmet.com.

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TECHNOLOGY PICKS

STELSEP Introduces New Polyglycol Capable Oil Water Separators

STELSEP Introduced the new polyglycol (PAG)-capable oil water separators. With a range from 150 CFM to 7000 CFM, STELSEP separators perform on the widest range of compressor oils (PolyAlkylene Glycol, PAO, esters, diesters, mineral, etc) with outlet performance that can better 99.9995% purity.

STELSEP's new oil water separators target both free-floating and dissolved PAG residues.

Modern air compressors demand high-tech lubrication to protect components and extend maintenance periods. PolyAlkylene Glycol (PAG) lubricants have evolved to meet these complex requirements, but their use brings additional challenges to downstream processes such as condensate management.

PAGs are usually *hygroscopic*. Though their hydrolytic stability will vary according to composition, solubility will affect the capacity of normal oil/water separators to purify condensate to the same extent that they remove other lubricants. STELSEP's new generation of PAG-specific condensate management systems provides the answer. Our standard separator bodies (from 150 to 7000 cfm) contain new hybrid technology targeted at both free-floating and entrained/dissolved PAG residues.

For more information please contact visit www.stelsep.com or call (602) 741-7970.

THE MARKETPLACE

JOBS & TECHNOLOGY

SALES LEADER

APO Pumps and Compressors LLC, is a seeking dynamic Sales Leader to join our team in Northeast Ohio. This position is responsible establishing and implementing sales plans and strategies to effectively manage and grow existing accounts while developing new opportunities for Compressed Air and Pump Systems.

Primary Responsibilities

- Direct sales responsibility managing major target accounts.
- Work with strategic suppliers to develop sales initiatives to achieve defined goals.
- Lead a team of Inside and outside sales representatives as a manager, leader and mentor. Manage team performance against quotas and sales forecasts, execute operating plans and ensure sales objectives are met.
- Lead and participate in training on products and applications.
- Drive revenue and contribute to the continued growth through consistently achieving individual and team quotas.
- Monitor daily activity of sales representatives including targeting specific customers to achieve objectives and manage sales support activities.
- Establish and report on metrics to measure performance of the inside sales activities; correct deficiencies where necessary.
- Interact with senior management recommending courses of action to further enhance sales.
- Direct marketing strategies and implement programs to enhance APO presence in market.
- Ensure effective control of sales, results, and takes action to guarantee that achievement of sales objectives falls within designated budgets.

Qualifications, Education and Experience

- 8+ years knowledge and experience applying and selling compressed air and/or pumping systems
- Experience with compressed air systems and/or pumps – 8 years preferred
- Proven ability to meet sales goals
- Proven ability to communicate effectively (written and verbal) and provide recommendations for sales growth
- Experience utilizing CRM to drive sales growth
- Must possess a valid driver's license for a minimum of 12 months with a clean driving record
- Bachelor's Degree

No regular overnight travel and relocation available.

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TECHNICAL SALES REPRESENTATIVE

Atlas Copco

San Fernando Valley, CA

Responsibilities

- Prospect, source and maintain quality customers in assigned area
- Achieve assigned goals with action plans and schedules
- Engage in planned prospecting
- Prepare and present quotes and credit terms
- Oversee customer services through quality checks and follow-up

Skills and Experience

- Self-directed with proven business analysis skills
- Four-year degree in engineering, business/ marketing preferred
- 5+ years of direct sales or customer service, industrial equipment sales preferred
- Up to 35% overnight travel
- Must have and maintain a valid driver's license

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THE MARKETPLACE

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