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January/February 2016

Safe Food Packaging


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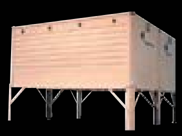

SUSTAINABLE MANUFACTURING FEATURES

14



20

COLUMNS


30

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FROM THE EDITOR | Safe Food Packaging

How do you like acronyms? Our lead article is loaded as it reviews GMPs (Good Manufacturing Practices) for GFSI (Global Food Safety Initiative) food safety compliance. After significant research, Lee Scott from the Parker GSF Division, has written a true technical resource to be kept at hand-permanently. Included is a tremendous chart summarizing all the GMPs out there: SQF (Safe Quality Foods), FDA and FSMA (Food Safety Modernization Act), BRC and BCAS (British Compressed Air Society and Retail Consortium), 3-A, ISO and GRMS (Global Red Meat Standard).

The Compressed Air Challenge® provides us with an actually entertaining audit story at a meat processing plant where Ron Marshall encountered "the world's worst job." What's more, legendary auditor Scot Foss confirmed he had designed the pneumatic tool for this job! The demand-side audit focused on the dense phase pneumatic transport system conveying "product parts" and also on air blowing for liquid removal from wrapped meat packages.

ISO 22000 is a food and beverage specific derivative of ISO 9001. Deepak Vetal, from the U.S. Oil-Free Division of Atlas Copco Compressors, reviews how this quality management certification can be applied to any organization in the food chain – from packaging machine manufacturers to the actual food processing facilities.

Air-operated double diaphragm (AODD) pumps are prevalent in all kinds of liquid transfer applications, including pumping viscous food products. Associate Editor Clinton Shaffer writes about a study confirming the energy-saving potential of using a MizAir electronic controller on AODD pumps. The study was conducted by Dr. David Goodman, Ph.D., C.E.A., Assistant Director of the Indiana Industrial Assessment Center (IAC) and professor at IUPUI.

Centrifugal air compressor installations can be impressive and of course significant. Rick Stasyshan and Ian MacLeod, on behalf of the Compressed Air and Gas Institute (CAGI), review some key considerations for installing centrifugal air compressors. The article covers planning a centrifugal air compressor installation, defining the major considerations for inlet air, and designing proper ventilation for centrifugal air compressors.

A common food industry air quality specification calls out for the -40° F/C pressure dew point reliably provided by desiccant air dryers. Veteran compressed air auditor Chris Beals reviews desiccant dryer installation issues he encounters including dew point spikes, cooling air on heated desiccant dryers, minimizing purge on heatless dryers, and air compressor cycle time impacts.

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

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INDUSTRY NEWS

Kaeser Celebrates Expansion at International Headquarters

Just a year after breaking ground on a major expansion project, Kaeser Kompressoren SE, the international headquarters of Kaeser Compressors, Inc., has held a topping out ceremony to celebrate adding the roof to one of the new industrial rotary screw compressor production halls.

Two production halls are being built in parallel. When complete, they will meet not only pressing needs for additional space, but also feature the latest in technology. "When it's finished, this 'Smart Factory' will be fully Industry 4.0 capable and will truly be a state-of-the-art facility," explained company CEO Thomas Kaeser. "This investment is yet another element that will ensure Kaeser Kompressoren remains internationally competitive and successful well into the future."

Kaeser celebrates expansion at its international headquarters in Coburg, Germany.

The expansion project is set to be completed in early 2017 and also includes a new administration building. The two new production halls will span the entire length of the company grounds and add over 200,000 square feet of manufacturing space.

For more information, visit www.us.kaeser.com.

Atlas Copco Acquires Air Supply Systems Inc.

Atlas Copco has acquired the operational assets of Air Supply Systems Inc., a full-service industrial Atlas Copco compressed air and vacuum system distributor and service organization based in Franklin, Wisconsin, near Milwaukee.

"We have an established relationship with this high-quality distributor," said John Brookshire, president, Atlas Copco Compressors. "Our acquisition of Air Supply Systems enables us to extend our reach and provide enhanced service to our customers in Wisconsin."

As a result of this acquisition, Air Supply Systems' customer base will have complete access to Atlas Copco's portfolio of compressed air products and technologies as well as its advanced in-house and field support services, energy savings systems design and control and remote monitoring program, SmartLink.

The acquired company becomes part of Atlas Copco Compressors LLC, and six former Air Supply Systems' employees will continue to serve customers across Wisconsin as Atlas Copco team members. Customers will receive the added benefit of a combined team of Atlas Copco sales, engineering, energy audit and field service personnel.

For more information, visit www.atlascopco.us.

ELGi Relocates to Accommodate Growth

ELGi Compressors USA, Inc. announced it has outgrown its current facility and has relocated to better serve its customer base. ELGi will be making room for the launch of oil-free screw, reciprocating compressors, dryers, and an expansion of its lubricated screw line to 300 hp. The Company said the transition has been seamless to day-to-day operations, and the ELGi phone number will remain the same.

For more information, visit www.elgi.us.


The new Charlotte location of ELGi Compressors USA, Inc.

INDUSTRY NEWS

North Carolina-Based Purification Solutions LLC Acquires nano-porous solutions

U.S.-based Purification Solutions LLC, d/b/a/ nano-purification solutions inc. (n-psi), has acquired Gateshead-based nano-porous solutions ltd. (n-psl) for an undisclosed sum. n-psl will now trade as nano-purification solutions UK ltd.

nano-purification solutions is a North Carolina, USA-based business which is rapidly becoming a leader in compressed air and gas filtration, purification, and separation. n-psl specializes in adsorption and separation technologies and features a product portfolio which includes modular compressed air dryers, nitrogen generators and industrial breathing air purifiers.

The purchase of n-psl supports the nano "Experience. Customer. Service." strategy by adding world-class design, engineering and manufacturing capabilities to a strong market-led business. The acquisition enables the newly formed nano-purification solutions to expand into new markets and serve its growing customer base with a diverse range of innovative products.

David Peters, Managing Member, n-psi commented: "We are delighted to welcome the n-psl team and organization into the expanding nano business and believe the new nano-purification solutions will present many exciting opportunities for our stakeholders and clients in the UK, Europe and the USA. The acquisition supports our short- and long-term company objectives and enables n-psl to retain its base in Gateshead which is of vital importance, since so many talented employees will be joining the new organization."

Phil Huddy, Business Development Manager, n-psl commented: "Remaining in the Northeast (U.K.) is very important to ensure success, and we are delighted we have been able to make this happen. As a leader in compressed air and gas filtration, purification and separation, our alignment with n-psi has always been critical. Now that n-psl is an integral part of the larger team, it further strengthens our market position and the service we can provide to our clients in the Northeast and further afield as we continue to grow."

For more information, visit www.n-psi.com/.

Michelin and Darigold Energy Engineers Join Editorial Board of Compressed Air Best Practices® Magazine

Darigold Energy Engineer, Uli Schildt, and Michelin North America Energy Performance Manager, Thomas Sullivan, recently agreed to join the Editorial Board of Compressed Air Best Practices® Magazine. Publisher Rod Smith commented, "We are honored and motivated by the continued interest and support to the mission of our publications by impactful and insightful Energy Managers like Uli and Thomas."

Uli Schild – Darigold

Uli Schildt is the Energy Engineer for Darigold, a leading dairy products company operating multiple facilities in North America. He has been involved in Energy Management for over 10 years. He has implemented Energy Management Programs with two different companies and was a participant in the Department of Energy ISO 50001/SEP Northwest Energy Management Demonstration

Pilot. He is a Certified Energy Manager, Certified Energy Auditor, Certified Practitioner in Energy Management Systems, Certified ISO 50001 Auditor and DOE AIRMaster+ Specialist.

Thomas Sullivan – Michelin North America

Thomas Sullivan is the Energy Performance Manager for Michelin North America, overseeing the corporate energy management program and strategy for the company's 19 tire and rubber manufacturing facilities in North America. Prior to joining Michelin and taking this position, Tom was an engineer officer in the U.S. Army and served in various units and positions both at home and abroad over a period of 6 years. Tom holds a bachelor's degree in computer science from The United States Military Academy at West Point, NY, and a master's degree in engineering management from The University of Missouri for Science and Technology in Rolla, MO.

For more information please visit www.airbestpractices.com, www.darigold.com, and www.michelinman.com/US.

Kobe Steel Establishes New Compressor Company

Kobe Steel, Ltd. recently announced that it has established a subsidiary company in India called Kobelco Compressors India Pvt. Ltd. (or KCIN). KCIN has begun full-scale marketing of standard air compressors.

Kobe Steel's standard air compressor business has large market shares in Japan and ASEAN countries. Kobe Steel anticipates that KCIN will further contribute to growing its share of the world market. In three years, KCIN anticipates cumulative sales of 500 units. In the future, KCIN aims to achieve sales of 1500 units per year in India.

With a global market scale of U.S. $9 billion (about 1 trillion yen), the Indian compressor market of U.S. $250 million (about 30 billion yen) is anticipated to double in the next several years, according to Kobe Steel projections. To capture a share of the Indian market, Kobe Steel saw the need for a local presence and formed KCIN. KCIN has now begun full-scale sales activities and is marketing the Kobelion series of screw compressors, which are noted for their high efficiency and energy-saving features. In

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INDUSTRY NEWS

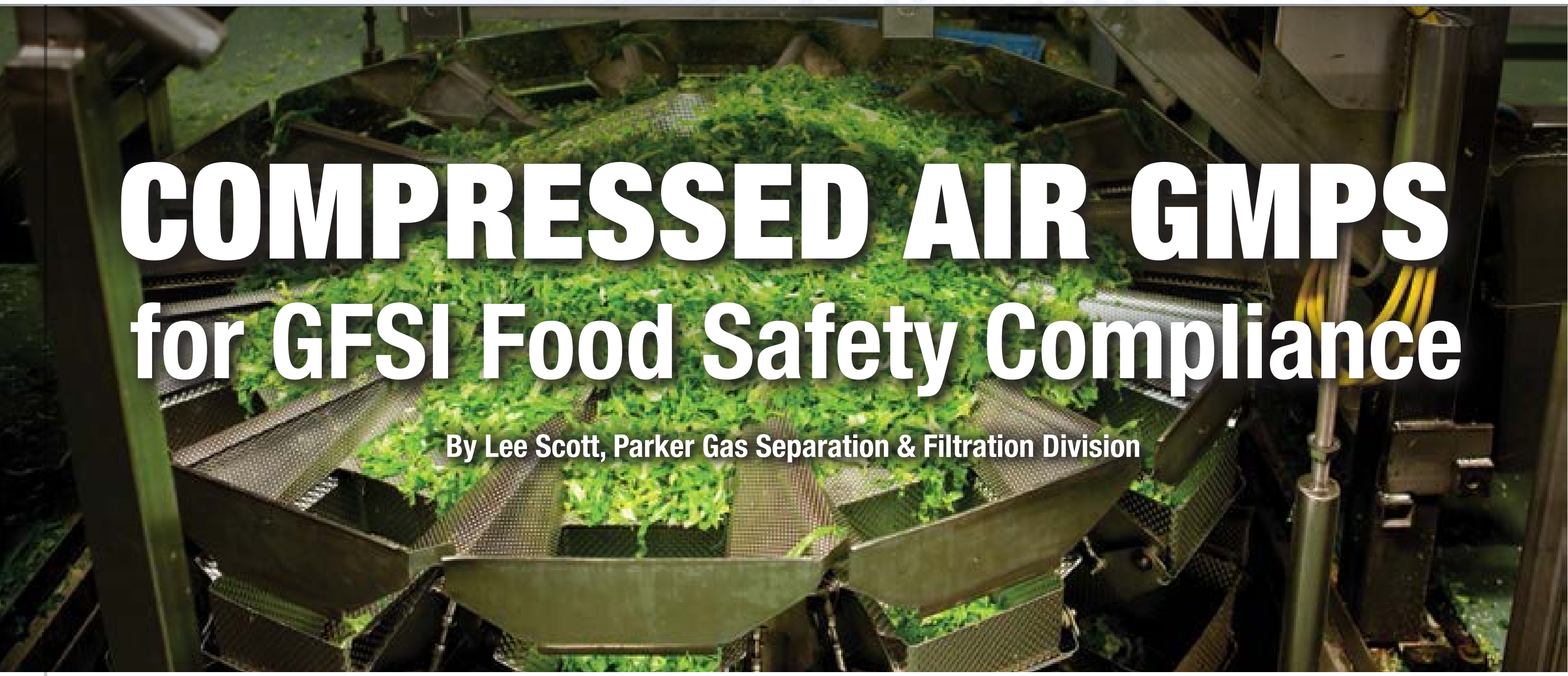
At the KCIN office, Managing Director Shozo Okada is second from the right.

Japan, the Kobelion series has gained a 30 percent share of the market and is highly regarded for its reliability.

Kobe Steel has built up a global network to market and service its standard compressors. Kobe Steel currently has manufacturing locations in three countries: Japan, the United States and China. Sales locations have been established in Singapore, Indonesia, Malaysia, the Philippines, Vietnam and Cambodia. The addition of KCIN will also further improve access to the Middle East and enhance marketing and after-sales service in the region.

In addition, Kobe Steel is a comprehensive manufacturer, with capability to supply centrifugal, reciprocating and screw compressors.

For more information, visit www.kobelco.com.



COMPRESSED AIR GMPS for GFSI Food Safety Compliance

By Lee Scott, Parker Gas Separation & Filtration Division

Any modern food manufacturing facility employs compressed air extensively in the plant. As common as it is, the potential hazards associated with this powerful utility are not obvious and apparent. Food hygiene legislation to protect the consumer places the duty of care on the food manufacturer. For this reason, many companies often devise their own internal air quality standards based upon what they think or have been told are "best practices." This is no wonder, as the published collections of Good Manufacturing Practices (GMPs) that relate to compressed air are nebulous and difficult to wade through (Figure 1).

Understandably this has led to a significant difference in the quality of compressed air used throughout the food and beverage industry, with major differences even existing in plants owned by the same company. The goal of this article is to help make sense of it all. First, we outline the potential risks and hazards that compressed air systems

Benchmarking of Compressed Air GMPs

Good Manufacturing Practices - Compressed Air in Food Plants	Dew Point	Oil Removal	Particulate Removal (includes microbiological particles)	Efficiency	Location of Filtration
FDA Code of Federal Regulations Title 21CFR, Part 110.40 (g)[1]		Compressed air or other gases mechanically introduced into food or used to clean food-contact surfaces or equipment shall be treated in such a way that food is not contaminated with unlawful indirect food additives.			
FDA Guidance RTE foods[2]			0.3 Micron		Point of use
FDA and the FSMA[12] (Food Safety Modernization Act)		The FSMA does not introduce any specific regulations related to compressed air. It primarily requires companies under FDA jurisdiction to employ a risk-based (HACCP-like) food safety management scheme.			
3-A Standard 604-05-3A[3] Section: D6.6.1		Point of Use-Contact (sterile air): 99.999%[10] All other: 99%[10]			
Britsh Compressed Air Society (BCAS)[4] Section 6	-40° F/C	< 0.01 mg/m^3	0.1 - 0.5 Micron		
British Retail Consortium (BRC)[9]		Compressed air used directly in contact with the product shall be filtered.			
Safe Quality Foods (SQF) 7.2 edition[5].		Compressed air that contacts food or food contact surfaces shall be clan and present no risk to food safety. Compressed air systems used in the manufacturing process shall be maintained and regularly monitored for purity.			
SQF Guidance Document for Edition 7.2, July 2014			0.01 Micron	99.999%	Point of use
International Featured Standards (IFS) version 6[6]. Section 4.9.10.2		Compressed air shall not pose a risk of contamination.			
Global Red Meat Standard (GRMS)[7]		Hazards relevant to food safety shall be controlled in critical control points (CCP) and/or by GMP measures.			
FSSC 22000 ISO 22000:2005[8] + BSI PAS 220:2008[11]	ISO22000:2005 := Prerequisite Programs should be in place to address supplies of air (Section 7.2.3.C) BSI PAS 220:2008 Section 6.5 := (Summarized) Compressed air systems shall be constructed and maintained so as to prevent contamination. Requirements for filtration, microbilogy, and humidity (RH%) shall be specified. Filtration of the air should be as close to the point of use as is practicable.				
Most Demanding Purification Levels	-40° F/C	< 0.01 mg/m^3	0.01 Micron	Point of Use-Contact: 99.999%	Point of use

(grey) = Not Specified
(green) = Most critical standard

Figure 1: Published Good Manufacturing Practices related to compressed air can be difficult to understand and apply to a food processing facility.

can introduce to food products. We then benchmark published Good Manufacturing Practices as they relate to compressed air use in a food processing facility under a Global Food Safety Initiative (SQF, BRC, FSSC22000) environment. Finally, we provide several compressed air quality GMPs based on those published standards.

Knowing the Potential Risks of Untreated Compressed Air

Compressed air is not as clean as it appears to be. Untreated compressed air contains many potentially harmful or dangerous contaminants that must be removed or reduced to acceptable levels in order to protect the consumer and provide a safe and cost-effective production facility. Along with moisture and particulate matter, inlet air to a compressor generally carries 5 to 50 bacteria per cfm. A 75-hp compressor with a capacity of 300 scfm therefore takes in 100,000 to 1 million bacteria each hour. These bacteria get compressed along with the air and begin their journey through the compressed air system. Introducing this type of microbial contamination to food products is very risky and would be considered a lack of control by the facility. Understanding how to integrate the treatment of compressed air in a facility will help ward off that risk.

Where Does Compressed Air Contact Food?

Sometimes it is not apparent where the compressed air is contacting the food. Working surfaces like counters and conveyors are obvious and manageable contact points. Compressed air is invisible. It leaves no visible trace where it contacts the food, other food contact surfaces, or the packaging. Without adequate hurdles and physical barriers in place, the microbial, particulate, and (in some cases) compressor oil contamination is left behind after the air dissipates.

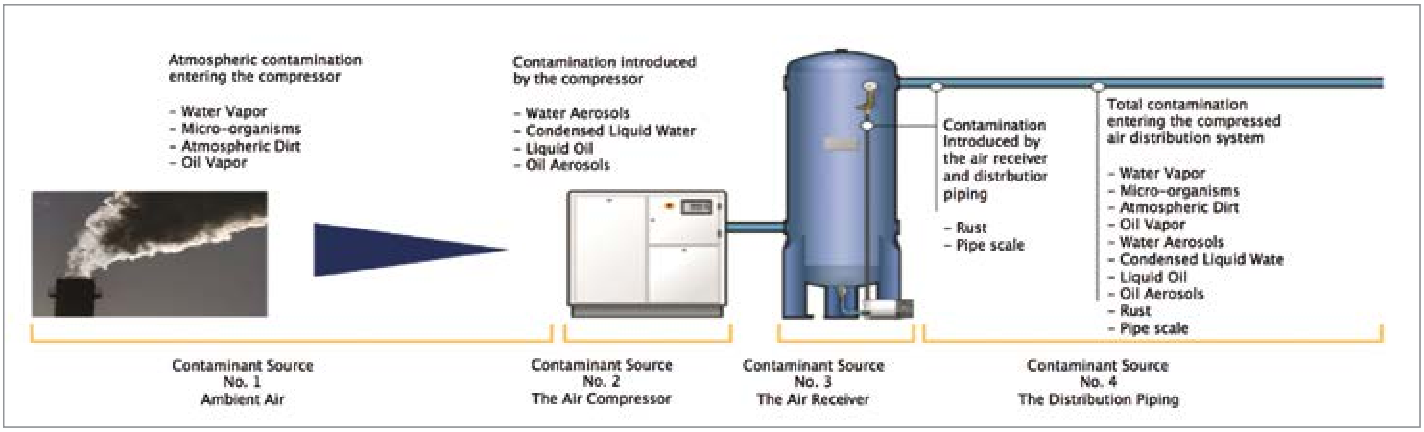
Some example applications that present direct and indirect contact points are:

- Bagging
- Sparging/Mixing
- Drying
- Air Knives (Blow-Off)
- Pneumatic Exhaust (i.e., cylinder exhaust)

Managing the Risks of Compressed Air in Food Processing

Compressor room drying and filtration are good, but they are not enough for a food processing plant. System filtration can do a good job reducing the amount of contaminants introduced into the downstream distribution system. However, that alone does not meet the requirements

COMPRESSED AIR GMPS FOR GFSI FOOD SAFETY COMPLIANCE



Without proper treatment, contaminants can travel from ambient air all the way through the compressed air system.

of the published GMPs that address compressed air — nor is it fully effective. In this scenario, the risk of food adulteration is still quite high. The warm, oxygen-rich environment inside the downstream air reservoirs, piping, fittings, and controls are ideal harborage sites for microbial biofilm growth — especially when fed with food-grade compressor oils that inevitably migrate downstream. For this reason, a number of the published GMPs call for point-of-use filtration that should be in place for all points where compressed air either directly or indirectly contacts food.

The first line of defense to ward off potential microbial contamination of the food product from compressed air is to use point-of-use sterile air filtration. With a properly designed compressed air system employing the benchmarked GMPs (outlined later in this article), along with well-designed Sanitation Standard Operating Procedure (SSOP) maintenance and monitoring programs, the risk associated with compressed air at points of contact can be mitigated significantly. A system design employing sterile air filtration at point-of-use puts a physical barrier in the air stream guarding against microbial contamination of the food. Combining this system design with an HACCP Prerequisite Program (PRP) formalizing these GMPs and SSOPs makes a cost-effective, efficient, and defensible risk management plan.

Parker Balston 3-Stage point-of-use filtration modules, in standard and 304 stainless steel housings, will remove contaminants at a very high efficiency - up to 99.99% for 0.01 micron particles and droplets. The final stage of filtration removes all viable organisms with an efficiency rating of 99.9999+% at 0.01 micron (5-log reduction).

Compressed Air for Ready-to-Eat (RTE) Foods

RTE foods are at high risk of contamination from compressed air. Any microbial contamination introduced in the later stages of RTE food processing can stay with the food all the way to the consumer, as few hurdles or barriers are generally in place to eliminate the hazards. Point-of-use sterile air filtration is critical to ensuring RTE food safety at any point where compressed air can contact the food or food contact surfaces.

Preventing the Growth of Microbes – Benefits of Dry Air

The warm, dark, moist environment inside a compressed air system is the perfect condition for microbes to flourish and grow. Drying the air to a low dew point is an effective way to inhibit this microbial growth. Inhibit — not kill. Microbes need food, water, and the right temperature to grow. Take one or two of those nutrients away, and the growth stops — temporarily. Some of the microbial pathogens that are hazards to food safety form spores and/or protect themselves by moving into a dormant stage when nutrients in the surrounding environment are depleted. These dormant spores resume propagation as soon as the missing nutrients (moisture) become available again through contact with the food.

"Bacterial spores survive very dry conditions without any problem. Vegetative bacterial cells can survive dried states for a period of time. In fact, lyophilization (freeze drying) is a common way to preserve bacteria. Once conditions are favorable for growth (moisture, nutrients etc.), the bacteria can grow again. The foodborne pathogen Salmonella is notorious for surviving under water limited conditions."[14]

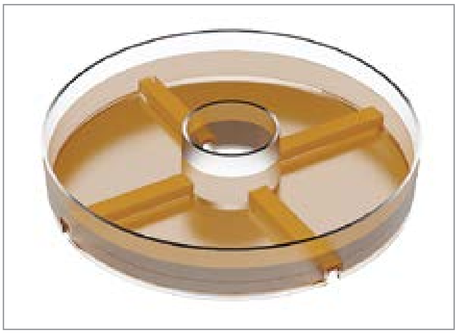
The best practice for food safety is to first dry the air, and — more importantly — use point-of-use filtration to capture the microbes and spores, so they never come in contact the food.

The Parker Balston Compressed Air Microbial Test Unit (CAMTU) is a lightweight, easy to use device capable of sampling compressed air systems for microbes. The unit requires no electricity and has a quick sampling time of 20 seconds. The CAMTU is an ideal device to incorporate into your Good Manufacturing Practices program for monitoring all identified HACCP risk points. Illustration of the CAMTU, Regulator, and Shutoff Valve to Sample Point (left to right).

Monitoring Compressed Air for Purity

Whether it is specified or implied by the food safety scheme being employed in a plant, regularly testing the purity of compressed air coming in contact with food is a best practice. A single test at one point in time is not enough. Compressed air systems are dynamic and the compressor intake is subject to microbial, particulate, and moisture variations throughout the year — as well as buildup of contamination in the system.

In addition to testing at the compressed air's point-of-food contact for pathogenic/allergenic contamination, it is also advisable to test the compressed air for yeast and mold spores where the product is packaged. Many companies find that yeast and mold spores from compressed air introduced in their final packaging operations can be one of the culprits impacting shelf life. Potato dextrose agar is best for testing for the presence of yeast and mold spores in the compressed air.



Unlike the conventional agar plate, this unique CAMTU agar plate offers greater dispersion of the compressed air over the agar as a result of an improved air flow path through the center hole in the plate. This provides optimum detection performance and enhanced capture of microbes.

COMPRESSED AIR GMPS FOR GFSI FOOD SAFETY COMPLIANCE

Parker GMPs for Point-of-Use Compressed Air

To help companies adhere to GFSI standards, Parker has developed recommended Good Manufacturing Practices (GMP) for compressed air systems in food processing plants based on benchmarking published practices. The following three simplified GMPs are recommended for food processing facilities using compressed air:

- **GMP #1:** Remove as much moisture as possible from the compressed air before distributing it throughout the plant. A dew point of -40˚F/-40˚C is ideal.
- **GMP #2:** Use point-of-use sterile air filtration wherever compressed air comes in contact directly or indirectly with food or food contact surfaces.
- **GMP #3:** Ensure the final stage in point-of-use filtration has a rating of 0.01 micron with a particulate removal efficiency rating that is equal to or better than 99.999 percent[10] (providing 5-log reduction of any microbial contamination).

Understanding the GFSI/SQF Environment

Due to the risks mentioned previously, the number of food manufacturing companies adopting GFSI-endorsed food quality schemes is steadily growing. One of the most popular schemes in the U.S. is the SQF Code. Beginning with the 7th edition of the SQF code, released in July of 2012, awareness of potential contamination from compressed air was highlighted. The 7.2 Edition of the SQF code, published March 2014, includes verbiage relating to compressed air in Module 11: Good Manufacturing Practices for Processing of Food Products. SQF has also published a Guidance Document to accompany the Edition 7.2 Code.

The key points applicable to robust GMPs are:

SQF Module 11.5.7.1[5]: "Compressed air that contacts food or food contact surfaces shall be clean and present no risk to food safety."

- "Wherever the compressed air comes in contact with the food, either directly or indirectly, high efficiency filters are to be in place at point-of-use where the air enters the final section of tubing (not in the compressor room)."
- "The recommended final stage of filtration in these food contact areas should have a rating of 0.01 micron with an efficiency of 99.999% (or as determined by appropriate risk analysis)."
- "It is generally advisable to locate the filtration as close as practically possible (near the "point of use," or the point where air contacts the food), so as to not have long lengths of piping/tubing between the microbial removal filter and the air/food contact point."

SQF Module 11.5.7.2[5]: "Compressed air systems used in the manufacturing process shall be maintained and regularly monitored for purity."

- "...[compressed air] testing must be conducted at a minimum of once a year."
- "Testing can be done in-house or by a contracted party."
- "Microbiological testing can include testing for aerobic plate count and/or indicator organisms as appropriate to the operation."
- "Aseptic sample collection needs to be used."

System Design GMP: Drying

To retard or stop the growth of microorganisms in the system, the pressure dew point should be reduced as close to -40˚F/C as possible. A compressed air dryer should be installed to remove this moisture. Ideally, the dew point should be reduced to -40˚F/C (ISO8573-1:2010 Class 2 for humidity and liquid water). Refrigerated dryers will provide dew points in the ~+38˚F range (ISO8573-1:2010 Class 4 for humidity and liquid water). If a refrigerated dryer is used, it is important that the three stages of filtration mentioned below be in place.

System Design GMP: Point-of-Use Filtration

When designing a compressed air system, use point-of-use filtration wherever compressed air comes in contact with the food — either directly or indirectly. Point-of-use filtration is the best line of defense against microbial contamination of food in a compressed air system. Even the best compressor room system filtration does not eliminate harborage sites and biofilm buildup in the downstream compressed air piping system. The following three stages of filtration will significantly reduce the risk of microbial contamination of the food.

- **Stage 1:** Remove bulk liquid and particulate matter down to 0.01 micron at ≥ 93% coalescing efficiency.[10] Automatic drain in filter. (ISO 8573-1:2010 Class 2.4.2)
- **Stage 2A:** Remove oil and water aerosols and smaller particulate matter down to 0.01 micron at ≥ 99.99% coalescing efficiency.[10] Automatic drain in filter. (ISO 8573-1:2010 Class 2.2.2)
- **Stage 2B (Optional):** If there is a concern for hydrocarbon vapor carryover from the air compressor, then the installation of activated carbon filter may be necessary. (ISO 8573-1:2010 Class 2.2.1)

- **Stage 3:** Remove microbial contamination down to 0.01 micron at ≥ 99.999% particulate removal efficiency[10] (5-log reduction) with a sterile air filter. (ISO 8573-1:2010 Class 1.2.2. Class 1 – or better – particulate is key.)

Sanitation Standard Operating Procedures: Maintenance of Filters

- **Stage 1:** Change filter element every 6 to 12 months.
- **Stage 2A:** Change filter element every 6 to 12 months.
- **Stage 2B:** Change filter element every 3 to 6 months.
- **Stage 3:** Change filter element every 3 to 6 months — or sooner — as necessary based on point-of-use air quality test for microbial content.
- **Note:** Sterile air filters are designed to capture microbial matter larger than the nominal element rating. Microbial matter will not create a differential in pressure across the element. Therefore, measuring differential pressure across the element will not give an accurate reading of contamination. Air testing and/or regularly scheduled element changes are the best practices.

Sanitation Standard Operating Procedures: Monitor Purity of Compressed Air

Compressed air at 100 psig contains 8 times the amount of bacteria and contaminants as atmospheric air. In addition, Mesophilic Aerobic bacteria and fungi love the warm dark environment inside a compressed air system. As a baseline, test compressed air at each food contact point at least annually. Determine the test interval empirically based upon presence of microbial contamination.

Following Compressed Air GMPs

Identifying the risks and potential hazards compressed air introduces in a food processing plant is the easy part. Determining — and following — Good Manufacturing Practices for effectively treating the compressed air is not so straightforward. In the end, the best and final defense against all types of compressed air contamination is point-of-use filtration. BP

For more information, contact Lee Scott, email: Lscott@parker.com, tel: (978) 478-2750, or visit www.balstonfilters.com. For more information on the CAMTU Sampling System visit www.solutions.parker.com/CAMTU

To read more about ***Food-Grade Compressed Air Standards,*** please visit http://www.airbestpractices.com/standards/food-grade-air

Notes and References

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14. McLandsborough, Dr. Lynne A., PhD, Associate Professor and Director of Undergraduate Food Science Program, Department of Food Science, University of Massachusetts, Amherst

MEAT PROCESSING PLANT DROPS COMPRESSED AIR COSTS 60%

By Ron Marshall for the Compressed Air Challenge®

One of the statements made in the Compressed Air Challenge's Fundamentals of Compressed Air Systems seminar is that improvements can always be made to every compressed air system, including new ones. The statement definitely applies to a Canadian pork processing facility built a few years ago. This article is based on a compressed air audit performed two years into the life of a brand new plant. The audit found numerous problems and made recommendations that helped reduce plant compressed air operating costs by 60 percent.

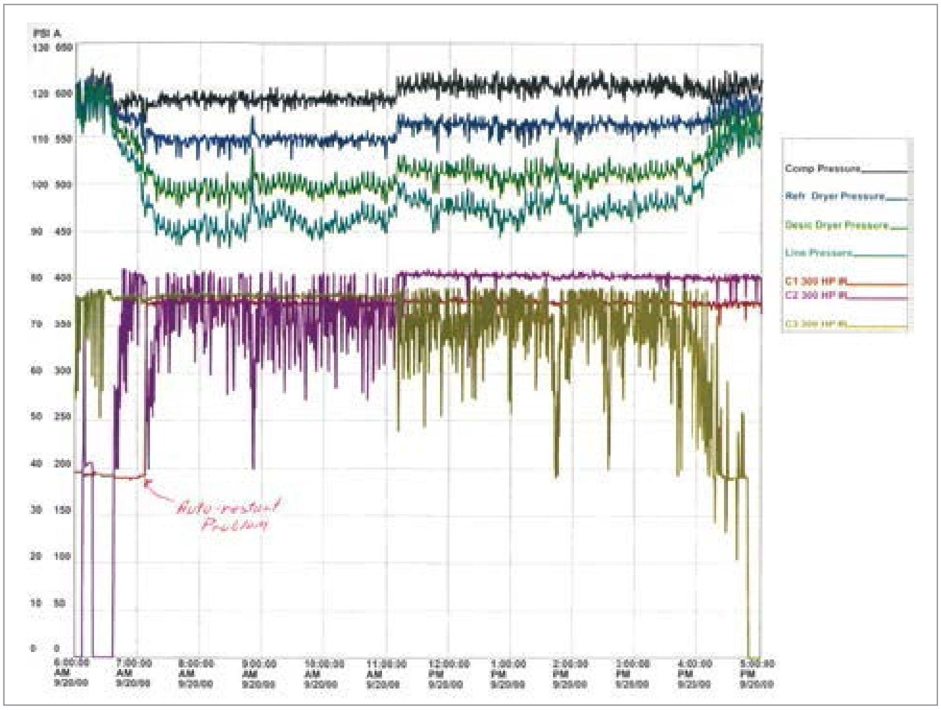

Figure 1: Data logging showed a significant pressure loss across the system.

Supply Side System Configuration

The compressed air production and treatment system consisted of three large, 300-hp, 1250 cfm, fixed-speed, and air-cooled lubricated screw air compressors running in load/unload mode. System storage was 4000 gallons. Two types of compressed air dryers were used; Non-cycling refrigerated was used for air sent to the kill floor areas of the plant where ambient temperatures were normal. For meat processing areas where the ambient temperatures were in the 40˚F range, the compressed air was dried using a heatless desiccant air dryer. The refrigerated and desiccant dryers were installed in series.

The air compressor cooling pulled in outdoor air, sometimes reaching temperatures of -40˚F, which was tempered by mixing with hot compressor discharge air through a crossover duct. While this is a good use of the

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compressors' heat of compression, it is one of the few good things known about the system.

Data Logging Identifies Surprisingly High Energy Costs

The local power utility offered to conduct a plant compressed air audit to determine the system efficiency. The system was monitored with data loggers to find out the system efficiency and assess if there were any obvious problems. The audit found the energy input into the compressed air system averaged 440 kW to produce an average flow of 1250 cfm, resulting in a system specific power of 35 kW per 100 cfm. This number was significantly higher than expected considering the air compressors are rated at 20 kW per 100. The audit also found about 47 percent of the compressed air demand was classed as "potentially inappropriate use," and more investigation was required.

The meat processing plant had significant problems with compressed air pressure (Figure 1) due to poor air compressor control methods and significant pressure loss across air dryers,

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filters and piping. At times the air loading was exceeding the capacity of the compressors, causing system pressure to draw down to lower levels. Air quality was poor due to problems with the dryer configuration and design. Filtration problems were allowing oil to foul the dryer desiccant, reducing the drying effectiveness. Required dew points were not being achieved due to these issues.

Occasional peak plant loads were far in excess of the total capacity of the air compressors.

	Estimated Average Present Demands (cfm)						
		Shift				Wtd.	
	Peak	Day	Evening	Midnight	Weekend	Average	%
Constituents of Demand	peak cfm	ave. cfm	ave. cfm	ave. cfm	ave. cfm	ave. cfm	
Process Machines	600	545	55	0	0	167	11%
Cleanup		0	50	100	0	30	2%
Blowing	1500	1260	480	0	0	455	31%
Transport Systems	2000	940	575	0	0	383	26%
Dryer Purge	440	300	250	200	150	223	15%
Condensate Drains	100	50	50	50	45	48	3%
Leaks	130	130	130	130	130	130	9%
Artificial Demand	0	0	100	90	45	52	4%
Totals	4770	3225	1690	570	370	1488	

Figure 2: Constituents of demand showed varying demand and significant waste.

	Differential (psid)			
Condition	Refrigerated Dryer	Filter and Dryer	Distribution	Total
High Load (3600 cfm)	9	12	7	28
Medium Load (2400 cfm)	4	5	3	12
Low Load (1200)	1	1.3	.7	3

Figure 3: Significant pressure differential was experienced during peak loads, especially across the dryers.

Some items in the plant had changed from the original design, and this had led to a huge increase in the expected load. For this reason, a very detailed inventory of the various end uses was compiled (Figure 2).

Pneumatic Transport Systems Convey Non-Traditional Product

A thorough investigation of the plant end uses was conducted to determine if compressed air loads could be reduced. Almost 60 percent of the flow was consumed by the plant transport systems and blowing.

The plant has a kill operation, and between the point of live hog input and cut meat output quite a lot of material is removed from the carcasses. The plant designers adopted an extensive dense phase pneumatic transport system to send materials like hair, offal, lungs, stomachs and ears to the locations in the plant where they could be prepared for transport to rendering or processing facilities. Although unpalatable to read about, all these byproducts serve a useful purpose in our food chain, and they are not wasted.

These things are not typical of the material that is normally transported using pneumatics, and transporters would get plugged.

During the troubleshooting phase, the plant technicians would experimentally alter the blow times and input pressures to try and solve the transport problems. Over time some of the transporters had blow times that were incorrectly adjusted, so that the compressed air flow was nowhere near the design flow of the transporter. Some of these transporters were consuming over six times the design value. The transporters also caused random, high-flow events to occur, which negatively affected system pressures and upset the compressor control strategy.

Blowing Applications Proliferate on the Processing Line

Also, the designers of various packaging equipment in the processing line started to adopt compressed air blowing for liquid removal from wrapped meat packages. The designers were unaware of the high cost of compressed air and installed very many nozzles throughout the processing line.

One system of blowing was particularly expensive. The setup used 24 flat nozzles to remove residual water from a conveyor after it had been washed and sterilized (Figure 5). Use of these nozzles is very energy intensive

Figure 4: Material is transported pneumatically, causing transient high flow events.

Figure 5: Plastic flat nozzles were used to remove water from conveyors

— especially if the nozzles have broken off, allowing air to blow from an open hole. Investigation found that 50 of these nozzles had been installed in various locations, totaling 820 cfm of peak flow — the equivalent output of a 200-hp air compressor.

World's Worst Job

During the plant audit, the author came across what, in his opinion, was the world's worst job. Part of the hog slaughtering process involves an operation called hog bunging. This operation can be meekly described as removing a prime portion of the rear end of the hog so the remaining carcass is not contaminated. This job involves inserting a special tool into the area of the hog "where the sun don't shine," and pulling the trigger to do a precision ring cut. This is done day after day, on 1500 hogs per hour — an important, but boring and dirty job.

The author was describing this "worst job" to legendary compressed air auditor Scot Foss, only to have him excitedly exclaim, "I designed that tool!" Sure enough, Scot had worked as a designer for a compressed air tool company, and was in fact involved in the "world's worst tool design assignment."

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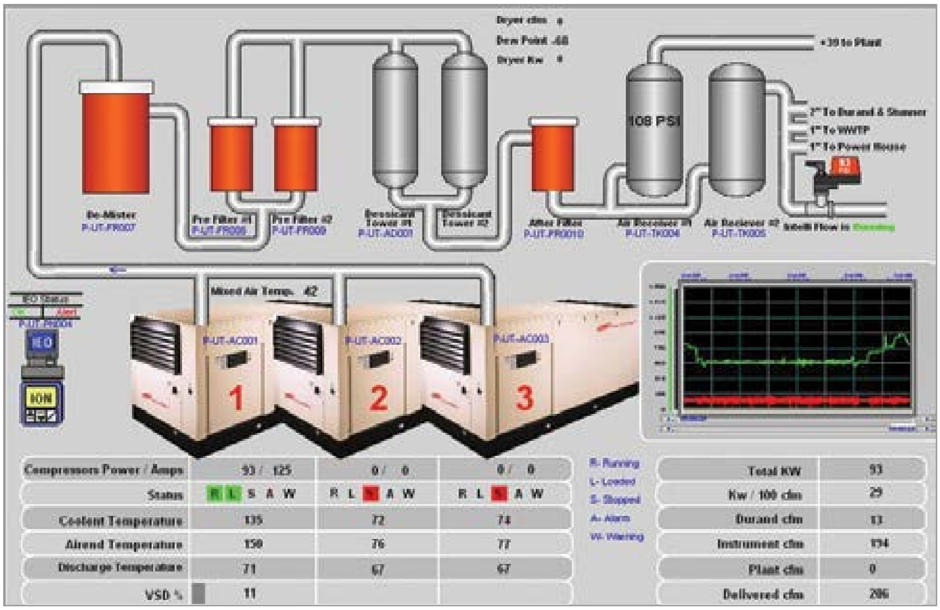

Figure 6: The system is now monitored from a central location.

Compressed Air System Reconfiguration Drops Energy Costs by 60%

The meat processor was able to make some extensive modifications to the compressed air system to improve the plant pressure, improve air quality, and reduce energy. The measures included:

- A decision was made to use only one style of dryer, and the series arrangement of refrigerated and desiccant dryers was replaced by a heated blower style unit. Dryer filters were upsized for reduced pressure differential. This change reduced drying energy costs by 66 percent.
- A pressure/flow controller was installed to regulate the pressure in the two lower levels, yet still allow the compressors to cycle with a wide pressure band to maximize the use of storage.
- One of the air compressors did not have an auto feature, which caused it to run unloaded for long periods of time. This feature was installed.
- A central controller was installed on the system to orchestrate the operation of the compressors.
- One of the air compressors was outfitted with VSD control. The pressure settings are now coordinated so that the unit always remains in trim position.
- Plant piping was modified where significant pressure differential existed.
- Condensate drains were replaced with no air-loss units.
- The transporter operations were re-commissioned for reduced average flow.
- Most of the blowing operations were eliminated or switched to low pressure blowers.
- Air leaks were reduced through a system of detection and repair.
- A monitoring system was installed that measured the input kW and the output flow so system efficiency could be continuously monitored. The data from this system was integrated with information from the compressor controller. All of that information is also sent to the plant SCADA system.

In all, the improvements significantly reduced the pressure differential and reduced the system energy consumption. The verified savings for the improvements showed that the plant saved 2.9 MWh per year, for a 60 percent reduction in energy costs. The company was also able to receive a financial incentive of $217,000 to help with the project costs. BP

For more information about the Compressed Air Challenge, contact Ron Marshall, email: info@compressedairchallenge.org.

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— Ron Marshall for the Compressed Air Challenge®

ISO 22000 CERTIFICATION for the Food & Beverage Industry

By Deepak Vetal, Product Marketing Manager – U.S. Oil Free Division, Atlas Copco Compressors

Any company in the F&B industry can adopt the quality safety management system detailed in ISO 22000.

ISO 22000 is a food and beverage (F&B) specific derivative of ISO 9001, a family of standards from the International Organization for Standardization that details the requirements of a quality management system. It is a quality certification that can be applied to any organization in the food chain — from packaging machine manufacturers to the actual food processing facilities.

Being ISO 22000 certified provides a level of confidence to customers. They can be sure the company they are buying from has the safety management measures in place to ensure the safety and quality of their product.

There are three primary safety hazards in F&B manufacturing that ISO 22000 addresses, including biological, chemical and physical. The key components of the ISO 22000 certification seek to address those hazards by identifying and mitigating them. Earning ISO 22000 certification involves the following:

1. Set up a documented food safety management system to manage the processes throughout the facility.
2. Establish prerequisite programs to ensure a sanitary environment.
3. Institute an HACCP (Hazard Analysis Critical Control Point) principal, which identifies, prevents and eliminates hazards.

Compressed Air and Blowers in the F&B Industry

Because air compressors and blowers play such an important role in the F&B industry, ISO 22000 should be a key certification for manufacturers supplying equipment to the industry. ISO 22000 gives F&B manufacturers peace of mind that, in the case of a compressor and blower manufacturer, a key piece of the manufacturing process was made in a clean, safe environment.

ISO 22000 certification also reassures consumers that the business they are buying from is working with suppliers who conform to international quality, safety and reliability standards. An ISO 22000-certified manufacturer needs to make sure that products along their own supply lines are manufactured in safe environments and meet the standard's requirements. For example, as part of the approval process Atlas Copco examined its sub-suppliers, helping them to eliminate any potential hazards. This process ensured there were no physical, biological or chemical hazards that could compromise the company's own manufacturing processes.

Blow-off applications are common in a great deal of F&B manufacturing facilities.

Atlas Copco Achieves ISO 22000

Atlas Copco is the first compressed air product manufacturer to receive ISO 22000 Certification. Applicable products have already achieved ISO 8573-1 Class Zero certification, ensuring compressed air is oil-free and

ISO 22000 CERTIFICATION FOR THE FOOD & BEVERAGE INDUSTRY

ISO 22000 certification ensures there are no physical, biological or chemical hazards that could compromise an F&B manufacturing process.

will not contaminate the F&B manufacturing process. To bring more value to the products, the next logical step was to apply for ISO 22000 certification.

In 2015, the production facility of Atlas Copco's Oil-free Air Division in Antwerp, Belgium, was awarded ISO 22000 certification after an audit was executed by Lloyd's. The Antwerp location manufactures oil-free air compressors, blowers and air treatment products.

ISO 22000 Provides a Unique Challenge

Achieving ISO 22000 was a challenging endeavor, and the process took more than one year. There are a lot of guidelines concerning food safety hazards in the F&B industry. Applying those guidelines and implementing a Food Safety Management System at the world's largest air compressor manufacturing facility was no easy task.

For instance, if a potential chemical hazard was identified, it needed to be communicated to everyone involved in the process — from

"Because air compressors and blowers play such an important role in the F&B industry, ISO 22000 should be a key certification for manufacturers supplying equipment to the industry."

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ISO 22000 gives F&B manufacturers peace of mind that equipment was made in a sanitary environment.

upper management on down. If that chemical was used for a particular process, proper sanitation needed to be performed to eliminate any potential contamination. Extrapolated across a large facility manufacturing many different products, communicating across different divisions, sub-suppliers and process engineers provided a unique challenge.

About the Author

Deepak Vetal has more than 15 years of experience in the compressor industry. He has worked at different levels in Sales and Marketing, including Sales and Service Engineer, Key Account Manager, and Marketing Manager at the national level. Currently, Deepak serves as the Product Marketing Manager for the U.S. Oil Free Division of Atlas Copco Compressors.

Perhaps the biggest challenge, however, was documentation. Even if a process was in place for managing safety, it required documentation in the language of ISO 22000. Trained managers are now in place who have gone through the process and understand the system. With those key members in place, the process has become significantly easier. With this experience, the Company can now assist F&B customers going through the ISO 22000 process as well. A revision of the ISO 22000 standard is currently underway with an expected publication date of 2017. BP

For more information, contact Deepak Vetal, email: Deepak.vetal@us.atlascopco.com, or visit www.atlascopco.us.

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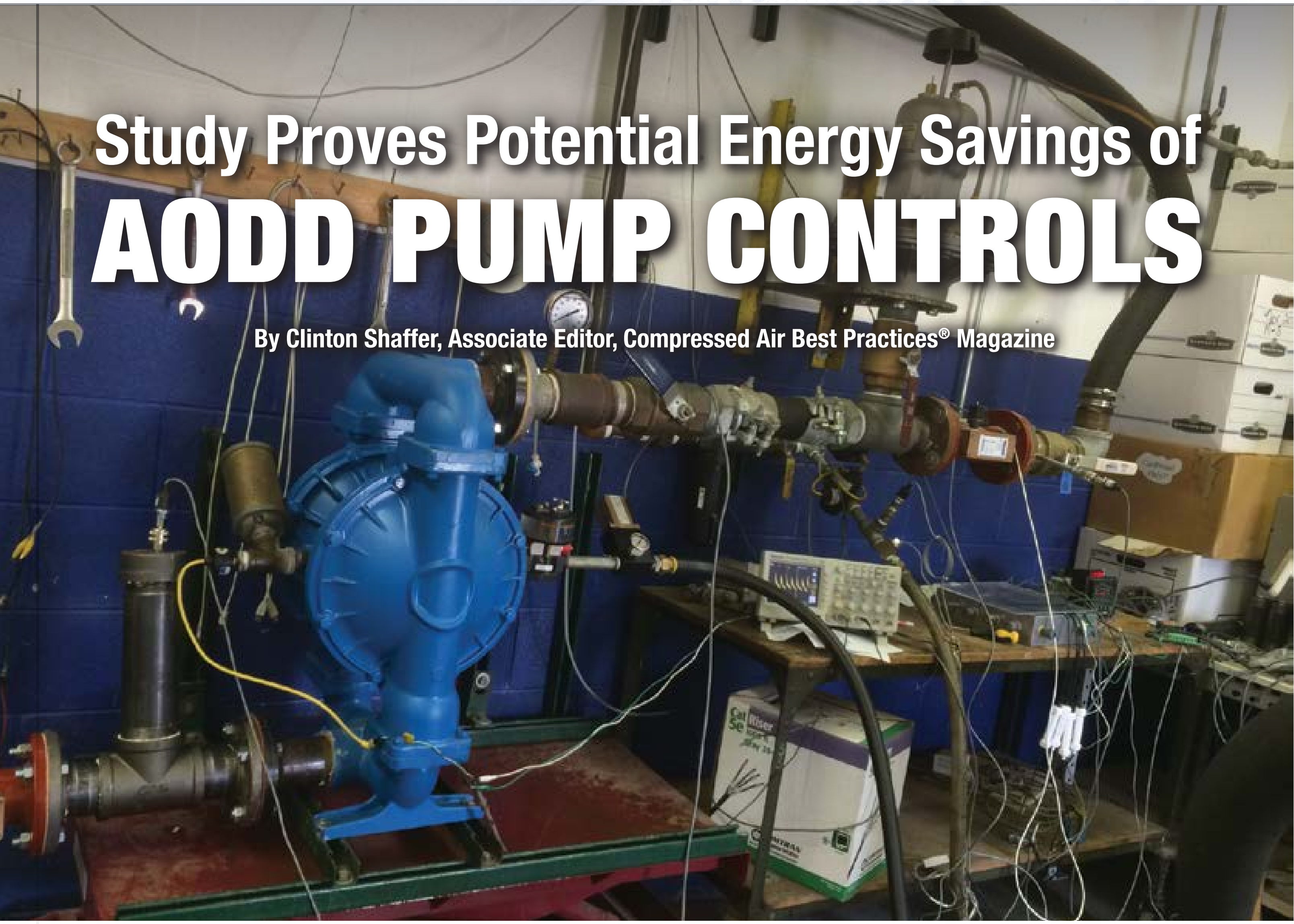
Study Proves Potential Energy Savings of AODD PUMP CONTROLS

By Clinton Shaffer, Associate Editor, Compressed Air Best Practices® Magazine



Air-operated double diaphragm (AODD) pumps are common to many manufacturing facilities. As estimated by veteran compressed air auditor Hank van Ormer of Air Power USA, approximately 85 to 90 percent of plants in the United States have AODD pumps. They are used for all kinds of liquid transfer applications, like those found in chemical manufacturing, wastewater removal, and pumping viscous food products.

As ubiquitous as they are, AODD pumps are also commonly misused. Per van Ormer, "No air-operated equipment should run uncontrolled." However, a good number of manufacturing facilities still run AODD pumps without controllers.

"The typical situation we see [with AODD pumps] is there is no controller attached," explained Dr. David Goodman, Ph.D., C.E.A., Assistant Director of the Indiana Industrial Assessment Center (IAC) and professor at IUPUI. "The pump has internal controls that cause the diaphragms to slam back and forth continuously. [Factory personnel] then turn the air off when they don't need the pump."

Goodman and his colleagues at the IAC help small and mid-sized manufacturing companies become more competitive by saving on energy costs. They work with several second- and third-tier automotive facilities whose AODD pump applications include chemical cleaning and paint removal.

AODD pumps have several advantages: they can handle aggressive chemical or physical product throughputs; they can run empty without catastrophic failure; and they can be repaired quickly. However, uncontrolled AODD pumps can be absolute energy hogs, so Goodman and his team evaluated the viability of electronic controls for saving energy. In their study, they ran comprehensive pump tests using MizAir®, an electronic controller manufactured by Proportion-Air, Inc.

Presented by Goodman at the World Energy Engineering Conference (WEEC) 2015, the study tested four different AODD pumps — running them with and without an electronic controller. The results were promising, and showed a potential reduction in compressed air consumption of 20 to 50 percent when the MizAir was applied to an unregulated AODD pump.

To learn more about the project, Compressed Air Best Practices® Magazine spoke with Dr. Goodman of the Indiana IAC, along with Jon Lister, Electrical Engineer, and Larry Brown, Sales Manager, from Proportion-Air, Inc. We also spoke with Hank van Ormer, President of Air Power USA, to get insight on the real-life application of MizAir electronic controllers on AODD pumps.

Compressed Air Logic: Air-Operated Double Diaphragm Pumps

Air-operated double diaphragm pumps use compressed air pressure to generate diaphragm force and move a liquid medium. The two diaphragms operate in paralleled oscillation — as one diaphragm is pushed by compressed air away from the center section, it forces liquid out of the pump. At the same time, the other diaphragm moves toward the center, creating a low-pressure zone and pulling liquid into the vacated chamber with atmospheric pressure (Figure 1). Once the pressurized diaphragm is fully extended, it activates a poppet valve. The poppet valve then triggers the inlet air valve to direct incoming compressed air to the suction-side of the diaphragm pump, reversing the whole process. Compressed air is wasted during the transition between diaphragms.

"Whenever the compressed air fills all the way in one of the diaphragms, the valve switches the air so it goes into the opposite diaphragm," Jon Lister, Electrical Engineer at Proportion-Air, explained. "But, while it is switching, it is constantly blowing out compressed air. In some cases, a certain amount of compressed air goes straight through the pump and out the exhaust. That's obviously pretty bad for shop air and for the people paying the power bills."

Each full extension of a diaphragm is called a press stroke. The speed of the strokes impacts how much compressed air flow (in cfm) the AODD pump consumes. They typically run at 85 to 95 psi, depending on the application. The more viscous a material is, the higher the pressure needed to push the diaphragm and move the medium. The higher the pressure, the slower the stroke frequency.

How the MizAir® Electronic Controller Works

MizAir® (U.S. Patent #7,517,199) is designed to decrease compressed air consumption in AODD pumps. It analyzes pumping performance with a microprocessor, and uses that information to modulate a high-flow, normally open, two-way air valve. Positioned on the inlet air valve of the AODD pump, the

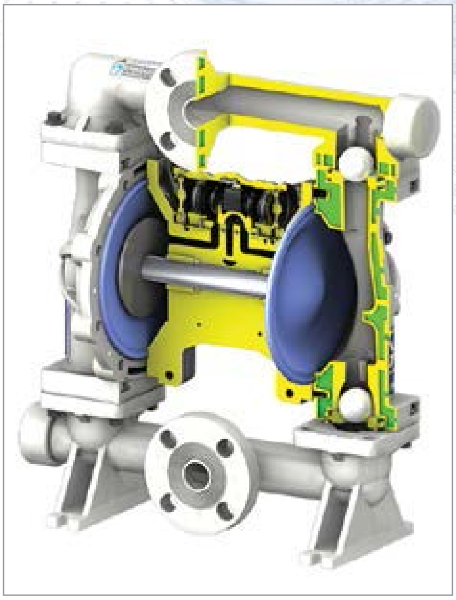


Figure 1: On a typical AODD pump, compressed air pushes the diaphragm (blue), which then forces the liquid up and out of the chamber (bypassing a ball valve).

STUDY PROVES POTENTIAL ENERGY SAVINGS OF AODD PUMP CONTROLS

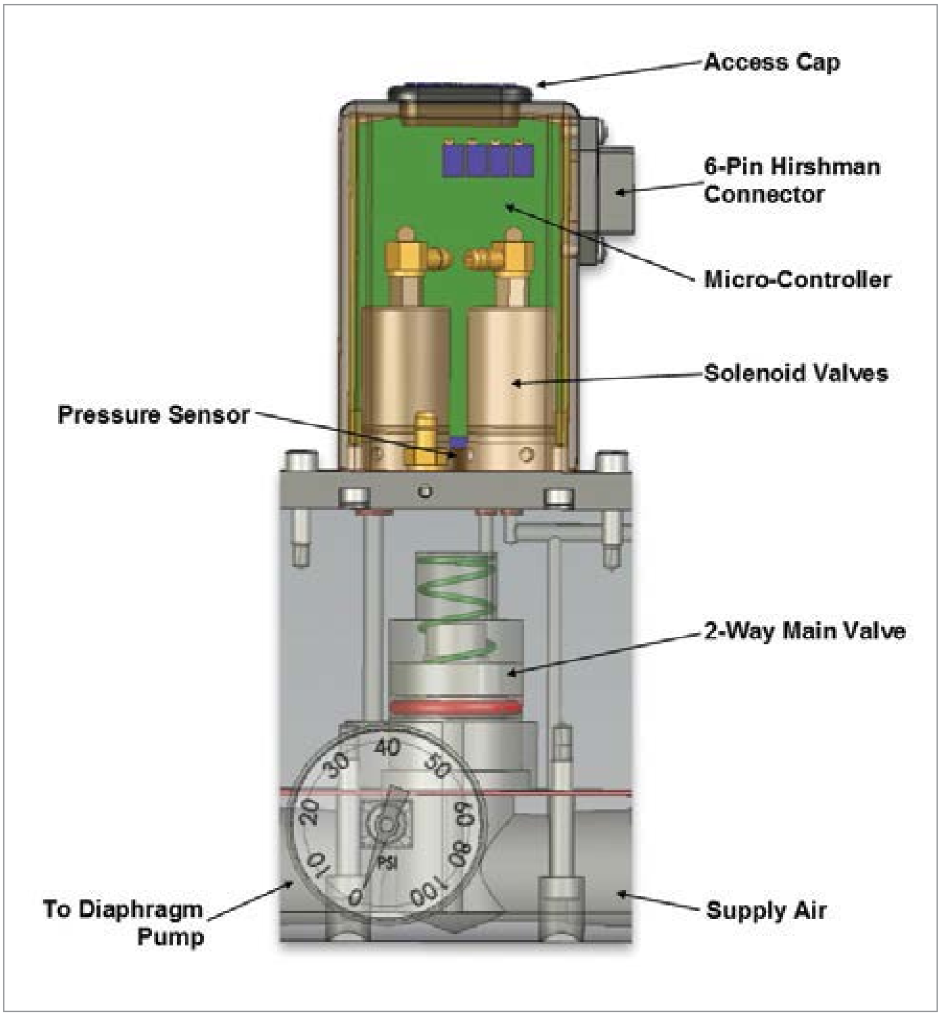


Figure 2: MizAir® analyzes pump performance and modulates the compressed air supply into an AODD pump accordingly.

MizAir unit delivers precisely timed and gauged pulses of compressed air at the beginning of each pump stroke, and it closes immediately afterwards. The compressed air in the pump can then continue expanding to fully extend the diaphragm.

"MizAir monitors the strokes, and it simply turns the compressed air on and off," Lister said. "It's synced up with the pump, so it gives it a big burst of air at the beginning of the [diaphragm] switch to get the momentum going. Then it cuts it off. Because you have 80 or 100 psi of compressed air in this diaphragm cavity, your typically throwing more air in there than you need. So we just shut it off, and let what's in there do the work."

There are several benefits to the approach. First, the pump ends its stroke with less compressed air, eliminating compressed air wasted in the exhaust. With less exhaust, there is also a definitive reduction in noise levels. The pump can then start its next cycle easier, as there is less resistance against the return stroke.

"During the switching, we aren't blowing compressed air directly out of the exhaust," Lister told us. "That's where we save our compressed air — by modulating the air coming in. Sometimes, depending on the situation, the pressure will bump up a little bit at the pump because you're no longer constantly bleeding, and that helps out too."

Adapting to AODD Pump Process Changes

The MizAir is programmed to a specific model of AODD pump. Therefore, it can adapt to outside influences, because it understands how the pump operates. Its microprocessor monitors how quickly the pump strokes, and what pressure is required for each stroke. It can then adapt to process changes.

"If you were unloading a rail car of fluid, pumping it to holding tanks on the first floor of your factory, and you have to shift the valve and send it up 20 feet to the second floor, it requires more energy to move the fluid," Larry Brown, Sales Manager, Proportion-Air, said. "You have 20 feet more head pressure. MizAir sees that and holds the valve open a little longer, allowing a bigger slug of air to go into that diaphragm cavity so that you still have similar throughput."

Fluids with differing viscosities could also affect head pressure. The MizAir controller adjusts to that type of process change as well.

"The neat part about the MizAir is it's a microprocessor, so if the viscosity changes it automatically resets itself," Hank van Ormer explained. "The biggest opportunity in savings is lighter weights — in other words, with water and similar liquids, because your stroke speeds are higher. Therefore, your air usage (cfm) is higher. If you have a pump with a pretty high head and low strokes per minute, then there's not going to have a very high demand."

Testing at the Indiana Industrial Assessment Center

Improving the energy efficiency of AODD pumping systems is directly in line with the goals of the Indiana IAC. Funded by the U.S. Department of Energy, the Indiana IAC is required to substantiate energy savings claims. When Dr. Goodman's team came across the MizAir controller, it provided an ideal project — comparative validation testing on an AODD pump controller.

"We are always looking for new technology that can reduce energy consumption in facilities," Dr. Goodman explained. "The DOE requires us to do cost justification and calculations to back up all of our energy savings claims. So, we decided to test the MizAir on four different pump systems. We did it at two separate pressures, and three different flow rates — so we had 48 trial runs."

Experiments compared four different AODD pumps under standard control and under MizAir control at ambient conditions with a water fluid medium (per ANSI). The researchers documented pump performance parameters, including compressed air pressure, compressed air flow, liquid medium pressure, and liquid medium flow. Each parameter was tested under three different fluid flow rates (minimum, nominal and maximum) and two different compressed air operating pressures (80 and 100 psi) — with a particular focus on energy efficiency.

Designing the Test Rigs

Using ANSI/HI 10.6-2010, the standard applicable to AODD and bellows pumps, the Indiana IAC team designed test rigs to evaluate four different models of 2-inch and 3-inch AODD pumps (Figure 3). The test rigs were evaluated for ANSI compliance, and they were fully validated before initiating the trials.

Figure 3: The Indiana IAC team evaluated the test rigs for ANSI compliance, fully validating them before the trials.

STUDY PROVES POTENTIAL ENERGY SAVINGS OF AODD PUMP CONTROLS

The study was fully complemented with a suite of diagnostic equipment, including:

- Pressure gauge to monitor compressed air pressure
- Pressure transducer to measure liquid outlet pressure
- Temperature sensor for monitoring liquid inlet temperature
- Pressure transducer for measuring liquid suction pressure
- Barometric pressure sensor
- Oscilloscope for measuring pump speed
- Impulse input adaptor for monitoring compressed air consumption
- Temperature and relative humidity sensors for ambient air
- Ultrasonic flow meter and an analog module for gauging liquid outlet flow rate
- Power and energy meter for air compressor power
- Current transformer for air compressor current

The tested equipment had the specifications shown in the charts below.

AODD TEST PUMP SPECIFICATIONS

AODD SPECIFICATIONS	PUMP 1	PUMP 2	PUMP 3
Max. Liquid Temperature	180˚F	190˚F	180˚F
Compressed Air Supply Pressure	20 to 100 psi	20 to 100 psi	20 to 100 psi
Discharge Volume per Cycle	2.26 gallons	0.94 gallons	1.12 gallons
Max. Cycles per Minute	95	235	146
Max. Size Solid	13/32"	0.38"	5/16"
Other	19 feet max. dry suction lift	Heads up to 125 psi	—

AIR COMPRESSOR SPECIFICATIONS

Type	Lubricated Rotary Screw
Full Load Pressure	125 psi
Air Delivery at Full Load Pressure	232 cfm
Compressor Drive Motor	60 hp

MIZAIR® CONTROLLER SPECIFICATIONS

Power Requirement	24 VDC ±0.5 VDC
Supply Current	275 mA
Maximum Supply Pressure	130 psig
End Connections (Port Size)	3/4" NPT Threaded
Media Working Temperature	32 to 122˚F
Ambient Temperature	32 to 158˚F

Test Results Illustrate Reduced Compressed Air Consumption

The test results demonstrated that controlling an AODD pump with a MizAir controller could reduce compressed air consumption by roughly 20 to 50 percent, depending on the size of the pump and the flow rate of the liquid pumping medium. Figures 4 and 5 illustrate the findings. The data on Figures 4 and 5 were taken from Pump 2 as it was tested at nominal fluid flow rates. Under MizAir control, the AODD pumps used significantly less compressed air when moving the liquid water medium. These results were mirrored in each of the other testing configurations.

The researchers also tested to see if the controller had an impact on liquid flow rates. Though the tests demonstrated that the fluid flow rates were reduced by an average of 2 percent when the MizAir controlled the AODD pump, the drop was considered negligible in contrast to the compressed air savings.

"The magnitude of that drop in [liquid] flow rate is small — it's really trivial," Dr. Goodman said. "You can make it up by either running the pump for 2 seconds longer, or you could make it up by increasing the pressure. Most of these pumps operate at 80 psi. We tested at 80 and 100 (psi). So, as you increase the pressure of the compressed air unit, you can improve the flow rates."

> "If you are interested in energy savings, then you have to know what the costs are of what you're running. To be accurate on the savings, you need a needle gauge and a hose right there where compressed air feeds the pump."
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> — Hank van Ormer, President of Air Power USA

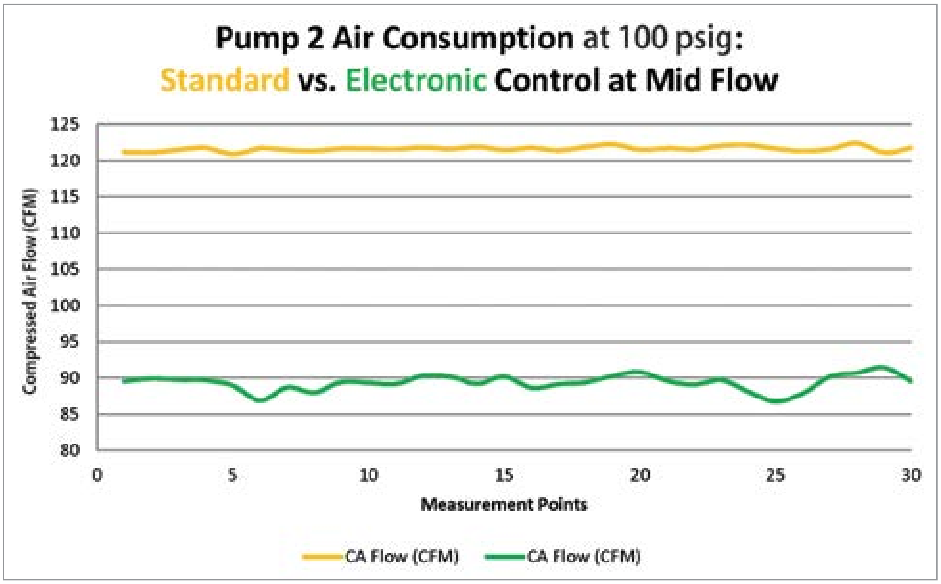

Figure 4: At nominal liquid flow, 100-psig compressed air consumption (cfm) was reduced dramatically with the use of electronic control.

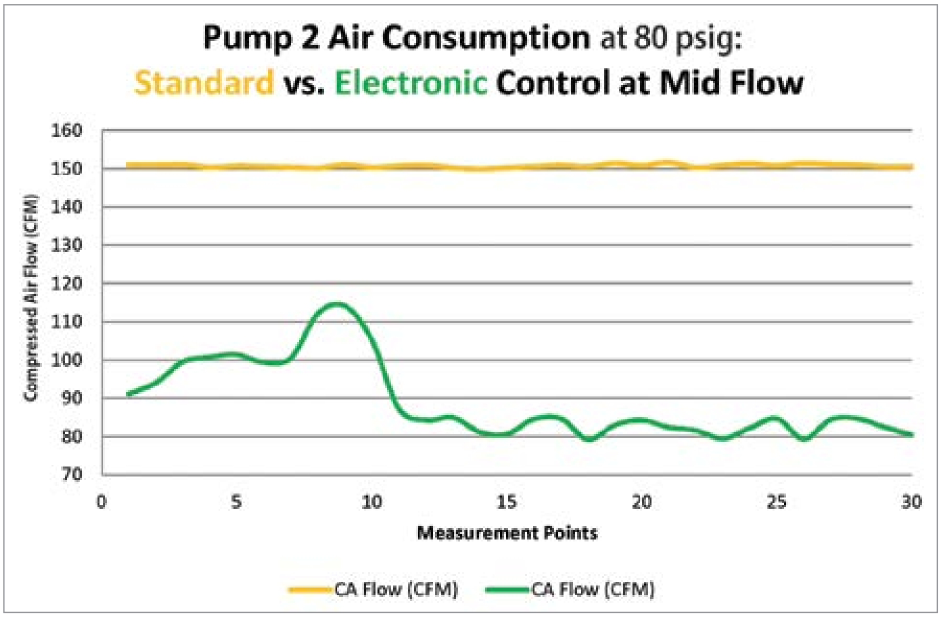

Figure 5: At nominal liquid flow, 80-psig compressed air consumption (cfm) was reduced dramatically with the use of electronic control.

For most applications, the potential benefit of dramatically reducing compressed air usage far outweighs the tiny drop in fluid flow rates.

"At any flow rate, the compressed air that you're going to use is going to drop by 30 to 60 cfm," Dr. Goodman explained. "In all three of the [fluid] flow rate conditions, your compressed air usage drops significantly. Your savings are going to be significant because of that. You did not have to sacrifice much on the flow rate of the liquid to get a huge reduction in the flow of compressed air."

Determining the ROI of Electronic Controls for AODD Pumps

As with most compressed air energy efficiency projects, moving forward comes down justifying the economics. In the field, Air Power USA has reduced the compressed air consumption of AODD pumps by as much as 40 percent with the MizAir controller. "The real problem is how you measure," van Ormer told us. "Most people don't have a lab."

"If you are interested in energy savings, then you have to know what the costs are of what you're running," van Ormer explained. "To be accurate on the savings, you need a needle gauge and a hose right there where compressed air feeds the pump, so you can see exactly what the pressure is. And then you have to count the cycles carefully."

The MizAir® has other benefits as well, including a decrease in noise and an extension of the life of the AODD pump. The results of the Indiana IAC study, along with real-world application of the MizAir in the field, all show the potential energy savings of retrofitting the controls of AODD pumps. BP

For more information about the Indiana Industrial Assessment Center, contact Dr. David Goodman, email: dwgoodma@iupui.edu. To learn more about MizAir, contact Larry Brown, email: lbrown@proportionair.com.

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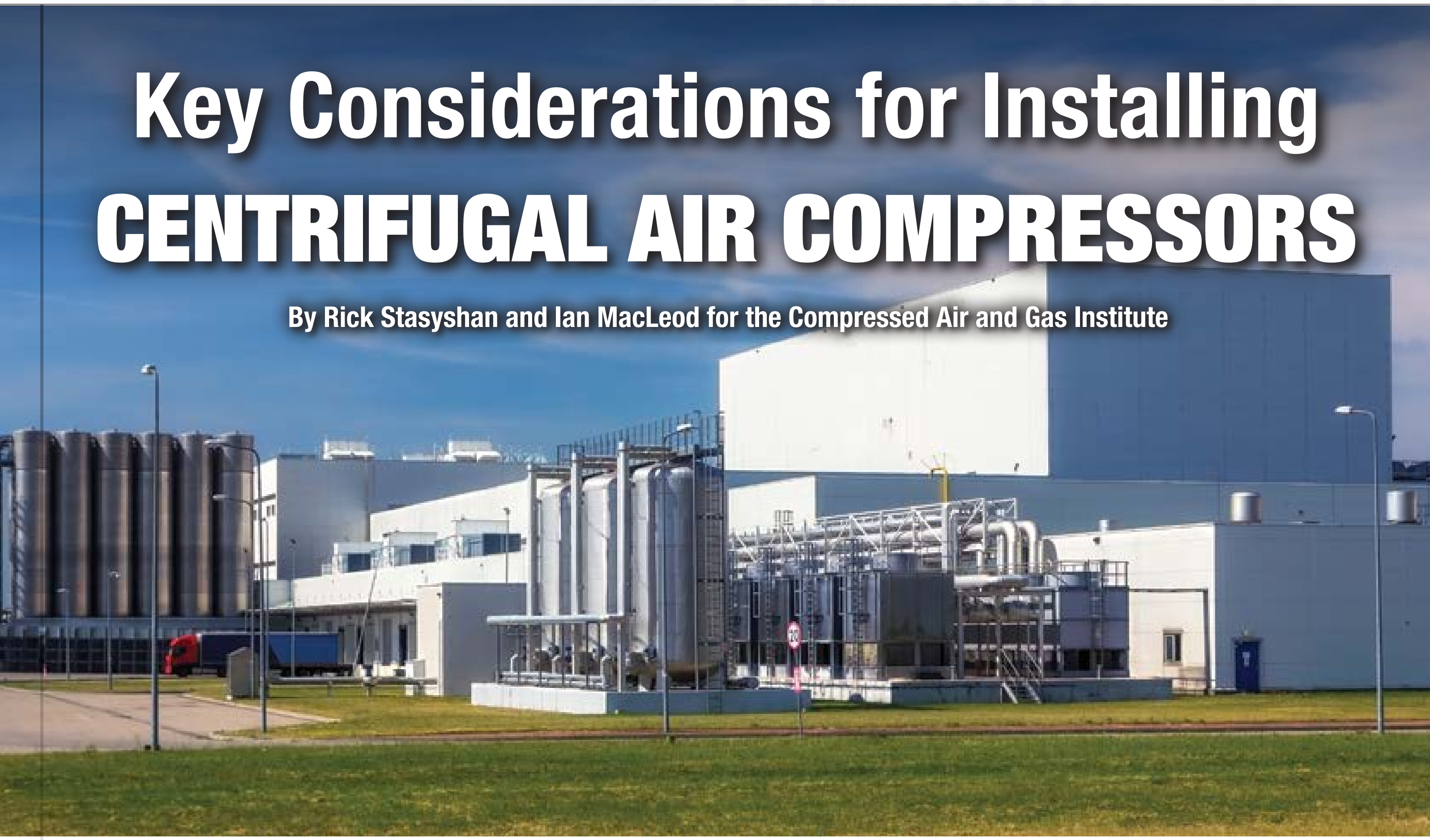

Key Considerations for Installing CENTRIFUGAL AIR COMPRESSORS

By Rick Stasyshan and Ian MacLeod for the Compressed Air and Gas Institute

Compressed Air Best Practices® Magazine and the Compressed Air and Gas Institute have been cooperating on educating readers on the design, features, and benefits of centrifugal compressor systems. As part of this series, Compressed Air Best Practices® (CABP) Magazine recently caught up with Rick Stasyshan, Compressed Air and Gas Institute's (CAGI) Technical Consultant, and Ian MacLeod of CAGI member company, Ingersoll Rand. During our discussion, we reviewed some of the things readers should consider when installing a centrifugal compressor system.

CABP: Having seen centrifugal compressors in several operations, I have to admit: many are quite impressive sites. Gentlemen, where is a good place to start when considering the installation of a centrifugal compressor system?

CAGI: The installation of any type of air compressor requires proper planning as well as adherence to the manufacturer's recommended guidelines. Centrifugal air compressors are no different in that care must be taken during the installation process to ensure reliable, safe operation, and ease of maintenance. The manufacturer should always be consulted for specifics concerning the location and the application of the system. Proper planning and prep work will ensure a safe and efficient installation for maximum return on investment.

Planning a Centrifugal Air Compressor Installation

CABP: What are some of the areas to be considered during this planning process?

CAGI: Before arrival of the new compressor, the end user or customer should convene a pre-installation meeting with the user site managers, site maintenance staff, the compressor manufacturer's technical representative(s), and the contractors responsible for installation. Most compressor manufacturers have an installation checklist that can be — and should be — reviewed during the meeting. The goals of the meeting should include:

1. Clearly define scope of work, roles and responsibilities.
2. Identify any ship loose items and accessories that may require installation.
3. Review the manufacturer's installation instructions.
4. Discuss site safety requirements, and address any questions or concerns.
5. Outline the timetable for completion.

CABP: From visiting plants with compressor systems, I know that the actual location of the equipment can impact system performance. What are your thoughts on this point — particularly concerning centrifugal compressor systems?

CAGI: You are spot on: choosing the right location is very important. While we would like to simply tuck the compressor in a corner and forget about it, the reality is proper location selection can assure the user of receiving maximum value from their system over its economic life. Obviously the location should be able to physically accommodate the compressor installation, but there are some other points to consider:

- Can the compressor be safely and efficiently maneuvered into place?
- Is there adequate room between other pieces of equipment?
- Are the required utilities (i.e. electricity and water) available nearby?

We recommend referring to the manufacturer's supplied drawings and rigging instructions prior to handling the compressor.

CABP: And what about future service and maintenance considerations?

CAGI: An excellent point. All compressors will require periodic inspection and maintenance. Adequate space needs to be provided for both routine maintenance and periodic overhauls. If permanent rigging is not in place, the location should allow for temporary rigging (such as forklift access) as required to perform maintenance.

Some of the components are heavy and awkward, and planning at the installation phase will ensure that compressors can be efficiently and safely serviced.

CABP: Do centrifugal compressors require "special foundations"?

CAGI: No they do not. However, while centrifugal compressors do not require special foundations, a level surface capable of supporting the weight is a must. The foundation should be free of any external sources of vibration created by nearby equipment. Many customers prefer to grout the compressor baseplate to ensure a level surface, although this is not always a requirement.

Major Considerations for Inlet Air

CABP: In past discussions with users, room temperatures have been discussed. How does ambient temperature impact centrifugal compressor operation?

CAGI: The ambient environment can adversely impact a compressor system's reliability, and centrifugal compressor systems are not an exception. We always suggest avoiding damp, dusty, or corrosive environments. If there is concern about a corrosive ambient, discuss options with the compressor sales engineer.

Solutions could include special filtration and/or alternative component materials of construction. A compressor sales engineer can also assist the user to ensure that adequate ventilation and ambient temperature in the room are controlled for optimum system performance.

CABP: I assume when you mention adequate ventilation, you are referring to inlet air. What are some of the considerations?

CAGI: Yes, once the location is determined and finalized, it is time to consider connection points. As mentioned, the quality of inlet air is important. Whether the inlet air source is within the compressor room or taken from outside, review the air quality to prevent potential problems. If air is coming from outside, look for warning signs, such as nearby cooling towers or exhaust vents. If the inlet air is taken from within the compressor room, confirm there is adequate make-up air coming into the room.

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KEY CONSIDERATIONS FOR INSTALLING CENTRIFUGAL AIR COMPRESSORS

Inlet piping should be nonferrous material and contain a spool piece near the compressor inlet to facilitate inspection and maintenance. The inlet pipe must be sized to minimize pressure drop. The inlet pipe should be properly supported and not rely on the compressor for support.

Loose material, such as welding slag, can damage the compressor if ingested, and the inlet pipe should be inspected prior to start-up to ensure cleanliness. Refer to Figure 1 to see an example of properly installed inlet piping.

Designing Ventilation for Centrifugal Air Compressors

CABP: In our discussions on the equipment, you had mentioned bypass piping as part of the scope of supplier equipment. Is now a good time to discuss this installation?

CAGI: Most centrifugal compressors have a shipped loose bypass silencer. The silencer can be installed indoors or outdoors. Typically the bypass line is vented outdoors. If vented outside, a rain hood and screen are needed to prevent water and small animals or birds from entering the line. In some cases, the bypass air can be hot. Therefore, proper consideration should be given to the outlet location (See Figure 2 for details).

CABP: Assuming the compressor is now installed, leveled, and we have inlet air, I guess it is time to connect to the plant's demand side. What are your thoughts?

CAGI: The discharge piping has to be rated according to the expected compressor pressure and temperature. Any elbows should be at least 3 pipe diameters downstream of the outlet and should be long radius type. In similar fashion to the inlet pipe, install a spool piece, and do not rely on the compressor for support. If a check valve was not supplied with

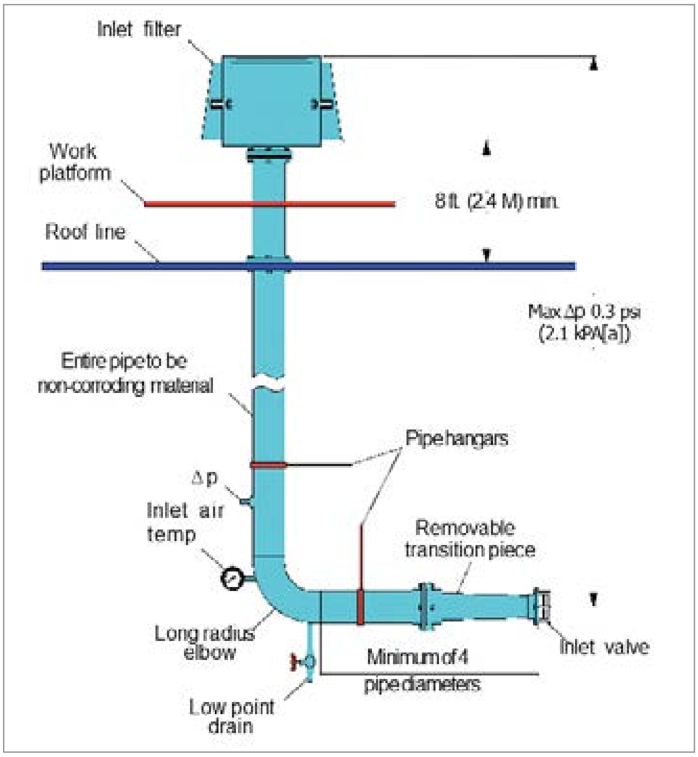

Figure 1: Properly installed inlet piping and inlet filtration are essential for optimal centrifugal operation.

the compressor, one should be installed in the discharge pipe. Make sure a properly sized safety relief valve is positioned before the required block valve (Refer to Figure 3 for more details).

CABP: Compressor performance depends on adequate cooling of the compressors. Can you share your thoughts on this subject?

CAGI: Water quality is equally as important as air quality. Consult with the compressor representative regarding water quality and quantity requirements. Installation of inlet and outlet pressure and temperature gauges is usually recommended. Throttle valves on the outlet will help

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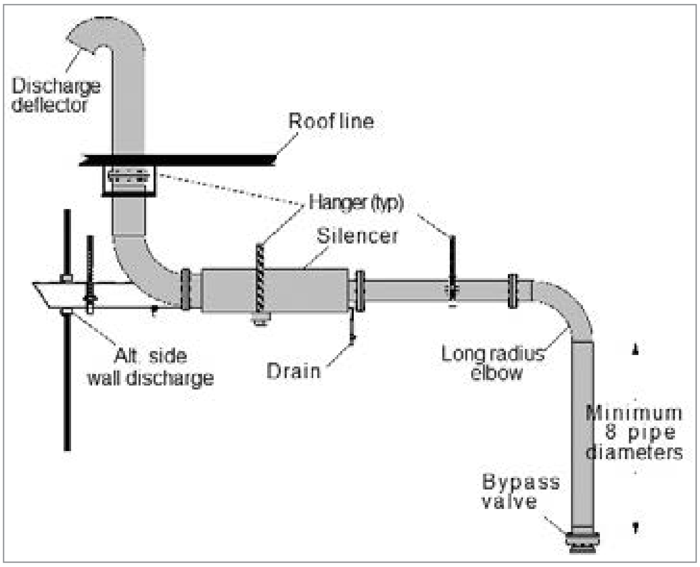

Figure 2: Bypass lines require special attention when routed outside, particularly when the bypass air is hot.

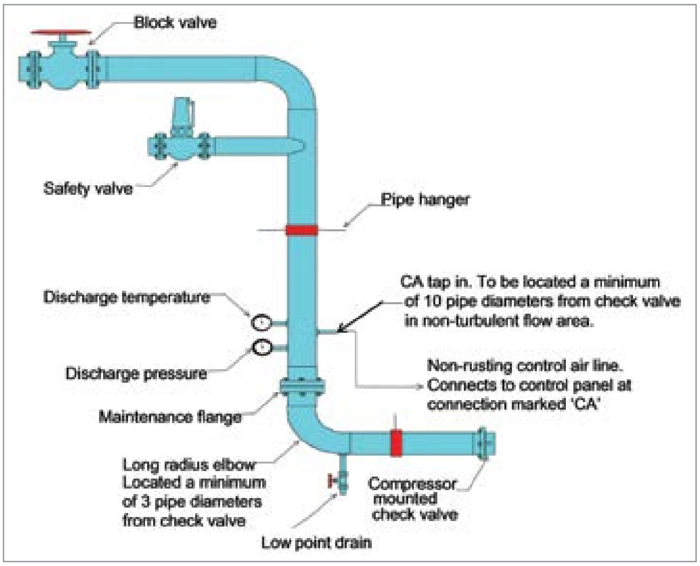

Figure 3: Be sure to install a properly sized safety valve before the block valve for centrifugal compressor discharge piping.

control water flow. A block valve on the inlet is needed to isolate the compressor for service.

As with any compressor, condensate is expelled from the unit. Condensate traps will either be shipped loose for field installation or factory mounted on the compressor. The condensed water should be piped to a drain location and designed to facilitate reliable operation. Local regulations concerning handling of condensate should be followed.

CABP: Please provide some commentary on the electrical hook-up.

CAGI: The design and installation of electrical systems should be performed by qualified personnel and must meet all applicable electrical codes. The majority of compressors require a single electrical input, but some require a separate source of control voltage. Review the electrical schematics to determine any additional control or wiring requirements.

Some compressors utilize an external source of instrument quality air for valves and seals. When applicable, follow all of a manufacturer's recommendations for instrument air.

CABP: Any closing thoughts?

CAGI: We have only highlighted the main aspects of installing a typical centrifugal compressor. We recommend users always thoroughly review and adhere to the manufacturer's instructions for a safe and successful installation.

CABP: Please tell our readers a little more about where to get information concerning centrifugal compressors and other information available from CAGI.

CAGI: CAGI's Centrifugal Compressor Section members include Atlas Copco, Cameron, FS Elliott and Ingersoll Rand. They each have trained engineers to assist and guide users through selecting the appropriately sized compressor for their operation. A compressor system assessment is recommended when upgrading and/or replacing existing systems to assure that system performance is maximized.

For more detailed information about CAGI, its members, compressed air applications, or answers to any of your compressed air questions, please contact the Compressed Air and Gas Institute. CAGI educational resources include e-learning coursework on the *SmartSite,* selection guides and videos, as well as the *Compressed Air & Gas Handbook.* BP

For more information, contact the Compressed Air & Gas Institute, tel: (216) 241-7333, email: cagi@cagi.org, or visit www.cagi.org.

To read more from ***CAGI,*** please visit www.airbestpractices.com/standards.

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Compressed Air Best Practices® is a technical magazine dedicated to discovering **Energy Savings** in compressed air systems — estimated by the U.S. Department of Energy to represent 30% of industrial energy use. Each edition outlines **Best Practice System Assessments** for industrial compressed air users — particularly those **managing energy costs in multi-factory companies.**

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– William Gerald, CEM, Chief Energy Engineer, CalPortland (feature article in August 2015 Issue)

"Compressed air is essential to any manufacturing process, particularly in the automotive industry, and it accounts for about 23 percent of total energy costs at our powertrain facility."

– Mike Clemmer, Director/Plant Manager-Paint & Plastics, Nissan North America (feature article in October 2015 Issue)

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– Michael Jones, Corporate Energy Team Leader, Intertape Polymer Group (feature article in July 2014 Issue)

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An Auditor's Notes on COMPRESSED AIR DRYER INSTALLATIONS

PART II

By Chris E. Beals, President, Air System Management, Inc.

➤ There is always something new to learn about compressed air systems – particularly in regards to compressed air dryer installations. As I discussed in Part 1 of this series, you can make compressed air dryer installations more reliable by understanding the consequences of any modifications you make to the system. As a continuation of those ideas, Part II explores more ways to make a dryer installation more reliable. Discussions include: the difference between operating a desiccant dryer in a fixed cycle opposed to demand mode, what happens when you operate a heated desiccant dryer with the cooling air turned off, and how to deal with the unintended consequences of dedicating a desiccant dryer to a compressor.

Operating a Heated Desiccant Dryer: Fixed Cycle vs. Demand Mode

When desiccant air dryers switch towers, dew point levels often rise (or spike) for short periods of time. This is often called a "pressure dew point spike." The smallest pressure dew point (PDP) spikes occur when the dryer is operating in the fixed mode. In addition, operating in the fixed mode allows multiple dryers to be synchronized so that the duration of the PDP spike isn't extended by the spikes occurring one after the other. However, operating in fixed mode doesn't save any energy. The higher PDP spikes that occur when the dryer is operating in demand mode can be reduced if the dryer is oversized and the dryer manufacturer provides a provision to extend the cooling air portion of the cycle.

One dryer manufacturer allows the cooling air to be turned on or off, and, when turned on, it can be extended from 90 minutes to 270 minutes. This dryer automatically turns off the cooling air when the PDP reaches -40˚F, so the dryer can switch towers. Therefore, the dryer must be oversized so that the cooling air portion of the cycle can extend for the full 270 minutes, allowing for the PDP spike to be reduced as much as possible. If all of the heated desiccant dryers in the plant were oversized so that the cooling cycle could extend for the full 270 minutes, the PDP spike would probably be small enough that there wouldn't be any need to synchronize the dryers. Oversizing the dryer also reduces the pressure drop across it.

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AN AUDITOR'S NOTES ON COMPRESSED AIR DRYER INSTALLATIONS — PART II

Operating with a Heated Desiccant Dryer's Cooling Air Turned Off

Cooling air is required to reduce the PDP and temperature spikes that occur when a heated desiccant dryer switches towers. Activated alumina's adsorption rate is reduced until its temperature is less than 120˚F, so a lower desiccant temperature in the offline tower produces a lower PDP and temperature spike at switchover. Because the temperature spike can travel a few hundred feet down the header, it's important to ensure that nothing will be damaged by it when the cooling air is turned off. For example, one medical equipment manufacturer shut off their heated desiccant dryer's cooling air, and their tubing products began melting.

In addition, the cooling air is important when the compressed air piping is exposed to low ambient temperatures. That said, not every plant contains items that can be damaged by temperature spikes. Nor does every plant have piping exposed to low ambient temperatures, so these plants can recapture compressor capacity by installing blower purge dryers and turning off the cooling air.

We have been shutting off the cooling air all year long on blower purge air dryers in chemical plants and refineries all along the Gulf Coast for years with great success. The cooling air can be turned off in northern states if the piping isn't exposed to winter ambient temperatures. If the piping is exposed, the cooling air can be turned off during the summer when the compressor capacity is reduced by summer temperatures, but those plants must remember to turn the cooling air back on when colder ambient temperatures return. Why a blower purge dryer? In our experience, the blower purge dryer offers the best mix of energy efficiency and reliability. Other dryers may be more efficient, but, in our experience, they aren't as reliable.

Effects of Compressor Cycle Time

Blindly dedicating dryers to compressors, as shown in Figure 1, can result in rapid cycling that can damage a compressor operating in load/unload mode, along with a desiccant dryer's desiccant. For example, to prevent damage to their compressors, most manufacturers want a minimum 90-second cycle time for rotary screw compressors and a 2-minute cycle time for centrifugal compressors operating in load/unload mode. Also, modulating lubricated rotary screw compressors should have a minimum 90-second cycle time between sump blowdowns. Anything shorter than these cycle times is known as short cycling. While short cycling can damage compressors that are loading and unloading, it can also pump the oil out of variable speed drive (VSD) lubricated rotary screw compressors.

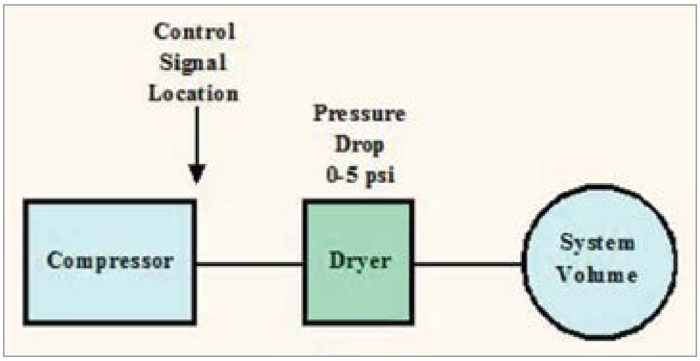

Figure 1: Rapid cycling can result from blindly dedicating dryers to compressors.

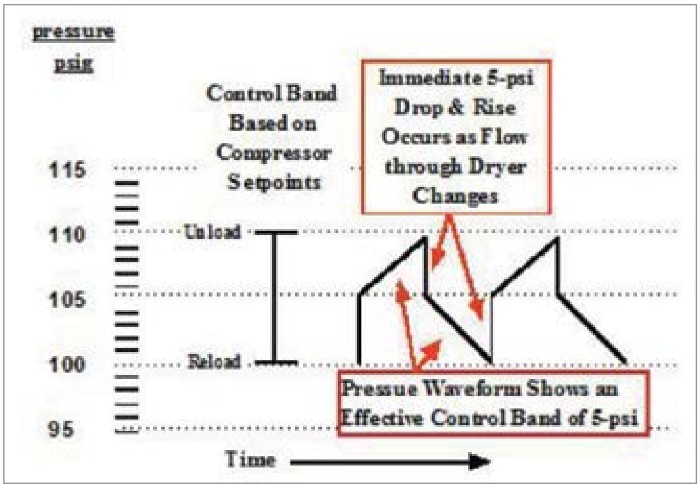

Figure 2: If a dedicated dryer has a 5-psi pressure drop across it when the compressor is fully loaded, it will have a 0-psi pressure drop when the compressor unloads.

Typically, almost all compressed air system designs assume a pressure variation of 10 psi, so the compressor's load/unload set points are often set 10 psi apart. However, that doesn't take into consideration the change in the pressure drop across a dedicated dryer. For example, Figure 2 shows that if a dedicated dryer has a 5-psi drop across it when the compressor is fully loaded, it will have a 0-psi drop across it when the compressor unloads. Therefore, the actual pressure variation is only 5 psi. Reducing the pressure variation reduces the effectiveness of the system volume and cuts the compressor cycle time in half, which most likely will result in the compressor short cycling. Options to address the short cycling include:

- Increasing the spread between the compressor's load/unload set points to compensate for the dryer's differential (i.e. 15 psi apart).
- Install storage between the compressor and the dryer, which maintains the flow through the dryer. However, installing storage upstream of some desiccant dryers may not prevent a compressor from short cycling or the pressure upstream of the dryer from dropping to zero, because the offline tower is often pressurized with wet air from upstream of the dryer.

- Move the compressor control sensing point downstream of the dryer — done carefully to avoid exceeding the compressor pressure rating. However, in the case of lubricated compressors, this option too often results in an air/oil separator high differential pressure alarm, which — if high enough — can shut down the compressor. Therefore, in the case of lubricated rotary screw compressors, it's best to install compressor automation if one intends to operate the compressor off the system pressure.

An additional issue exists if the dedicated dryer is a desiccant dryer with a bottom-to-top flow. In this case, when the compressor is controlled off the system pressure downstream of the dryer, the pressure between the compressor and its dedicated desiccant dryer's outlet check valves can drop to zero when the compressor unloads. Consequently, the loading and unloading of the compressor may bounce the desiccant by causing the desiccant beads to grind against one another, slowly breaking them down. Piping multiple compressors into one dryer, with a backup or at least tie-ins for a rental dryer, has proved to be more reliable.

Many plants have multiple compressor stations with only one compressor and dryer in each, so it's important to understand the issues associated with dedicating desiccant dryers to a single compressor. These plants could address this issue by installing storage between the compressor and desiccant dryer, but this means installing a receiver ahead of each dryer, which can be expensive. An alternative to installing storage is to install a bypass containing a check valve around the desiccant dryer that allows dry air to maintain the pressure upstream of the dryer, but doesn't allow wet air to bypass the dryer. If the checked bypass is installed, the check valve should be replaced when the desiccant is changed. With centrifugal compressors, we try to load share across all the operating compressors, which either eliminates the need to load and unload a compressor, or minimizes it.

Minimizing Purge Air on "Heatless" Dryers

The purge air flow rate required by a "heatless" dryer can be calculated using the following formula:

$$QP = (Q * 1.15) / PR$$

Where:

QP = Purge Air Flow Rate

Q = Dryer Inlet Flow Rate

PR = (P+14.7)/14.7

P = Dryer Inlet Pressure

For example, if the inlet pressure is 100 psi, then PR equals 7.803. If the dryer is rated for 1000 scfm, then the assumption is that the purge rate should equal 147 scfm. However, if the average inlet flow is only 800 scfm, then the purge flow rate can be reduced to 118 scfm. At an average inlet flow rate of 800 scfm, the 147 scfm purge rate will produce a PDP better than -40˚F, but if -40˚F is all that is required, why waste the air?

Simplistically, the purge air flow is being expanded in the offline tower so it's using acfm to regenerate the desiccant. That acfm needs to equal the dryer inlet flow (scfm). Because desiccant dryers use dry downstream air as purge air, the 15 percent in the above formula accounts for the pressure drop across the dryer, along with the pressure drop across the exhaust mufflers. Assuming a 10-psi drop across the dryer and a 4-psi drop across the exhaust mufflers, the air can only be expanded in offline tower from 90 psi to 5 psi, so the compression ratio is 6.85. Multiplying the 147 scfm purge air flow rate by the 6.85 compression ratio equals 1007 acfm, which is equivalent to the dryer's 1000 scfm rating.

Addressing Varying Flow Rates through Dryers

Reducing the dryer's purge rate works in a system where the flow through the dryer is relatively constant, but let's consider a system where the flow through the dryer varies. One system had multiple compressors upstream of two paralleled 6400 scfm "heatless" dryers. The manufacturer's recommended purge flow for each dryer is 882 scfm — for a total of 1764 scfm. The flow through each dryer was usually only 1500 scfm, but could be 4500 scfm for long periods. In order to not waste air, the plant was told to reduce each dryer's

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AN AUDITOR'S NOTES ON COMPRESSED AIR DRYER INSTALLATIONS — PART II

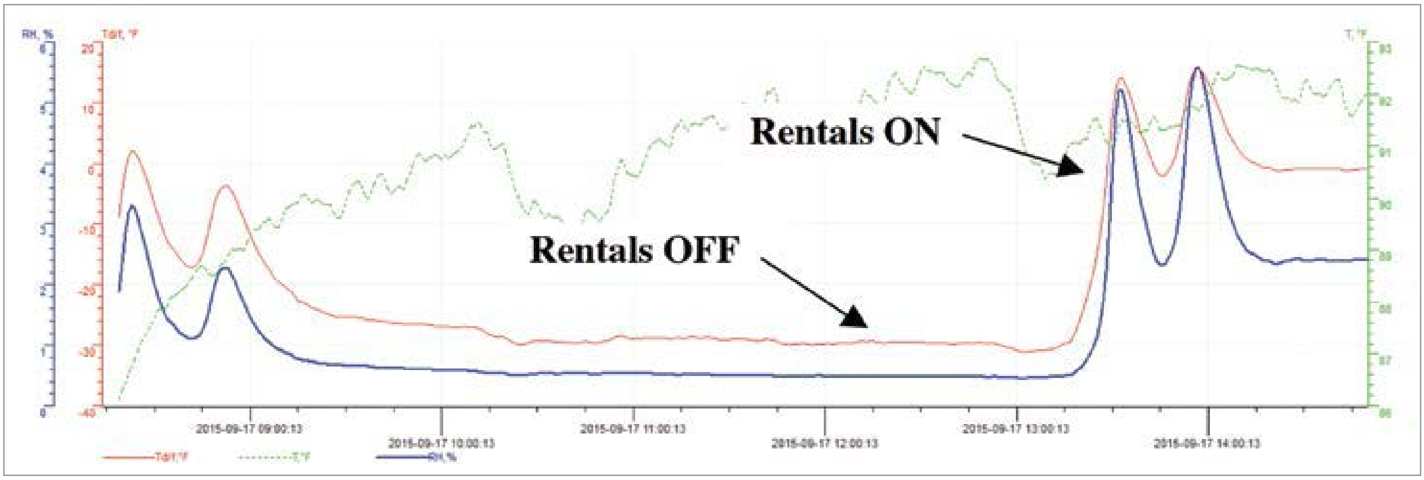


Figure 3: Differences in inlet temperature caused by rental compressors resulted in varying PDP and moisture in the plant.

purge flow to 525 scfm, which was based upon an inlet flow of 3500 scfm. The total purge flow for the two dryers was 1050 scfm. This meant that the plant had to increase the purge rate when the flow increased to 4500 scfm. When the flow through the dryers increased and the plant didn't change the purge flow rate, moisture was found in the plant during the winter. In addition, with both dryers online, the normal flow through each dryer was only equal to 23 percent of each dryer's rated capacity, which the dryer manufacturer says can create channeling through the desiccant. Channeling reduces or stops the flow across the capacitance probes, so the demand control didn't function properly, which also resulted in moisture occurring in the plant during the winter.

In order to simplify the operation of the dryers and improve the system reliability, it was recommended that the plant set the purge rate of both dryers at 882 scfm. One dryer would then operate in demand control, while the other dryer operates in standby, which means that it operates in demand control with its inlet valve closed. This approach reduced the total purge flow rate from 1050 scfm to 882 scfm, and increased the flow through the dryer. Operators rotate the dryers on a monthly basis by opening the inlet isolation valve on the standby dryer and then closing the inlet isolation valve on the dryer that was online for the past month. Dew point and pressure alarms were installed to inform the operators when they needed to put the second dryer online.

Rental Compressors and Heat of Compression (HOC) Dryers

In an example from a petrochemical plant, one of three centrifugal compressors failed, so this particular olefins plant rented two 1600 cfm "oil-free" diesel-engine drive portable compressors. The HOC dryers had preheaters that required a minimum of 220˚F inlet temperature. The compressor discharge temperature was 250˚F, but the dryer inlet temperature was 238˚F — even though the pipe between the compressor and the dryer was insulated. The dryer desiccant was recently changed, and the dryer was drying the air to a PDP between -25˚F and -30˚F when the rental compressors were shut off.

The rental compressors were connected to the header between the centrifugal compressors and the HOC dryers. When they operated, the dryer inlet temperature dropped to 180˚F, and the PDP of the air rose to +0˚F. The dryer inlet temperature was lower during the winter, so the PDP of the air was worse, causing moisture to occur in the system. When a compressed air audit determined the cause of the moisture, the rental compressors were connected to the wet air header downstream of a check valve so they couldn't cool the air going to the HOC dryers.

More Information From the Author

For help sizing compressors and piping, designing or auditing a compressed air system, sizing or calculating the size of a receiver, or just calculating the cost of operating a compressor, check out the "Compressed Air Toolkit" iPhone App at http://www.compressedairapps.com/. BP

For more information, contact Chris Beals, tel: 303-771-4839, email: cbeals@earthlink.net.

To read more about ***Compressed Air Treatment,*** please visit www.airbestpractices.com/technology/air-treatment.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

Kaeser's SmartPipe™ Now Available in 2" Diameter

Kaeser's versatile aluminum SmartPipe™ is now available in a 2" diameter. SmartPipe is a modular, aluminum compressed air distribution system featuring lightweight materials and simple connectors that can be installed without threading, welding, or sweating. Available in multiple sizes from 1/2 to 6 inches, SmartPipe is ideal for headers and branch lines all the way down to the point of use.

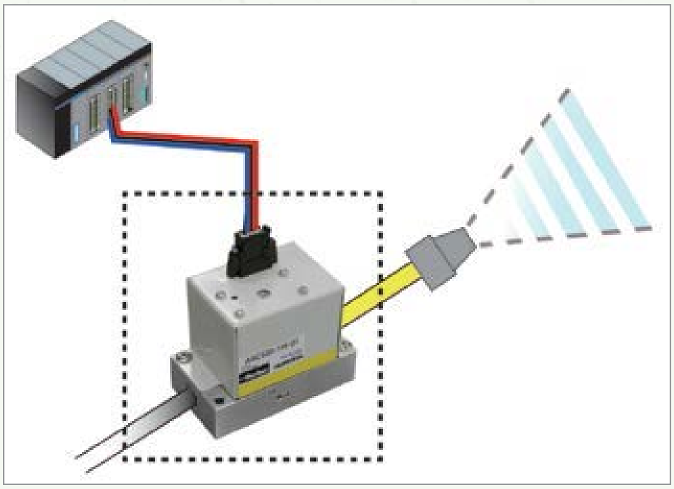
SmartPipe is made from smooth, calibrated aluminum and will not rust. It has a low coefficient of friction and provides the best possible laminar flow. Full bore fittings minimize pressure drop and leak-free connectors prevent costly compressed air loss. SmartPipe can be easily integrated into existing steel or copper systems and modified to accommodate changing needs. When installed by a Kaeser authorized service provider, SmartPipe comes with a 10-year warranty.

For more information, visit www.us.kaeser.com.

Kaeser's SmartPipe aluminum piping is available in a broad variety of diameters.

Parker Air Saver Cuts Compressed Air Costs in Blow-Off Applications

Parker Hannifin Corporation, a global leader in motion and control technologies, recently announced that its Pneumatic Division has introduced a product to the North American market that's designed to address emerging trends like Energy Savings/Sustainability. The new Air Saver Unit is suitable for use in both new and existing factory floor air nozzle and air guns applications that allow uncontrolled blow-offs.



The Parker Air Saver provides pulses of compressed air for blow-off applications, reducing the compressed air requirement.

Air audits Parker has conducted have revealed that the use of uncontrolled blow-offs is one of the top air consumption issues on factory floors. In a blow-off application, compressed air is directed through an air nozzle to provide a steady stream of air at a part for any of a number of reasons: to dry the part, to remove debris from the part, to blow it off a conveyor, etc. In these applications, it's common to discharge air continuously, even when no part is present.

The Parker Air Saver, which was introduced in Asia and Europe previously, already has documented success stories to its credit. The Air Saver generates a rapid pulse of air rather than a continuous flow, which offers two major benefits: It reduces compressed air costs by as much as 40 to 50 percent over typical constant flow applications; and it improves efficiency. Unlike a continuous stream of air, the pulsed air blow strikes the work repeatedly, improving the efficiency of the air blow for drying and removing debris.

The Air Saver is available in port sizes ranging from M5 (5 cfm flow) to 1.25-inch (530 cfm). Other features include adjustable pulse frequency and duty cycle, a silicon-free grease version for paint shop applications, and an on time/off time adjustment needle.

For more information, visit www.parker.com.

TECHNOLOGY PICKS

Festo Introduces Smart Service Unit with Automatic Standby

Festo recently introduced a first-of-its-kind intelligent service unit that automatically puts compressed air on standby when a machine stands idle, thus reducing energy consumption. These units also alert plant personnel to wasted energy when air leaks from a machine's pneumatic system. The new Festo MSE6-E2M, or E2M for short, can pay for itself in less than a year.

Based on user-defined parameters, the E2M module detects when a machine is idle and automatically shuts off compressed air — thereby saving energy. When the unit receives a startup signal from an operator, the E2M resupplies compressed air. In the case of a particularly complex production process, automatic standby detection can be deactivated in favor of manual operation.

Festo's new MSE6-E2M identifies when a machine is idle and automatically shuts off compressed air to save energy.

The E2M features a solenoid valve integrated with a pressure and a flow sensor in one compact package. A Profibus node provides communication between the E2M and a PLC. Festo plans to introduce Ethernet/IP and PROFINET communication options in 2016. The E2M flows up to 5000 liters of compressed air per minute, programs easily, and offers fast connection to Festo MS series air preparation units.

The E2M unit detects pressure drops below a predefined value and sends an alert about the leak. Higher-than-anticipated airflow during production also indicates a leak and triggers a user-defined alert. Eliminating leaks not only saves energy, it brings the compressed air system back to specification, which ensures quality operation of the machine, optimum throughput, and higher overall equipment effectiveness.

COMPRESSED AIR BEST PRACTICES

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Proportion-Air	29	www.mizair.com
ENMET	31	www.enmet.com
Globalcon	45	www.globalconevent.com

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

The E2M actively monitors the condition of the pneumatic system in real time. This feature gives plant operators access to up-to-the-minute energy- and process-related data as well as comparative data over time. Values for flow rate, air consumption, and pressure are available. Data can help personnel determine historical trends on consumption, the amount of air consumed per product batch, and pressure and flow at the time of a malfunction or bad batch of product.

Not only is this module suitable for new machines, but it also, thanks to the simple connections, offers an easy retrofit on older machines.

For more information, visit www.festo.com/us.

Sparks Dynamics Launches ReMaster Mobile Auditing System

Sparks Dynamics, a provider of intelligent solutions for industrial customers, is now offering its ReMaster Monitoring and Analytics System Technology as a mobile platform for auditing services.

Understanding current compressed air system operating parameters and justifying the Return on Investment for a compressed air system efficiency upgrade requires a comprehensive data acquisition and analysis tool. The ReMaster mobile system provides measurement of compressed air system data streams that are transmitted to cloud servers for analysis.

ViewMaster software allows for detailed system analysis and modeling of energy efficiency enhancements. Projected system enhancements reducing specific power or flow patterns can be inputted versus current operating profiles for detailed projected system energy savings.

Once the ReMaster mobile system is installed, system information can be accessed by authorized users anywhere in the world through authenticated sign-in information.

A ReMaster Mobile 30-day audit of a petroleum processing plant identified 1,000,000 kWh of potential savings annually in a compressed air system. Improper compressor control and sequencing led to a 400-hp centrifugal air compressor bypassing compressed air on a continuous basis. Base loading centrifugal compressors and trimming with a VSD compressor will produce $70,000 in energy savings per year and a simple payback of 1.5 years with a utility energy rebate.

For more information, visit www.sparksdynamics.com.

The ReMaster Mobile System for monitoring compressed air systems.

THE MARKETPLACE

JOBS

Job & Product Marketplace Advertising Information

Reach 13,000+ readers of Compressed Air Best Practices® Magazine with Marketplace Ads every month! Job Marketplace ads are also placed for one month on www.airbestpractices.com and promoted in our three monthly e-newsletters.

Ad dimensions are 2.36" wide x 3.91" tall. We can help you design the ads. Send us your logo, product photo, and text to anna@airbestpractices.com. We recommend 20-50 total words of text.

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Contact Rod Smith for ad rates: **rod@airbestpractices.com, Tel: 412-980-9901**

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THE MARKETPLACE

TECHNOLOGY

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