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Food Packaging


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FEATURES

COLUMNS

FROM THE EDITOR | Food Packaging

Quality, Safety and Reliability

We all know air compressors produce a lot of water. Lubrication fluids from lubricated air compressors will mix with this "condensate." Oil/Water Separators are needed to dispose of this condensate responsibly and industry numbers show not all systems are thus equipped. David Rosenthal, from SA Performance, provides us with an excellent article titled, "Lubricant Chemistry and Oil/Water Separator Performance."

Yesterday, a gentleman who manages compressed air systems for 10 plants told me, "If I don't provide reliable and consistent compressed air to production…someone else will!" Ensuring stable systems has been Tim Dugan's focus as he delivers his second straight article on air compressor control gap. Last month he focused on centrifugals and this month he delivers the article, "How to Avoid Control Gap with VFD Rotary Screw Air Compressors."

Productivity, Sustainability & Energy Conservation

Our own Mike Grennier delivers another outstanding feature story about a manufacturing plant delivering excellence in sustainability. I hope you enjoy his story about how the TE Connectivity manufacturing plant in Lickdale, Pennsylvania reduced compressed air energy costs by 11%, saving $223,000 annually. They are a U.S. Department of Energy Better Plants® Partner and they took full advantage of these resources including DOE's In-Plant Training Program and Energy Treasure Hunts.

Many food packaging plants use oil-free air compressors. These air compressors are ideal for the use of Heat of Compression dryers. Hank van Ormer returns to our pages with an excellent article about how to generate impressive energy savings with heat recovery projects.

Speaking of oil-free air compressors, Ron Marshall provides us with a detailed system assessment case study about a manufacturer of plastic packaging titled, "Winpack Reduces Demand by 33% and Switches to Oil-Free Air Compressors."

For all manufacturing and distributor personnel, we are thrilled to announce the following certification and formal training opportunities at the 2020 Best Practices Expo & Conference, located near Chicago's O'Hare International Airport. For more information and to register, please visit www.cabpexpo.com

- Compressed Air & Gas Institute Personnel Certification: Compressed Air System Specialist
- Compressed Air Challenge Level 1 Fundamentals of Compressed Air Systems
- Compressed Air Challenge Level 2 Advanced Management of Compressed Air Systems

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

ROD SMITH, *Editor*
tel: 412-980-9901,
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INDUSTRY NEWS

Atlas Copco Official Partner of Ford Performance Racing School

Atlas Copco Compressors is pleased to announce its partnership with the Ford Performance Racing School in Concord, North Carolina, as it becomes the official compressed air partner of the school. The partnership will see Atlas Copco providing the compressed air and dryer equipment needed for the school to function and ensuring it's optimized and in perfect working condition.

In July 2019, in a move made to accommodate its growing number of programs and driving enthusiasts, the Ford Performance Racing School expanded operations by relocating its pavement-based programs to Charlotte Motor Speedway in Concord, North Carolina.

The Charlotte Motor Speedway location offers a diverse array of facilities to support a variety of driving experiences, including a new infield road course, the oval itself and the zMAX Dragway with its unique four-vehicle-wide configuration, plus many buildings on-site. These amenities provide the Ford Performance Racing School with unmatched opportunity to conduct a wide variety of owner programs, as well as retail high-performance driving instruction. The East GT350 Track Attack and ST Octane Academy programs, as well as the paid 1-Day School and 2-Day School programs, are scheduled to be offered on the track in the spring of this year.

"All of us at the Ford Performance Racing School are proud to include Atlas Copco among the partners we work with to deliver the experiences of a lifetime to our guests," said Brian Smith, CEO at the Ford Performance Racing School. "This innovative, multinational company operates to the highest performance and ethical standards and delivers products that work behind the scenes to support the many experiential programs we offer."

The Ford Performance Racing School installed an Atlas Copco AR piston air compressor.

After looking at the needs of the school, Atlas Copco chose one of its tough, reliable AR piston compressors, along with auxiliary equipment, to ensure air quality. As part of the partnership, all students attending the school will receive details about the available Atlas Copco compressors, along with the opportunity to purchase products with a special discount code through the company store. Atlas Copco employees will also receive extra benefits if they sign up for a Ford Performance Racing School class.

"Ford is a tremendous global brand, and it's great to see the Ford Performance Racing School coming to Concord, North Carolina," said Paul Humphreys, vice president of communications at Atlas Copco Compressors. "We have had a relationship with the track and several race teams in that area for many years. When the opportunity to partner with Ford was presented, it was a quick decision. We are delighted they wanted to put their faith in the quality of our air, and we look forward to the partnership ahead."

About Atlas Copco Compressors

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

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INDUSTRY NEWS

Parker Releases White Paper on ISO 8573-1 Class 0

There are three ISO standards currently in use directly relating to compressed air quality (purity) and testing. The most commonly used air quality standard is the ISO8573 Series, consisting of nine separate parts. Part 1 relates to the quality classifications for compressed air by specifying the amount of contamination allowed in each cubic meter of compressed air. Parts 2-9 specify the methods of testing a compressed air system for one or more common contaminants.

ISO 8573-1 breaks compressed air contaminants in three major groups: Particulate, Water and Total Oil. Different levels of contamination (per cubic meter) are then assigned "Purity Classes."

Unfortunately, the ISO 8573-1 Class 0 classification is often misapplied to air compressors or treatment products (almost all oil-free compressors are sold under the banner of Class 0). It is often implied in marketing literature that:

- Class 0 means zero contamination in the compressed air
- Class 0 refers to oil contamination only
- A Class 0 compressor guarantees totally oil free compressed air

When referring to ISO8573-1 Class 0, it is important to remember:

- Class 0 does not mean zero contamination
- Class 0 does not mean oil-free compressed air
- A Class 0 compressor does not guarantee oil-free compressed air
- Class 0 does not solely refer to oil contamination
- A Class 0 specification must be 'cleaner' than the Class 1 specification for the contaminant chosen
- The contamination levels stated for a Class 0 specification must also be within the measurement capabilities of the test equipment and test methods shown in ISO 8573 Part 2-9
- The Class 0 specification must clearly state which contaminant the Class 0 claim refers to - i.e. "Solid Particulate," "Water" or "Total Oil (aerosol, liquid & vapor)"
- Class 0 requires the user or the equipment supplier to show a contamination level as part of a written specification

To learn more about ISO 8573-1, visit https://discover.parker.com/ISO to download the *Introduction to ISO 8573-1 White Paper* by Mark White, Compressed Air Treatment Applications Manager at Parker Hannifin. Within it, he explains common myths surrounding the ISO8753-1-Class 0 Standard, and what you need to know when specifying air purity.

About Parker Hannifin

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

ISO8573-1:2010 CLASS	Solid Particulate				Water		Oil
	Maximum number of particulates per m³			Mass Concentration mg/m³	Vapor Pressure Dewpoint	Liquid g/m³	Total Oil (aerosol liquid and vapor) mg/m³
	0.1 - 0.5 micron	0.5 - 1 micron	1 - 5 micron				
0	As specified by the equipment user or supplier and more stringent than Class 1						
1	≤ 20,000	≤ 400	≤ 10	–	≤ -70°C	–	0.01
2	≤ 400,000	≤ 6,000	≤ 100	–	≤ -40°C	–	0.1
3	–	≤ 90,000	≤ 1,000	–	≤ -20°C	–	1
4	–	–	≤ 10,000	–	≤ +3°C	–	5
5	–	–	≤ 100,000	–	≤ +7°C	–	–
6	–	–	–	≤ 5	≤ +10°C	–	–
7	–	–	–	5 - 10	–	≤ 0.5	–
8	–	–	–	–	–	0.5 - 5	–
9	–	–	–	–	–	5 - 10	–
X	–	–	–	> 10	–	> 10	> 10

Easy to use classification table for solid particulate, water and total oil.

INDUSTRY NEWS

EcoPlant and Atlas Machine Receive Grant from BIRD Energy Program

EcoPlant, a leading provider of industrial IoT solutions for optimization of compressed air systems, and Atlas Machine & Supply Inc. a 4th generation family business based in Kentucky, with over a century of experience in servicing industrial equipment, were funded by Israel – US Binational Industrial Research and Development (BIRD) Energy program to carry on a joint $1.9M project for improving compressed air quality and energy efficiency for Food & beverage plants. The BIRD Energy Program is funded by the US Department of Energy and Israel's Ministry of Energy together with the Israel Innovation Authority.

EcoPlant and Atlas Machine & Supply will jointly deploy a state of the art Industrial IoT technology in 5 selected Food & Beverage industrial sites. This revolutionary technology continually monitors and dynamically controls all types of compressed air systems regardless of brand, or technology type to optimize air quality and energy efficiency. The selected sites will be chosen during the 1st half of 2020 after reviewing more than 100 potential sites in the US.

"Our joint BIRD Energy project marks the first step of the partnership between EcoPlant and Atlas Machine & Supply," said Aviran Yaacov EcoPlant's CEO. "EcoPlant is now expanding into the US market and I see the combination of EcoPlant's novel Industrial IoT technology with Atlas Machine's compressed air expertise and market leadership as an opportunity to bring EcoPlant's patent-protected, cutting edge IoT/AI technology to the US industrial compressed air market, to dramatically improve reliability and energy efficiency."

"We are beyond excited to work with EcoPlant to bring this novel solution to the US market. The amount of wasted energy in compressed air systems presents a unique opportunity for manufacturers to improve profitability while simultaneously reducing their carbon footprints. The common sense of this solution is what first drew our interest to partnering with EcoPlant, the value proposition is so strong relative to the cost of the product – we will see this technology become a standard part of plant operations in the coming years." said Richie Gimmel, President of Atlas Machine & Supply Inc.

About EcoPlant

EcoPlant has developed a novel Industrial IoT solution to optimize critical equipment such as air compressors, chillers, and pumps, which accounts for almost 60% of an average planet's energy expenditure. EcoPlant's solution connects to air compressors' controllers and pipeline sensors to continuously monitor, control, and optimize the entire system. Using predictive AI algorithms, EcoPlant conducts ongoing energy surveys and dynamically controls each compressor, as well as the entire system to enables significant improvement in system reliability, energy waste reduction, and maintenance optimization. This enables continuous savings of hundreds of thousands of dollars annually. For more information, visit www.ecoplant.co.

About Atlas Machine

Atlas Machine is a 4th-generation family-owned and operated business based in Kentucky, with 8 locations across the Midwest. Atlas is the authorized distributor for Sullair compressors in Kentucky, Indiana, Ohio, and Tennessee. Atlas has decades of experience in compressed air system design, optimization, controls, and maintenance. For more information, visit www.atlasmachine.com.

About the BIRD Foundation

The BIRD (Binational Industrial Research and Development) Foundation works to encourage and facilitate cooperation between U.S. and Israeli companies in a wide range of technology sectors and offers funding to selected projects. The BIRD Foundation supports projects without receiving any equity or intellectual property rights in the participating companies or in the projects, themselves. BIRD funding is repaid as royalties from sales of products that were commercialized as a result of BIRD support. The Foundation provides funding of up to 50% of a project's budget, beginning with R&D and ending with the initial stages of sales and marketing. The Foundation shares the risk and does not require repayment if the project fails to reach the sales stage. For more information, visit www.birdf.com.

INDUSTRY NEWS

AICD Offers Online Training and Discounts

It is the goal of the AICD (Association of Independent Compressor Distributors) to partner with members to create stronger and more knowledgeable service departments. In an industry where product training is easy to access, the necessary fundamentals of service are not as easy. Through the creation of the AICD online training program, members have access to affordable fundamental training without having to send their technicians away for extended periods of time.

Active members may access the exclusive AICD Online Service Training through the member portal. This training was developed by leaders in the compressed air industry, rooted in many years of industry experience. Some of the courses offered include, but are not limited to:

- 101 Reading Blueprints
- 102 Reading Schematics and Symbols
- 104 Making Measurements
- 107 Hand Tools
- 108 Portable Power Tools
- 109 Industrial Safety and Health
- 110 Troubleshooting Skills
- 301 Basic Mechanics
- 302 Lubricants and Lubrication
- 318 Industrial Rigging Principles and Practices

Continuing to find ways to provide the members of the AICD with tools to be successful, the AICD has partnered with many equipment manufactures to offer additional discounts on products and services. Many of the products offered through our Member Discount Program are items that are already typically being ordered on a daily basis. As a member of the AICD, these special discounts are available to you. The savings add up and ultimately increase your bottom dollar making this program well worth the enrollment and continued membership into the AICD.

Some of the channel partners participating in the Member Discount Program offer equipment ranging from receiver tanks and compressor lubricants to services ranging from fleet vehicle management to emergency compressor rental discounts.

About AICD

In an everchanging market, the AICD exists to bring independent air compressor distributors together to share market strategies, market trends, and industry insights. These non-branded conversations foster an atmosphere of success among colleagues, rooted in the foundation of unlimited years of expertise. In addition to the great networking opportunities, the AICD provides exposure to equipment manufacturers ready to partner with independent distributors, allowing for portfolio growth. This exposure to both independent distributors and equipment manufacturers, educates AICD members in new technologies and industry best practices and encourages member growth and success. To find out more, please go to www.aicd.org.


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TE CONNECTIVITY'S FOCUS ON ROI DRIVES Sustainability Success and Compressed Air Savings

By Mike Grennier, Compressed Air Best Practices® Magazine

The TE Connectivity manufacturing plant in Lickdale, Pennsylvania, reduced compressed air energy costs by 11%, saving $223,000 annually, thanks to a focused effort to improve compressed air efficiencies.

There are numerous reasons companies commit to sustainability. For TE Connectivity, it often boils down to the return on the investment made – both financially and otherwise. And by every measure the investment is paying off for the global leader in connectivity and sensor products.

Since its fiscal year 2010, TE Connectivity has reduced its overall energy use intensity by 30%. In addition, greenhouse gas emissions have declined by 38% in the same time period. Efforts to save water and reduce scrap have yielded equally significant results. In 2019, TE Connectivity (https://te.com/usa-en/home.html) was named to the Dow Jones Sustainability Index for the eighth consecutive year, showcasing its long-term economic, social and environmental impact on the world.

"Our employees, investors, and customers all want our company to operate in a way that is of course profitable, and sustainable as well," said Carl Schultz, Senior Director, TE Connectivity Global Environmental Health & Safety Program. "When it comes to energy reductions and greenhouse gas emissions, it has to have a return on two critical fronts. One is reducing our costs and the second is a reduction in environmental impact. That's really what we focus on."

The company is succeeding with sustainability at many operations, including its manufacturing plant in Lickdale, Pennsylvania. In fall 2019, officials from the Department of Energy's Better Plants program joined company officials there to celebrate the plant's energy achievements – including an 11% reduction in compressed air energy costs. Its ability to reduce the cost of compressed air to the tune of $223,000 per year is a prime example how many TE Connectivity operations have fully embraced sustainability.

Knowing the Cost of Compressed Air

In Lickdale, TE Connectivity operates a 250,000-square-foot plant where approximately 500 employees make electronic connectors and contacts for a wide range of applications. TE Connectivity is a Department of Energy (DOE) Better Plants Challenge Partner.

The plant relies on compressed air for the majority of its production processes, including plastics molding, electroplating metal stamping and assembly. Like many manufacturing plants, there was a time when Lickdale and other TE Connectivity plants never thought about compressed air energy consumption and costs, said Schultz.

"Everybody used to think compressed air is free," he said. "But I think we've made some great strides in helping people understand that's not the case."

The Lickdale plant began formally investigating compressed air energy consumption and costs in 2009. Jeff Overbey from TE Connectivity's facilities organization then worked with the plant to review infrastructure and then brought in Ingersoll Rand to perform a compressed air assessment. The assessment illustrated numerous opportunities for efficiencies and energy savings.

"We didn't know what to expect. The compressed air study really opened our eyes as to how we could optimize our compressed air system," said Tony Burkett, Maintenance Manager of the TE Connectivity Lickdale plant.

Based on the compressed air assessment, the plant dedicated itself to a multi-year journey to address multiple issues with its compressed air system, while saving energy in the process.

Do What-it-Takes Mindset to Save Energy

The Lickdale plant's commitment to improving its compressed system aligns with TE Connectivity's approach to sustainability, which is predicated on a "do-what-it-takes" mindset and employee engagement. For more about TE Connectivity's commitment to sustainability, visit https://te.com/usa-en/about-te/corporate-responsibility.html.

"With anything we do as a company of this size and complexity, engagement of everyone is absolutely key," said Schultz, noting how sustainability is embedded in the company's culture. "You can declare anything and hold a bunch of meetings, but where you really start to have success is when sustainability becomes part of people's way of thinking."

TE Connectivity's way of thinking includes "Centers of Excellence," which are areas of focus within the company where teams come together to identify areas of improvement and

TE CONNECTIVITY'S FOCUS ON ROI DRIVES SUSTAINABILITY SUCCESS AND COMPRESSED AIR SAVINGS

put words into action. Energy is one such Center of Excellence.

"We created a Center of Excellence for energy because everyone uses energy and we can share best practices and promote good work," Schultz said.

Taking it another step further, TE Connectivity also focuses on Ready-To-Deploy (RTD) projects. An RTD project is a refined approach to harnessing best practices that TE Connectivity operations have implemented with success.

"With the RTD concept, we say, 'Look, let's not just throw everything up there that people have done that is kind of good. Instead, let's find things that are broadly applicable and focus on a limited number of them so that operations leadership can look at them and see what to deploy at their plants, and then do it,'" Schultz said.

Energy Treasure Hunts: A Way of Life

The DOE's Energy Treasure Hunt program is one such RTD project adopted by the Lickdale plant and others throughout TE Connectivity. The DOE brought the treasure hunt approach to TE Connectivity through DOE's In-Plant Training program. The program workshops are led by Better Plants experts who train participants on how to identify, implement, and replicate energy-saving projects. To learn more about the Better Plants program one can read the March feature article, in Compressed Air Best Practices® Magazine, "Better Plants® Partners Get a Leg up in the Battle for Energy and Water Efficiency."

The Lickdale plant discovered the value of energy treasure hunts when the DOE conducted the Treasure Hunt In-Plant training at TE Connectivity's manufacturing operation in Greensboro, North Carolina. TE Connectivity invited people from its other plants to participate and learn so they could take it back to their own facilities. The concept was just what the Lickdale plant had in mind as one way to save on compressed air energy consumption, said Burkett.

"After we learned about energy hunts at the Greensboro plant, we brought it back to Lickdale and figured out a way to roll it out," he said. "It was the next step in our evolution of compressed air efficiencies and it kept us energized and moving forward."

At the Lickdale plant, cross-functional teams work for a two-week period each year to identify and develop plans for implementing no- and low-cost energy savings opportunities that result in immediate or short-term ROI. They also help established ongoing processes for implementing energy control measures designed to reduce energy use, costs and associated greenhouse gas emissions.

Energy treasure hunts at Lickdale and other plants support TE Connectivity's goal of leveraging the expertise of employees with the knowledge and skillsets to produce results, said Schultz.

"After the DOE brought treasure hunts to us, we developed a playbook and a lot of fairly easy-to-use materials everybody can use to put into practice," he said. "Now we have people around the company who have expertise in this area. It's something we can train people on, give them the resources, and let them run with it. It's really caught on, and the Lickdale plant has been a pioneer for TE Connectivity and key to proliferating the approach around the company."

Burkett said seeing the results of treasure hunts conducted at the Lickdale plant delivers a powerful punch.

"They make you a believer," he said. "Before, people would walk through the plant, hear a sound and say, 'Yeah, it's an air leak.' But now, they literally put work orders in and say, 'We need to fix that. Do you know how much money we're wasting there?' It's become a way of life."

Compressed Air System in Need of Attention

In addition to finding and fixing leaks, the Lickdale plant's journey toward compressed air energy savings involved a number of projects designed to address multiple issues with its compressed air system.

The plant's original compressed air system included two compressor rooms, each of which contained four 200-horsepower (hp), fixed-speed rotary screw air compressors and refrigerated dryers. Each set of air compressors shared a small receiver tank and ran at full load essentially non-stop to deliver compressed air to plant operations, most of which run on a continuous basis.

The compressed air assessment revealed the system was working more than needed to generate unnecessarily high pressure of 110 psig to meet artificial demand for air. On occasion, the plant also rented additional air compressors to keep pace with intermittent compressed air demands. Rental machines also gave the plant the ability to take any aging air compressor offline for repairs, while stilling meeting demand for air. Aging air compressors were also consuming too much time and effort to ensure reliability.

"We had our facilities maintenance group come in during the weekends to perform preventive maintenance when demand for air was lower because we simply could not afford to lose one air compressor," Burkett said.

Upgrading the Compressed Air Supply Side

With a roadmap for improvements in place, the plant made a number of important changes and upgrades to the supply side of the compressed air system to increase system reliability and achieve energy savings.

TE CONNECTIVITY'S FOCUS ON ROI DRIVES SUSTAINABILITY SUCCESS AND COMPRESSED AIR SAVINGS

Shown is a 200-hp, VFD oil-free rotary screw air compressor at the Lickdale plant, which implemented numerous changes to its compressed air system for improved reliability and energy savings.

The Lickdale plant installed solenoid valves on machines in its stamping operation to conserve expensive compressed air.

The plant replaced two aging air compressors with two fixed-speed, 350-hp rotary screw air compressors. It also replaced a fixed-speed air compressor nearing its end of life with a 200-hp Variable Frequency Drive (VFD) oil-free rotary screw air compressor. As a trim machine, the VFD air compressor generates additional compressed air when the plant's fixed-speed baseload units approach their maximum capacity. Currently, the plant normally only operates the three newer air compressors, while two of the plant's original air compressors serve as backup units.

To help stabilize pressure and reduce overall system pressure, the plant also replaced the small receiver tank with two receiver tanks, each of which is rated to store and deliver 1,100 scfm of compressed air. The VFD air compressor, in combination with the new receiver tanks, allows the system to better match supply to peak air demands.

Another key upgrade included the installation of a Programmable Logic Controller, allowing for lead-lag operation of the air compressors. It also installed a pressure flow controller to gain control of compressed air production in combination with air already in storage. Today, the system is better able to meet fluctuating demand for compressed air. Additionally, changes resulted in gradual reduction in system pressure from 110 psig to 88 psig without adversely affecting production.

Fixing the Compressed Air Demand Side

The Lickdale plant gave the same level of attention to the demand side of its compressed air system as it did the supply side to improve system efficiencies and achieve energy savings.

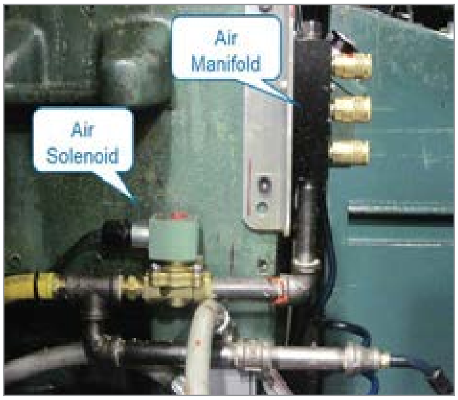
One measure included the installation of solenoid valves on stamping machines, which conserves expensive compressed air by blowing air onto stamped parts in pulses only where it's needed – and not otherwise – when blowing off lubricant and debris.

Engineers also designed air nozzles and installed them in place of open tubes that were used to remove residual liquid from the metal strip as it goes through multiple baths in the plating process. The plant also eliminated unneeded open blowing applications, further reducing air demand.

Another significant change to the compressed air system included the installation of additional piping to better balance airflow. The plant also installed valves on piping to control the airflow to non-operational areas of the facility.

In keeping with the energy treasure hunt approach, the Lickdale plant has also implemented a rigorous leak detection and repair program. It also uses flow meters on assembly equipment to monitor compressed air consumption and detect leaks needing repair.

The Lickdale plant's upgrades to the demand and supply side of the compressed air system allowed it to meet production needs with considerably less energy needed for compressed air.



Shown is a solenoid valve in the plant's stamping operation, which is one of many used to ensure compressed air is used only when needed.

Achieving Results that Matter

By adopting best practices in managing compressed air and implementing other energy-efficient improvements plant-wide, the Lickdale plant saves nearly 10 million British Thermal Units (BTUs) per year.

In addition to energy and cost savings associated with compressed air, the plant has reduced compressed air system maintenance costs and eliminated the need for rental machines – all while boosting reliability of the system to ensure peak production at all times.

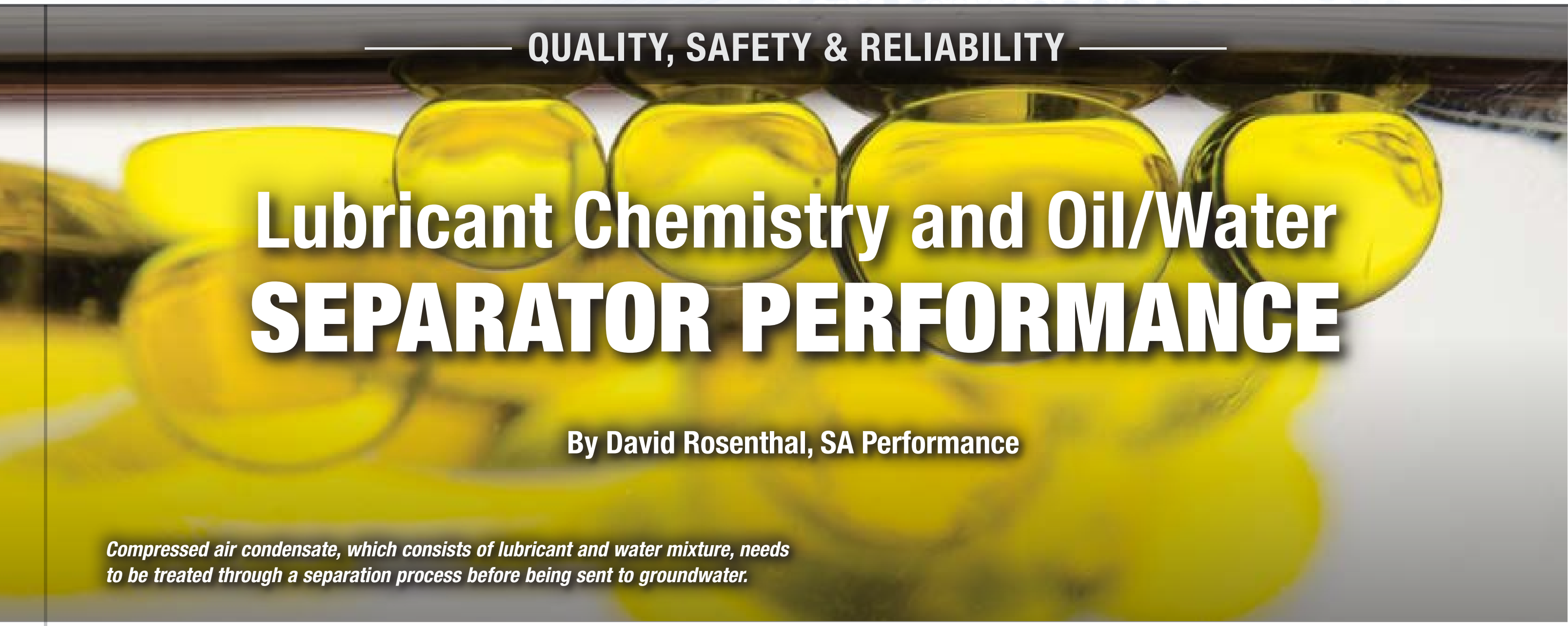
According to Schultz, success with compressed air energy savings at the Lickdale plant is an example of how TE Connectivity's approach to sustainability produces results virtually everyone involved can appreciate.

"We've really engaged people in a way that appeals to those who want to make the earth a better place by reducing greenhouse gases and that also appeals to those who want to maximize profits," he said. "Whichever one of those things people care about, we capture all of the folks by making them aware of the advantages to reducing compressed air usage." BP

All photos courtesy of TE Connectivity.

To read more ***Sustainability Project*** Articles, please visit https://airbestpractices.com/sustainability-projects.

QUALITY, SAFETY & RELIABILITY



Lubricant Chemistry and Oil/Water SEPARATOR PERFORMANCE

By David Rosenthal, SA Performance

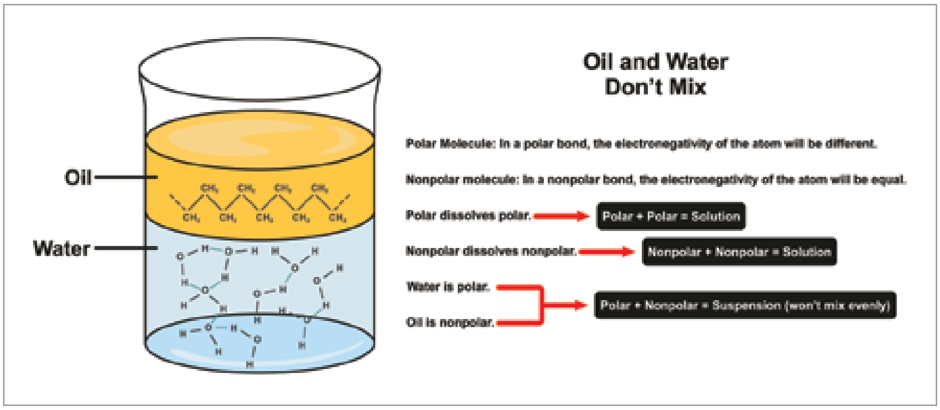
Compressed air condensate, which consists of lubricant and water mixture, needs to be treated through a separation process before being sent to groundwater.

Air compressors can produce a lot of water. Humidity in ambient air, once compressed, results in much of this water falling out, which we know as condensate. On a warm and humid summer day with inlet air temperatures of 80 ˚F, a 75-horsepower (hp) air compressor running fully loaded can produce over 25 gallons of condensate in just one eight-hour shift, with another five gallons being produced once the compressed air is sent through a dryer. The compression process allows for the air, water vapor, and lubricating fluids to mix. Once the condensate leaves the system, trace amounts of lubricant travel with it. This condensate should be processed through an oil-water separator before being discharged to groundwater or wastewater treatment plants.

A wide variety of lubricants including synthetic hydrocarbons, Polyalphaolefins (POAs), Polyolesters (POEs), diesters, polyalkylene glycols (PAGs) and silicones paired with different styles of oil/water separators lead to an often overlooked aspect of the effectiveness a separation system will have in removing lubricant from the condensate water – one type does not necessarily fit all. Here's what to know about lubricants and oil/water separators to keep your compressed air system up and running – and operating efficiently.

Phases of Water in an Air Compressor Oil System

Water can be exhibited in three phases within the oil system. When water encounters a lubricant, the chemistry of the lubricant dictates the amount of water that can be naturally dissolved, known as the saturation point. Beyond this saturation point, water may



The polarity of lubricant and water molecules explains why oil and water don't mix.

> "Some synthetic lubricants, including polyglycols and diesters are also moderately polar, and when mixed with water, create a steady emulsion that does not easily separate."
>
> — David Rosenthal, SA Performance

then emulsify within the fluid, in which the water and lubricant remain mixed together. This is especially prevalent while the system is running, and the fluids are circulating. Finally, after no more water can be held within the emulsified state, free-water is formed.

There is a strong dependence of temperature on degree of solubility between a lubricant and water. Lubricant at operating temperature can hold more water than lubricant at ambient temperature when a compressor is off or on standby. With moisture in the air being ingested into the air compressor, the hotter the lubricant gets, the greater the amount of water that can be held by the lubricant.

Water content held in suspension by the lubricant is commonly measured on most air compressor fluid's oil analysis reports. The Karl Fisher titration test method can determine the amount of water in the lubricant, with the water content being reporting in parts per million. The resulting value on the oil analysis report shows the total water content in the sample, not specifically whether the water is dissolved in the lubricant or is free-water.

Polarity of Water and Lubricant Molecules

All water molecules are polar, meaning the hydrogen ends of its molecular structure have a positive charge, while the oxygen end has a negative charge. The positive charge of the hydrogen atoms is attached to the oxygen atoms of adjacent molecules, allowing water molecules to be attracted to one another. This attraction causes water to coalesce and drop out of lubricants as free-water.

Many lubricants though are non-polar, with both ends of their molecular structure not exhibiting any electrical charge. When oil and water are combined, an emulsion mixture is formed for a short period of time. Shortly after settling, water molecules are more strongly attracted to one another than they are to the non-polar lubricant, which is an additional force to cause separation.

Some synthetic lubricants, including polyglycols and diesters are also moderately polar, and when mixed with water, create a steady emulsion that does not easily separate. Common air compressor lubricants, such PAGs, can hold as much as 7,000 parts per million (ppm) of water, while standard synthetic hydrocarbon oils may hold no more than a few hundred ppm. To avoid water accumulation in an air compressor, the system should be run hot enough to allow excess water that has become emulsified with the lubricant to evaporate. Free-water, also known as condensate, is then sent through a drain trap and into an oil/water separator.

Determining Whether Fluids Will Separate

Two American Society of Testing and Materials (ASTM) test standards can be used in determining whether an air compressor lubricant will readily separate from water, both of which are commonly found on lubricant technical data sheets.

- ASTM D4052 is the standard test method for density of a lubricant. With the density of water being $1.00 g/cm^3$, an air compressor lubricant's stated density can be compared to water in determining their affinity for one another. For reference, a PAG's density is commonly seen at about a $0.99 g/cm^3$ and has a strong tendency to maintain emulsion with water, while a PAO's density of about a $0.84 g/cm^3$ readily separates from water within minutes.

LUBRICANT CHEMISTRY AND OIL/WATER SEPARATOR PERFORMANCE

Without proper removal of lubricant from compressed air condensate, groundwater can become contaminated, impacting local plant life and the surrounding ecological areas.

Oil/water separators help lower the amount of lubricant in compressed air to acceptable levels before condensate water is discharged.

- ASTM D1401 is the standard test method for water separability of hydrocarbon lubricants and synthetic fluids. This test includes 40 milliliter (ml) of water and 40 ml of a given lubricant. This mixture is agitated and allowed to settle for up to thirty minutes for separation. After the time has elapsed, a measurement is taken to determine the resulting milliliters of water, lubricant and emulsified mixture (presented as water ml/lubricant ml/mixture ml). This specification provides insight as to whether the lubricant can be expected to readily separate from water or not.

The Push for Better Oil Water Separation

The 1970 Clean Water Act states that local municipalities and their legislatures develop initiatives for the proper disposal of wastewater generated by manufacturing facilities. Fast forwarding to 2020, it is now generally accepted that air compressor condensate be treated to remove trace amounts of lubricant before the condensate water is sent down a groundwater system or to a municipal wastewater treatment plant.

Regulations for condensate water going to a municipal wastewater treatment plant vary somewhat by locality. The concentration levels allowed by municipalities can range from 10 ppm to 100 ppm of residual oil in the discharged water. A common misconception is that this residual oil limit is measured at each system across a facility independently (i.e., the condensate leaving the air compressor). Rather, the regulation is normally for the entire waste stream from the plant. Since the air compressor is commonly a small component of the entire wastewater flow, the level from the air compressor might be substantially higher than the local limit, without causing the total wastewater stream from the plant to be close to the local limit.

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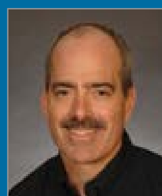

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LUBRICANT CHEMISTRY AND OIL/WATER SEPARATOR PERFORMANCE

The level of lubricant in the condensate will vary from day to day. For example, on a hot and humid day conditions will result in a higher volume of condensate because of the increased amount of moisture entering the air compressor. Assuming air demand remains the same, there will be the same amount of lubricant in a much larger amount of water. While local and state regulations regarding contaminant concentration limits can vary widely, plant personnel must determine the requirements for their site.

A Close Look at Common Oil/Water Separators

With the condensate leaving the air compressor being more than 99% water and less than 1% lubricant, oil/water separators are often used to assist in the reduction of the lubricant down to acceptable levels.

The two most common oil/water separator types used in the air compressor industry are gravity separation and chemical absorption. Evaporative separators are also available, but only make up a very small percentage of installations.

Gravity separation systems function by allowing the condensate to flow into a settling tank for the water and lubricant to naturally separate. With a lower density, the lubricant floats to the top and is then skimmed off into a separate container for disposal. Various types of porous media, such as polypropylene or activated carbon, are then used to increase the surface area the condensate is in contact with. This helps aid in the removal of remaining oil in the condensate and serves as a finishing filter. The treated condensate is then discharged from the separator.

These gravity style oil/water separators perform well with lubricants that have low saturation points and do not form an emulsion with water. Low-density lubricants and water naturally separate when settled in the unit. Higher density lubricants, such as PAG's, do form emulsions, and may not effectively separate through this gravitational method. As a result of this, alternative media bags or oversizing of the system to allow for more dwell time and to also allow for further increased surface area across the media, may be recommended by oil/water separator manufacturers to overcome this emulsification.

Chemical adsorption systems allow the condensate to flow into a tank filled with a high polarity media. The media adsorbs the lubricant while repelling the water. Dwell time is important in this method, allowing for the condensate to interact with the media long enough for the lubricant to adhere. The concept here is that the polarity of the media is more likely to attract the lubricant within the condensate, forcing a separation from the water. Activated carbon is commonly included as part of the media bed to aid in the removal of non-emulsified lubricants. After flowing through the media, condensate water is then removed from the separator.

These chemical adsorption style oil/water separators have a high holding capacity of approximately 50% of the media bed by weight. The polar, porous media easily attracts emulsified lubricant from the water as it flows through the bed. Non-emulsified lubricants will also separate in this process, with much of the lubricant remaining toward the top of the media bed. Over time, the oil content within the separator begins to accumulate, which can potentially lead to decreased efficiency. For this reason, the parts per million of lubricant in the oil/water separators discharge water should be regularly monitored. With proper monitoring, a user should begin to understand "mean time between failure" for their system and change the systems element or media bag at the appropriate interval.

Both types of systems may experience efficiency losses in their ability to separate the oil/water condensate and their holding capacity when lubricants of different types are mixed in the unit. As a result, many manufacturers recommend that if multiple air compressors have their condensate discharge piped into the same separator, a common lubricant chemistry be used across all systems. Likewise, different media types are more efficient with polyglycols versus hydrocarbons, and media should be selected for the appropriate type of lubricant.

Finally, evaporative systems utilize electrical heating elements to raise fluid temperature. This allows the condensate water to separate via steam, leaving behind the lubricant for periodic draining and disposal. Evaporative systems are typically more costly to purchase and operate when compared to gravity separation and chemical adsorption systems. Additionally, some lubricants, when heated in these systems can emit harmful gases that should not be inhaled.

Achieve Performance Through Analysis

Visual comparisons of treated condensate to tap water are a common validation that lubricant has been removed properly prior to discharge down groundwater drains. In many cases however, the lubricant remaining in the condensate may not be readily visible. There are many water analysis laboratories available that can easily evaluate condensate water samples for true lubricant concentration levels. These levels can then be measured against local regulations on concentration limits. BP

About the Author

David Rosenthal is Product Manager with SA Performance, tel: 517-295-9386, email: dave.m.rosenthal@gmail.com.

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SA Performance offers a complete line of high-performance air compressor lubricants, all manufactured out of an ISO9001 facility with multiple distribution points to best serve their customers. Additionally, SA Performance offers complete airend remanufacturing services including rotor balancing and machine work, performed in-house at their own specialized facility. Pairing air compressor expertise with lubricant knowledge has helped SA Performance become a leading partner across the compressed air industry. For more information, visit https://saperformance.net/.

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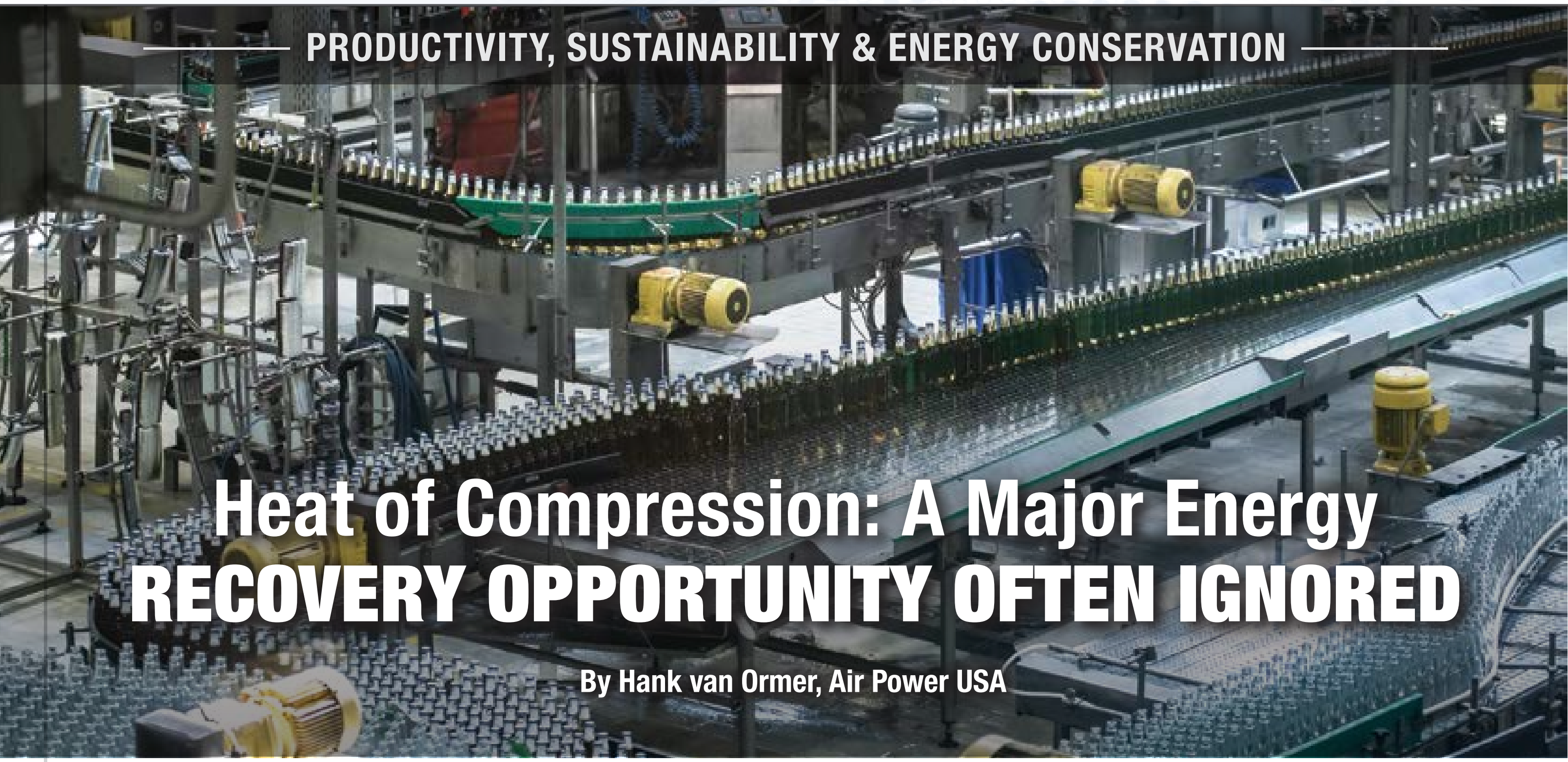


Heat of Compression: A Major Energy RECOVERY OPPORTUNITY OFTEN IGNORED

By Hank van Ormer, Air Power USA

Often when you mention heat of compression the first thought generally relates to HOC desiccant dryers, which are also an under-applied opportunity for heat recovery. However, there are many other heat of compression recoverable energy savings opportunities in all compressed air and gas systems. This article reviews many opportunities in energy heat recovery and provides answer to commonly asked questions, such as:

Heat of Compression 101

Heat of compression reflects the basic inefficiency of compressed air or gas with regard to energy used to compress it compared to work energy actually delivered. For example: in a 100 psig-class (seven bar) air system, the air compressor uses about eight horsepower (hp) to deliver one hp worth of work. This concept is also true for other gases and at other pressures with variable answers. The 100 psig-class air compressed air is the largest sector in many commercial industrial, construction and other markets worldwide. These values may vary under different atmospheric operating conditions and will also be very site specific.

A discussion about heat of compression requires a look at the basic law of energy. It says that energy can neither be created nor destroyed. Therefore, energy input to compression not used in final work energy will be converted to heat within the system. This heat is expressed in Btu/hours.

As an example, if work energy used by the process is one hp = 2,546 Btu/hr., for example, then the total power input to produce the eight hp leaves a total of seven hp not used in process work – or seven hp x 2,546 Btu/hour = 17, 522 Btu/hour of heat left in the compressed air cooling system. (Note: Power over time = energy. In electrical terms, kW is power and kWh is energy.)

Heat of compression comes from the unused energy at the process – heat that is left in the air system is usually referred to as "free" because it is a by-product of compressed air or gas and is covered by the cost of operating the air compressor. If you don't take advantage of this heat source (which is free) you will not only lose the available energy but may have to cool the air compressor system using more energy to avoid other issues. Recovered heat will offer the plant another heat source and the opportunity taken may well reduce plant operating energy costs.

Recovering Heat of Compression

As stated, all air or gas compressor generate heat of compression in the air compressor. Depending on the work used, the stored heat of compression in the system is around 15,276 to 17,822 Btu/hr. Within the plant there may be areas where a current heating application can be reduced or shut off utilizing the available heat of compression.

TABLE 1

CAPACITY (SCFM) 100 PSIG (7 BAR)	APPROXIMATE BTU/HR.	CAPACITY (SCFM) 100 PSIG (7 BAR)	APPROXIMATE BTU/HR.
250 scfm	150,308	1,000 scfm	572,400
350 scfm	208,500	1,200 scfm	694,700
500 scfm	287,700	1,500 scfm	920,000
800 scfm	463,100	2,000 scfm	1,237,000

Looking at a typical air system, a reasonable target to recover the available heat of compression within the system would be 85 to 95 percent of the total motor horsepower input from the heated cooling air, water or other coolant used. For example:

- Cooling water from a water-cooled air compressor and aftercooler etc. – probable discharge temperature of around 130 °F.
- Cooling air from air compressor coolers and air-cooled aftercooler etc. – probable temperatures 5 °F to 20 °F above ambient.
- Coolant (oil) from various injected lubricating cooling rotaries (screw, vane etc.) 150 °F to 190 °F before the aftercooler.

Air compressors can be lubricated or non-lubricated. Non-lubricated units such as centrifugals, reciprocating, rotary screw, etc. operate hotter than lubricated machines.

Potential Value of Heat of Compression by Capacity (scfm) Class

Table 1 displays the approximate potential values of recoverable heat of compression based on full load compressed air delivered in Btu's/hr. including probable transport losses.

Here's an example calculation of potential savings for one compressed air system. Let's assume it has a capacity of 2,000 scfm at 100 psig and operates 6,240 hours annually. Also assume one kW equals 3,414 Btu/hr. A system with a capacity of 2,000 scfm at 100 psig equates to 1,237,000 approximate Btu/hr.

To calculate the savings, divide 1,237,000 Btu/hr. by 3,414 Btu/hr, which equals 362 kW. An expected maximum recovery rate of about 94% equates to an estimated 339 kW. The maximum recoverable power is 339 kW (energy kWh).

The savings based on 339 kW and a blended electric rate of $.07 kWh equals a savings of $148,075 year.

It doesn't matter whether the units are air-cooled or water-cooled – the maximum approximate recoverable energy under these conditions is still 339 kW, or $148,075 year in HOC recovery!

Heat of Compression Methods of Heat Recovery

Now that we've given an example of how to calculate the potential values of heat of compression lets discuss different ways of locating the recovery potential and HOC methods in your facility.

Heat of compression stored does not have to be from an oil-free or non-lubricated compressed air system. There are many successful applications that can be implemented with lubricated air compressors by using the heated cooling media to accomplish the final heating at the process – such as heating specific areas in the plant with a dedicated heat exchanger. (Note: HOC dryers require oil-free air.)

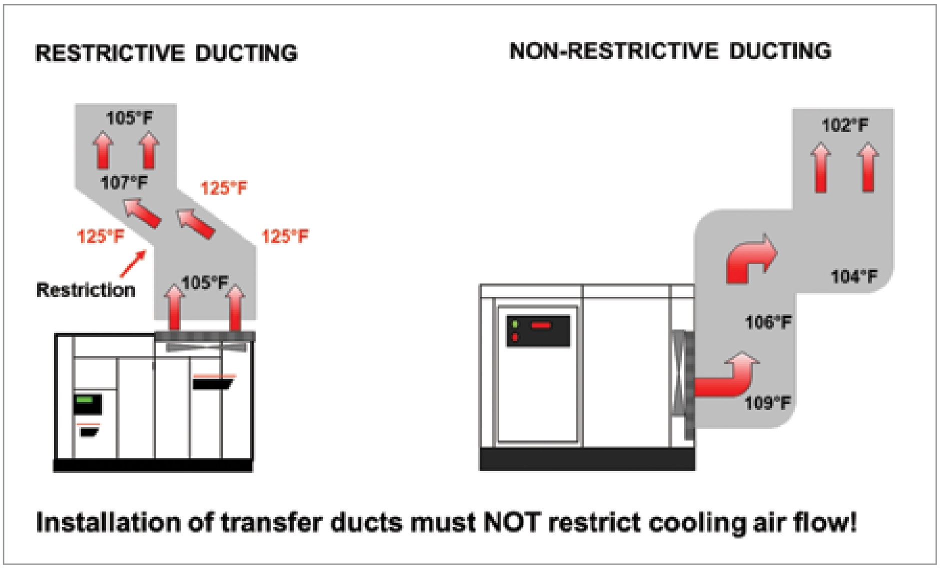
Air-cooled units collect all the air in one airstream then may duct the heated air to a desired location. Examples would be space heating and the creation of a heat barrier. Adding booster fans may be required to ensure enough fan capacity to move air without restricting the cooling airflow. Installing this type of ducting requires working very closely with the installer to avoid the risk of damaging the air compressor by operating too hot.

HEAT OF COMPRESSION: A MAJOR ENERGY RECOVERY OPPORTUNITY OFTEN IGNORED

Pet Food Manufacturer Achieves Energy Savings

A pet food manufacturing plant compressed air installation serves as good example of the savings achieved with heat of compression recovery involving a closed-cooling system.

The system layout (Figure 1) shows two, 250-hp class injected-cooled two-stage rotary screw air compressors with a 2,500 scfm rated water-cooled refrigerated dryer. All the components are in a single, closed-loop air-cooled, 10 fan cooling unit.



A typical oil-cooled rotary screw air compressor heat recovery opportunity includes both space heating and the creation of a heat barrier.

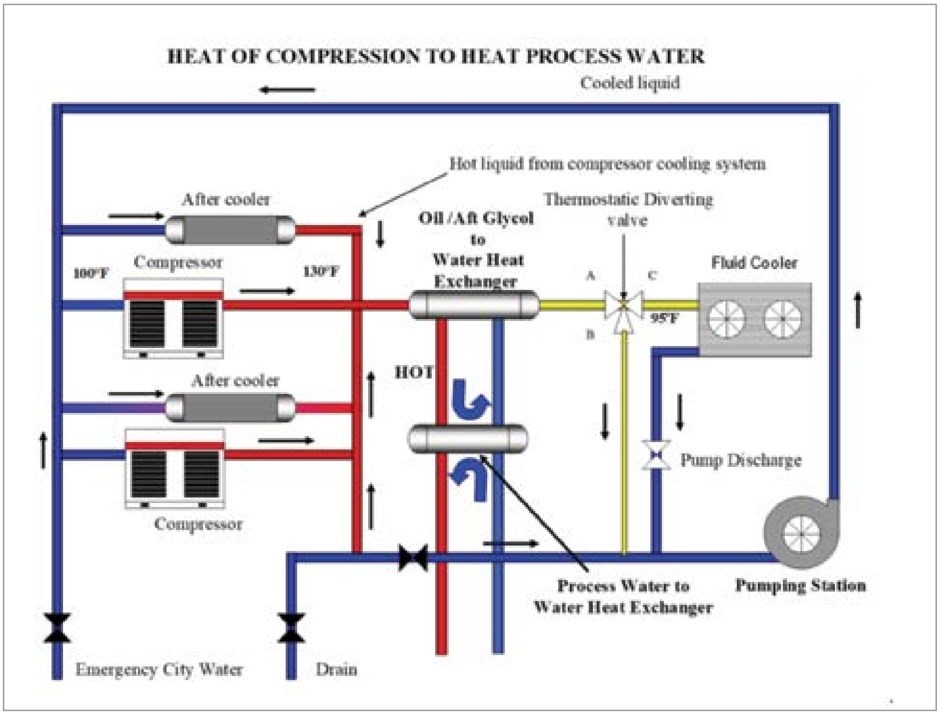


Figure 1.

The process water used for production is river water with an average temperature of 60 °F which had to be raised to 94 °F with the electric heat exchanger. Utilizing heat of compression to heat the process water to the desired 94 °F takes the energy load of the electric heater off the system. The total maximum recoverable potential was calculated at $146,764 yr. After a five-year continued measurement program, the recovered energy savings averaged $128,000 annually.

Identified causes of the lower recovery savings were:

- The original baseline was estimated too high and did not accurately predict the variations of cooling water flow.
- The heat recovery closed loop had a high pre-cooling effect on the exchanger loop of the primary (60/40 polyglycol) closed cooling system. During summer weather conditions eight fans operated, while only two fans operated during the cooler weather conditions.

After 15 years of operation the established baseline of about $128,000 year is constantly monitored and accurate.

Using Heated Cooling Oil from a Lubricated Screw Air Compressor

Hot cooling oil (190 °F to 200 °F) or cooling water (130 °F) can be used to reheat saturated or high relative humidity compressed air to lower the relative humidity in the pipe. In some applications, this will not only eliminate outside pipe sweating, but also, under proper operating conditions, deliver hot, dry air to the process.

This hot air contains more usable energy because the heat raises the pressure with less air volume required and the water vapor is still in the form of a usable gas if it does not cool below the pressure dewpoint (when the vapor then falls out as water).

This has been very popular in sawmill plants where the hot discharge oil from lubricant-cooled rotary screw air compressors (150 °F to 200 °F) is routed to another heat exchanger and heats the discharge after-cooled air from the heated oil and delivers lower Relative Humidity (RH) and hotter air to the compressed air system. The reheater also pre-cools the heated lubricant, which reduces the heat load on the cooling system. The effect of operating at high air temperatures, which increases pressure, is illustrated in Figure 2.

As shown, raising the temperatures of the discharge air after the compressed air leaves the air compressor within the pipe it will raise the pressure without additional compressed air until it cools, i.e., more pressure with no increase in input energy to the air compressors. In this example, air from compressor discharge is 170 °F at 100 psig, air to the dryer is less than 100 °F at 100 psig, air from dryer is 70°F at 95 psig, and air from the reheater is 120 °F at 104 psig.

The result is a 9% increase in delivered energy with no increase in input energy to the air compressors!

Important to note is the effect of Charles' Law on energy savings on heated confined discharge air. According to Charles' Law, "At constant pressure, the volume of an ideal gas varies directly as the absolute temperature." Absolute temperate is °F + 460 Rankine (°R)where °R is a constant utilized for these calculations. °FR is also presented as absolute °F.

Charles' Law states that in a confined volume stored gas will increase in volume or pressure directly proportional to the rise in temperature.

In the example, the airline being reheated started at 70 °F at 95 psig. Adding the 460

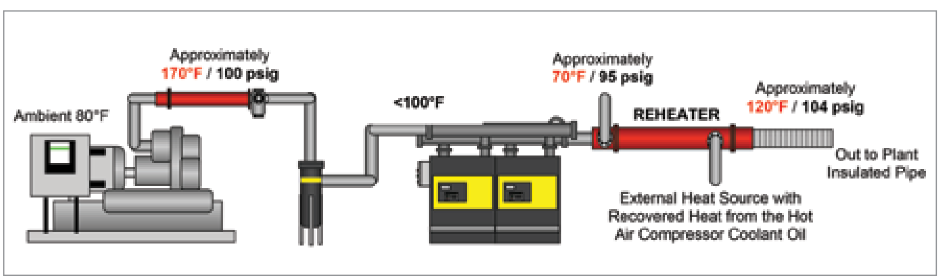
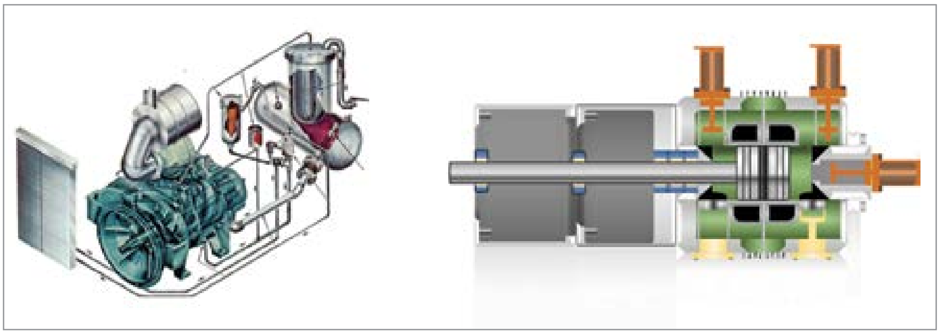


Figure 2.



Shown is an injection lubricant-cooled rotary screw air compressors (left) and a water-cooled reciprocating air compressor with jackets and inline coolers, both of which offer heat of compression recoverable energy savings opportunities.

HEAT OF COMPRESSION: A MAJOR ENERGY RECOVERY OPPORTUNITY OFTEN IGNORED

°R value to the °F makes the absolute F value 520 °R. When the reheater was operating it changed to 580 °R with a 9% increase in pressure from 95 to 104 psig with no change in energy input to the air compressor.

Finding Common Types of Cooling in Air Compressor Rooms

Many common types of cooling can be located in an air compressor room, you just need to know where to look.

- Air-cooled air compressors: Heat of compression trapped in the air to air heat exchanger and cooling system. Heat is available in the cooling airflows and will discharge cooling air from 5 °F to 20 °F above the inlet cooling air. To be effective, this cooling air may need thermostatic type controls.
- Water-cooled air compressors: Heat recovery energy savings and projects are often easier to implement with the heat being well trapped in a controlled water flow. Regardless of the type of air compressors, the maximum expected heated discharge cooling water temperature is about 130 °F post aftercooler or higher taken before the aftercooler.
- Oil-injected/lubricant-cooled rotary vanes, screws and scrolls etc.: The injected cooling lubricant at about 150 °F is atomized into the compression chamber absorbing the heat of compression while it is being generated. This generally holds the discharge temperature to about 190 °F to 200 °F maximum or 165 °F to 185 °F minimum when taken before the aftercooler.

Lower Overall Energy Costs with Heat of Compression

Heat of compression in air or gas compressors reflects the basic inefficiency of the compression process with regard to energy input to the compressors to actual energy utilized in a given process. In the case of compressed air at 100 psig discharge pressure the nominal relationship is 8 hp into the air compressor to produce one hp of delivered energy or work.

Any input energy not used in the process comes "off" as heat of compression. These numbers will vary by inlet conditions, discharge temperatures etc. Heat of compression is considered free because the cost of the input energy is covered in the cost of producing compressed air or gas. But if you don't recover the energy in some form of heat recovery, then there is no energy reduction. Keep in mind all of the heat of compression you're able to use in other processes will lower the overall energy cost to generate air or gas. BP

For more information about this article, call Hank van Ormer, Air Power USA, at 740-862-4112, or 614-580-2711.

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PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

WINPAK REDUCES DEMAND BY 33% and Switches to Oil-Free Air Compressors

By Ron Marshall, Marshall Compressed Air Consulting

By making changes primarily focused on compressed air uses, Winpak, an international plastics products manufacturer based in Winnipeg, Manitoba, Canada, increased compressed air production capacity and reduced annual energy consumption by 33%. These benefits have been accomplished while the company was making the switch to lubricant-free compressed air to support product quality goals. This article discusses some of these changes and addresses measures that could be implemented in any compressed air system.

Sustainability a Priority

Winpak manufactures and distributes high-quality packaging materials and related innovative packaging machines. The company's products are used primarily for the protection of perishable foods, beverages, and in healthcare applications.

Part of a global packaging group, Winpak operates twelve production facilities in Canada, the United States and Mexico, while offering global coverage and expertise. The North American business units assist customers throughout the United States, Canada, Latin America, the Pacific Rim countries and, for certain products, Europe and the Middle East. Winpak has a strategic alliance with Winpak, one of Europe's leading manufacturers of packaging materials.

"Winpak is committed to developing sustainable packaging, achieving energy efficiency through its operations, and investing in R&D to deliver innovations to minimize adverse environmental impacts," said Masoud Sharafi, P.h.D., P.Eng., CEM, about the company's lofty goals. Sharafi is the company's Project Engineer-Energy. "We believe everyone in the organization shares the responsibility to protect the environment and minimize our impact on natural resources. To that end, we are committed to consuming energy in the most efficient, cost-effective and environmentally responsible manner. Our mid-term target is to reduce our energy intensity by 10% by end of 2025."

The company's first manufacturing plant was started in Winnipeg, Manitoba, in 1977, but in a different location, it recognized early on sustained growth would require a bigger plant so they moved to their current spacious facility. The facility was serviced by a set of modulating style lubricated screw air compressors and non-cycling refrigerated

> "This project shows the benefits of having a compressed air assessment done in a plant and having an energy manager to help champion projects."
>
> — Ron Marshall, Marshall Compressed Air Consulting

dryers, with the company adding compressed air capacity, and improving efficiency as the facility was expanded.

Winpak's high commitment to product quality and food safety recently guided their change to lubricant-free compressed air. When the decision was made to upgrade the compressed air system due to an expansion Winpak's engineering department contacted the local power utility, Manitoba Hydro. The utility offers technical and financial support for any project that might save electrical and natural gas energy.

Establishing an Energy Consumption Baseline

For the first step, Winpak had a compressed air auditor capture a baseline of their compressed air system energy consumption. The auditor placed measuring instruments on all the air compressors to capture a power/energy profile, installed pressure loggers to monitor pressure at various points in the plant, and installed flow meters to measure the compressed air demand profile.

The efficiency of Winpak's original compressed air supply was very good, the company had worked with the power utility for previous expansions in the years before. The baseline system was set up with two base, fixed speed air compressors, and one variable speed-controlled unit, and modern and efficient cycling style refrigerated air dryers. This system had been converted from modulating air compressors in a previous project for significant savings.

An electronically controlled pressure/flow controller limited the pressure in the plant to 100 psi in order to reduce artificial demand. The system of piping within the plant was well-sized and arranged in a loop system to reduce pressure loss. The air compressor heat was directed to the plant to displace natural gas heat. But the company had not had their end uses and leakage assessed for many years, so an end use and leakage audit was also conducted.

Item	cfm	annual cost
Baler new	100	$ 9,603
Baler old	225	$ 21,606
Air Fans	42	$ 4,033
Vibrator	20	$ 1,921
Blower	29	$ 2,785
Leaks	90.75	$ 8,714
Comp drains	10	$ 960
Total	**516.75**	**$ 49,622**

During a leak audit a number of potentially inappropriate end uses were found.

WINPAK REDUCES DEMAND BY 33% AND SWITCHES TO OIL-FREE AIR COMPRESSORS

Finding Leaks, Inappropriate Compressed Air Uses

A thorough compressed air leak audit was conducted using an ultrasonic leak detector. The facility has a high noise level, so use of ultrasonic equipment is a must. During the audit, 58 significant leaks were found and tagged for later repair. The cost for leakage was estimated at 90 cfm, consuming about $8,700 in annual compressed air costs per year. This cost paled in comparison to the cost of some inappropriate uses also found during the assessment.

One of the side benefits of using an ultrasonic detector in a plant is that end uses of compressed air are also detected during the same facility survey. Having an experienced auditor do the study means end uses can be assessed for appropriateness. An inappropriate use of compressed air is defined as an operation that could be better supplied by another energy source or could be reduced or eliminated altogether.

Some potentially inappropriate uses found and flagged during the Winpak audit were:

- Agitation of drums of ink using air motors.
- Open blowing in reclaim grinders.
- Use of air powered vibration for bin unloading.
- Cracked open air compressor drains.
- Use of compressed air-powered portable fans.
- Installation of compressed air ionizers in scrap collector baler intake ducts.

After discussion with plant personnel, not all these findings were identified for future investigation. For example, the compressed air agitation of the ink drums had already been identified for a project and addressed. The solvent-based ink is very flammable; therefore, compressed air agitators are appropriate in this case, however, it was found by research that the agitators did not need to run continually to keep the ink color consistent. A control system was installed on each motor that ran the air motors for each barrel one at a time in sequence for 15-minute intervals throughout the day. This greatly reduced the estimated 70 cfm continuous compressed air demand down to less than 10 cfm.

Winpak had already converted some compressed air powered humidification nozzles, consuming 90 cfm (equivalent to 18 kW of electrical power) to a high-pressure water system consuming only about 4 kW.

Ink agitator air motors were controlled so they operate one at a time in sequence over the course of the day, greatly reducing compressed air usage.

Need for Lubricant-free Air

To improve product quality and reduce the risk of air compressor lubricant coming in contact with their products, Winpak's management made the decision to switch to lubricant-free air of instrument quality in a phased approach. There was no longer space in the original air compressor room for new air compressors, so a second compressor room was allocated. The new lubricant-free air compressors and dryers were placed in this room, and the ventilation designed to recover the air compressor heat to the plant in winter months.

Rather than installing heatless desiccant air dryers, which would have consumed a constant 150 cfm of purge flow for each air compressor to produce instrument air, Winpak chose to purchase heat-of-compression dryers. To save space, drum style dryers that are integrated into the air compressor enclosure were used. The air compressors installed were each 200 hp (160 kW) in size, one being a variable frequency-controlled unit for efficient control.

The old air compressors were configured as spares and shut down for normal use. Since there were two separate compressor rooms a significant distance apart, a central air compressor controller was installed that communicated to all the air compressors in both rooms to ensure the plant had a constant pressure in both sides of the plant.

Improvements Deliver Energy Savings

Since the original compressed air production system was quite efficient, it would have been challenging to find additional improvements

Some portable air fans were replaced with explosion-proof electric fans.

WINPAK REDUCES DEMAND BY 33% AND SWITCHES TO OIL-FREE AIR COMPRESSORS

A scrap collector duct was fitted with compressed air powered ionizer nozzles to prevent clogs due to static causing the plastic to stick to duct walls. This unit consumed 100 cfm of compressed air using an equivalent of 20 kW.

on the supply side of the system. The key to this successful project was attacking problems on the demand side. The following things were done:

- Winpak hired an energy manager. This manager was key to following up, researching, and completing the changes required for the project. Part of the manager's wages are offset by energy incentives for special projects from the power utility.
- The air powered vibration was eliminated by installing new, more modern unloading bins for a reduction of 20 cfm.
- Cracked open air compressor drains were replaced with airless drains for a reduction of 10 cfm.
- Air-powered portable fans were replaced with permanently fixed explosion-proof fans for a reduction of 42 cfm.
- Compressed air ionizers were replaced with low-air consumption units for a reduction of 325 cfm.
- Heat-of-compression drying was installed eliminating the need for 300 cfm in total dryer purge.
- Refrigerated air dryers were shut down on standby to save power.
- Air leakage was repaired and a regular leak detection program initiated.

Sustainability Aligns with Business Goals

Winpak's compressed air system was already quite efficient on the production side so end use and waste reduction strategies needed to be found to reduce compressed air energy consumption.

Baseline energy for the original system was set at about 2,500,000 kWh per year costing about $167,000 per year. With the improvements the compressed air energy consumption dropped to about 1,640,000 kWh per year, resulting in an energy savings of 33%. Since the reduction in airflow achieved represents about one whole 200-hp air compressor, plans for installing additional lubricant-free capacity were deferred.

The project qualified for a substantial energy improvement incentive from the power utility. It should be noted that fairly inexpensive improvement measures on the demand side helped fund more expensive measures on the supply side, a common benefit of addressing the whole system and combining the project into one.

This project shows the benefits of having a compressed air assessment done in a plant and having an energy manager to help champion projects. Since the original compressed air system supply side was already quite efficient, looking to the demand side was key. In addition to leakage, some inappropriate end uses were found that saved far more than what would result from leakage repair.

In the end Winpak achieved the change to high-quality compressed air, but also gained much lower electrical cost, an excellent result that is something to brag about.

"Compressed air is essential to the operation of most significant production lines in operation at Winpak Division. Keeping production lines running with clean and reliable compressed air at high volumes is critical where breakdowns can have serious consequences," Sharafi said.

"Before the compressed air project, three high-pressure air compressors were operating continuously in order to keep up with the demand," he said. "The project allowed us to save electricity as well as some maintenance cost as we only need to run two air compressors instead of three. We acknowledge the support we received from MB Hydro including financial rebates which assists the business case of the project. Moreover, the technical advice received by the Hydro team helped us to identify and implement more improvement opportunities through this project."

Scrap collector system ionizers were changed to a different style since they use only a small amount of compressed air

Recently Winpak identified this compressed air project as one of the highlights of their experience with Manitoba Hydro's Energy Manager program.

"This project is a great example of showing how energy/sustainability initiatives can be in line with business goals and to protect the environment at same time. Definitely, we will keep monitoring compressed air, including its demand and supply side and looking for any opportunity to improve it," Sharafi said. BP

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

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

QUALITY, SAFETY & RELIABILITY

How to Avoid Control Gap with VFD ROTARY SCREW AIR COMPRESSORS

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

Air compressors need to be matched to load effectively and efficiently. If the air compressors' range of variation can't be matched to the system variation, instability and/or inefficiency can result. This article discusses the problem when it isn't matched, which is called "control gap" and what to do to avoid it.

Master VFD Control Basics

It's important to remember a few basics about combining fixed speed and Variable Frequency Drive (VFD) screw air compressors before discussing control gap, which I wrote about in a previous article. The article is available at (https://www.airbestpractices.com/technology/compressor-controls/master-controls-multiple-air-compressor-systems-vfd-compressors). In summary, to properly control a set of screw air compressors with a VFD trim air compressor:

- Ensure all air compressors have common sensing location.
- Set up air compressors to accept remote commands.
- Select proper control algorithm. The "target" algorithm is best.
- Test, tune and measure.

There are several control algorithms that might be used to control multiple air compressors. The best for systems with a VFD trim air compressor is a target algorithm if it's a properly-sized unit. I recommended sizing the VFD air compressor at 1.5 X the base-load air compressor size, without going into detail about the control gap problem. The VFD air compressor speed control is set in the middle, or "target," and the base-load air compressors "bracket" it. They operate with one or multiple pressure windows, fully bracketing the VFD unit. See Figure 1. The pressures are arbitrary; the differences in pressure are what is important.

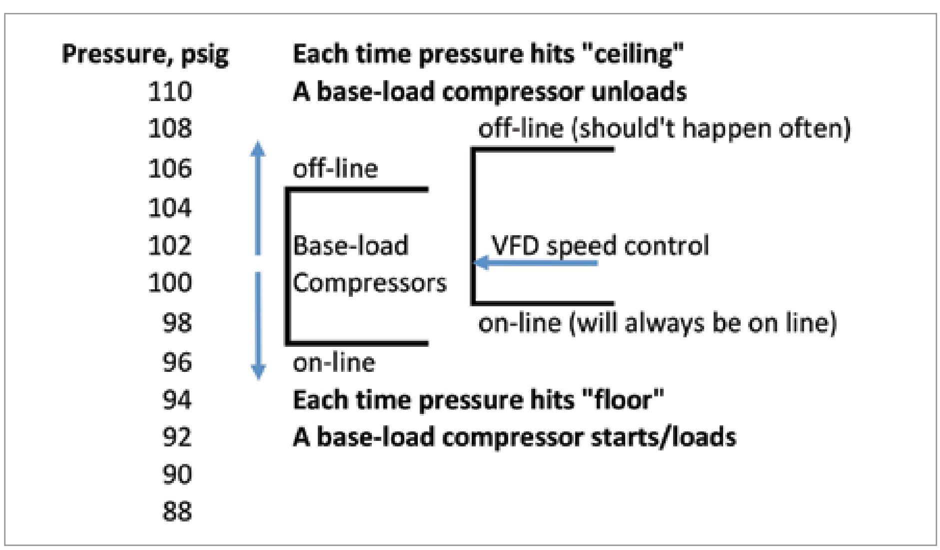

Figure 1. Target algorithm for a properly sized VFD air compressor.

A Close Look at the Control Gap Problem

Now that you know the proper way to set a VFD air compressor's control pressure in a system, let's discuss the problem as it relates to screw air compressors. What happens when you have the right pressure settings, but the relative sizes of the air compressors makes it impossible to control to those settings?

That problem is what we call control gap, which is more definitively defined as the mismatch between supply and demand that happens when demand is in a range where no stable set of air compressors is possible. With a VFD/fixed speed mix of air compressors, that is where the VFD air compressor is not able to control pressure in its speed range with base-load air compressors at stability, either fully loaded or off. This is due to an improperly-sized VFD air compressor relative to the other air compressors, and/or improper control settings.

Notice I said "improperly sized" VFD air compressor. What would happen in Figure 1 if the base-load air compressor was the same size as the VFD air compressor, which is a typical scenario? What would be the problem with that?

To explain, let's call the capacity of each air compressor X. Let's assume the VFD had a generous 70% turndown, matching demand from 0.3 X to 1.0 X demand. Assume demand went from just below the capacity of the VFD to just above it, from 0.9 X to 1.1 X. The VFD would go to maximum speed, and pressure would drop. The base-load air compressor would start and load. Supply would be the sum of the two air compressors, or 2.0 X. Remember demand is 1.1 X.

Pressure would rise quickly, the VFD would try to spin back to accommodate that (but still making air at minimum speed, 0.3 X). Assuming storage is sufficient and VFD response speed is fast enough supply would drop to 1.3 X and demand 1.1 X by the time pressure was at the top end of the VFD's control range. Pressure would continue to rise. Then, the base-load air compressor would have to unload. Now supply is 0.3 X and demand is still 1.1 X, so the pressure would drop very quickly. The VFD would try to spin up and catch demand. Even if storage was large enough and the VFD fast enough, pressure would still fall below its setpoint

HOW TO AVOID CONTROL GAP WITH VFD ROTARY SCREW AIR COMPRESSORS

because demand is more than supply still, 1.1 X demand versus 1.0 X supply. The base-load air compressor would load up again.

This cycle would repeat over and over again until demand was below the VFD's capacity or above the base-load plus minimum VFD speed capacity. In the middle, this "dead band" or "no-man's land," is where the control gap problem occurs.

There is a way to tune around control gap. Certainly, the best way is to make the VFD speed range more than the base-load air compressor size (in cfm), 1.5 X as I recommended above. Also, use a targeting algorithm. It will keep the VFD moving back and forth in its speed range all the time.

There is also the alternative of merely putting the VFD in "trim" or the No. 2 position by "cascade" control. Unfortunately, this would not be an efficient and effective mode if demand went below 1.0 X often, which in most small- to medium-sized plants it does.

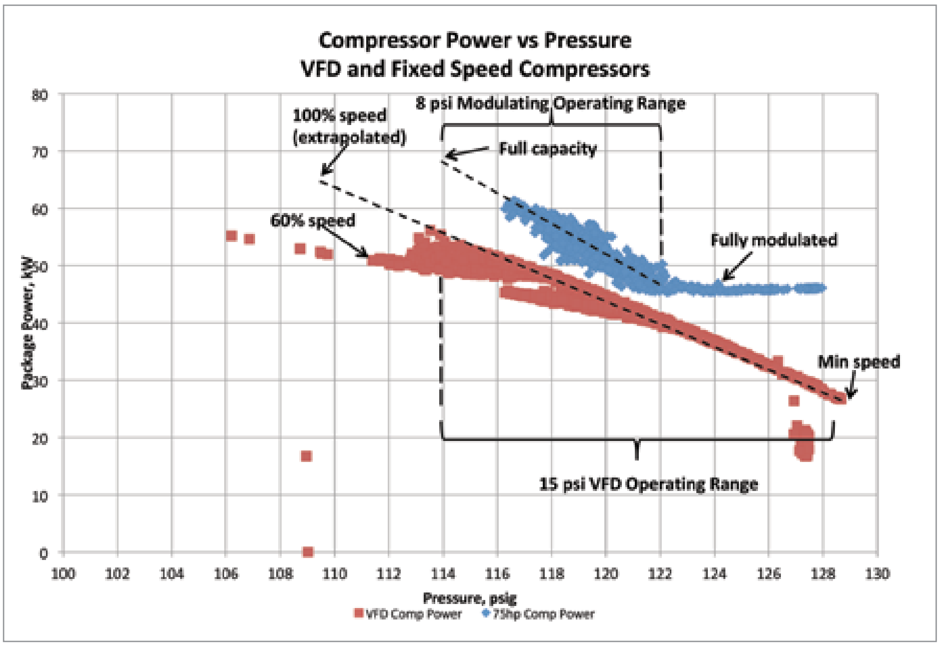

Figure 2. Total power versus flow curve before improvements.

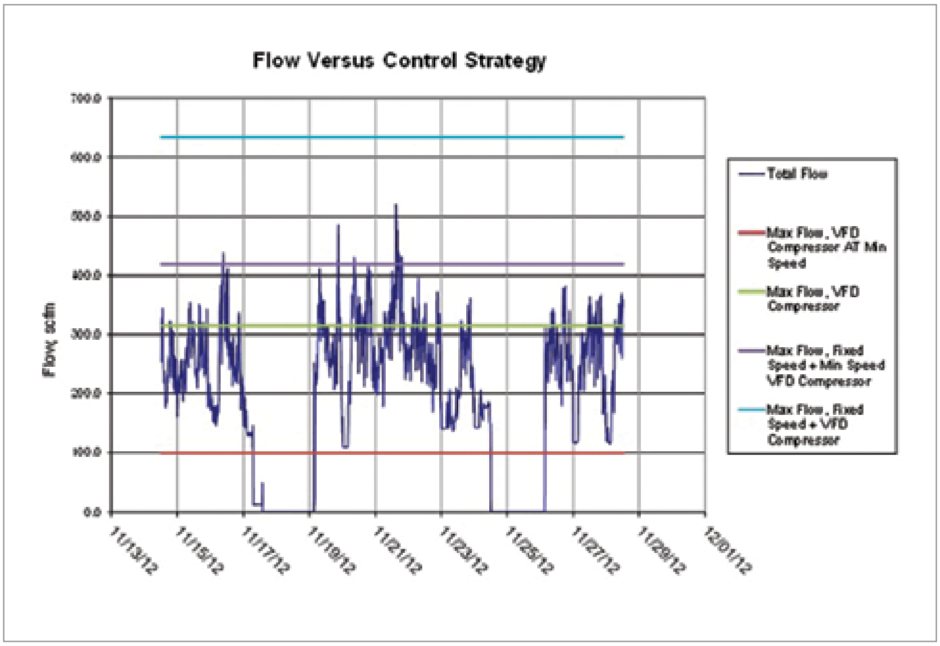

Figure 3. Control gap flow range.

Solutions to Control Gap

Let's finally get to the solution! Here are some recommendations.

- Right-sized VFD air compressor: The first and best solution is to use a bigger VFD air compressor or smaller base-load air compressor. Note that doesn't always require a new, bigger VFD air compressor! If your budget is limited, and you can't get a new VFD air compressor, look around for a solid, reliable 0.5 X to 0.7 X sized air compressor, and install it. Maybe it is already in the system. Then, let automation decide how to run the system.
- Proper storage: I suggest greater than five gal/scfm of the largest fixed speed air compressor you will run, to get the five psi rise time to greater than nine seconds. Check with your OEM if that is enough time for the VFD to react without greater than 2.5 psi over/under shoot. If it needs more time, increase storage accordingly.
- Properly tuned VFD: Set it and test it to be able to control pressure within half of the pressure range as the fixed speed air compressor pressure range. Proportional control in a fixed pressure range will make it more predictable, eliminating over/undershoot.

- Better automation: Use a proper algorithm, properly tuned and commissioned. That is the target algorithm. However, never, never start two machines instead of one because the VFD is slow in responding. You might need to tolerate a very short time that the system rides above the top pressure and below the low pressure. The algorithm of your master controller should be transparent. You need to know that it is truly a "target" sequencer, not a "cascade" sequencer, or you will have to retune the system for one fixed speed on/off, then two, then on. For example, if you can't change the VFD air compressor, program the algorithm to use the 50 horsepower (hp) before the 100 hp, and switch between the 50 hp and 100 hp, rather than adding the 100 hp. Then the "jolt" on the system will be half.

Retro-commissioning Study Reveals Control Gap Issue

A case study illustrates the problem. In this case, an actual 75 hp air compressor system was improved by the addition of a 75 hp VFD air compressor and then fell into a worse efficiency condition than before, all because of improper controls. After the system was retro-commissioned, however, control gap was managed. This was an actual project from 2012.

Seven years later, I performed an audit and discovered the inevitable. Demand had crept up and the second air compressor was needed. It had been just turned on in manual control, no controls adjustments made or automation added. The result was:

- The VFD air compressor was operating from 150 to 200 scfm in a large pressure range, over 10 psi swing, from 114 to 129 psig.
- Simultaneously, the fixed speed air compressor was modulating from 0 to 170 scfm in a narrower pressure range, from 116 to 122 psig.
- The overlapping ranges caused both air compressors to always operate in parallel. Even when flow was 120 scfm, both air compressors were on, consuming 75 kW. This was very inefficient as shown in Figure 2.

Solving the Control Gap Problem

For this project, I could have recommended either a larger VFD air compressor or a small base-load air compressor, and a target sequencer, but the air compressors were fairly new, and the utility's incentive already paid for a VFD. I wanted to still use these air compressors. In order to tune around this control gap, root problems had to be solved:

- The VFD proportional range (in pressure) was too large. It couldn't be bracketed by a target like that shown in Figure 1 without a huge pressure range.
- No automation was in place to coordinate the setpoints of the VFD air compressor and the fixed speed air compressor.
- Control gap had to be addressed without adding a new air compressor.

HOW TO AVOID CONTROL GAP WITH VFD ROTARY SCREW AIR COMPRESSORS

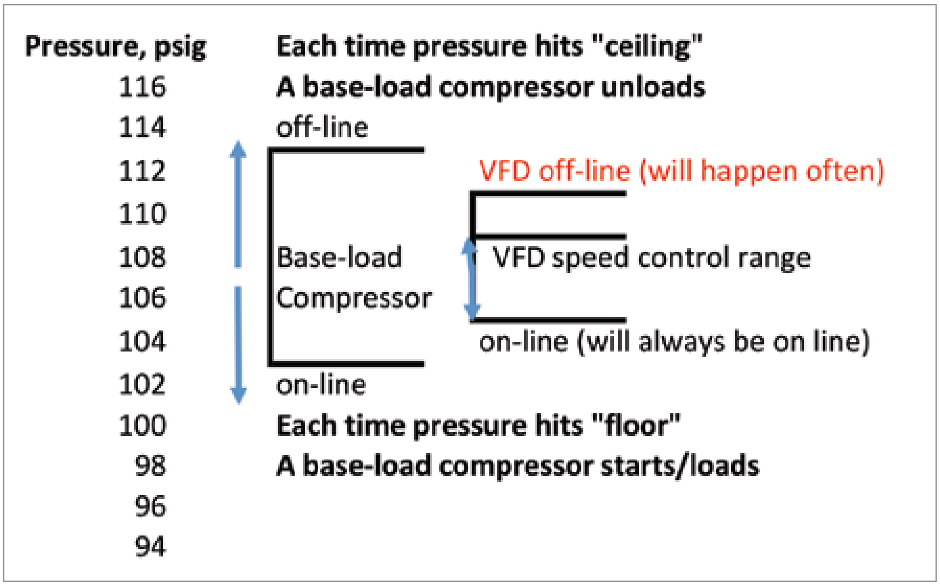

Figure 4. Target algorithm, small VFD air compressor.

Per my specification, the supplier modified the settings for the VFD proportional range to as tight as possible. I liked the fact that it was pure proportional demand, making it very predictable. Next, they supplied a master controller to manage the setpoint of the VFD and control the fixed speed unit. Finally, they adjusted controls, including the local modulation controls to be above the range of the automatic controls.

The control gap was between about 320 and 430 scfm. See Figure 3. We were able to tune the system to be stable in the control gap by the following:

- Installed automation that controls the VFD setpoint, the VFD air compressor's load and unload point, and the fixed speed air compressor's load and unload point.
- Used proportional control for VFD versus pressure (predictable pressure 1 ("P1") and pressure 2 ("P2") for speed 1 and speed 2.
- Set VFD air compressor proportional range as tight as possible. For this unit, that was seven psi.
- Set VFD air compressor unload pressure barely above minimum speed pressure P2.
- Set fixed speed air compressor setpoints outside the entire VFD air compressor's range, including its unload point. See Figure 4.

The above settings would trim the VFD when demand was below 320 scfm. However, it would also base-load the fixed speed with the VFD trimming at demands above that, creating a potential control gap between 320 and 420 scfm, where the VFD air compressor couldn't spin down far enough. See Figure 3. In spite of that small control gap, we were able to commission the system to only have a maximum load-unload cycle of four minutes and very low unloaded losses.

However, without data-collection and tuning, this easily could have gone awry. We tuned around the "control gap" problem. In general, to avoid control gap with a small VFD air compressor, you need to completely capture the VFDs control range within the base-load air compressor's range as illustrated in Figure 4. Then the VFD will unload before the base-load air compressor does.

Try Avoiding Control Gap Altogether

Try to avoid control gap with VFD/fixed speed air compressor systems by sizing the VFD air compressor at 1.5 X the base-load size. In addition, add 5 X storage (gallons x base-load scfm capacity) and install a target sequencer that is designed to control a VFD air compressor as a trim unit.

If installing a properly-sized VFD air compressor is not possible, control the VFD air compressor completely within the target range of the base-load air compressor, and tune the system.

Finally, having a retro-commissioning (or "tune-up) study and project performed and on any VFD/fixed speed air compressor system will probably result in energy savings and reliability improvements. I strongly recommend having a qualified independent professional conduct one. BP

For more information about this article, contact Tim Dugan, President of Compression Engineering Corporation, tel: (503) 784-2331, email: Tim.Dugan@comp-eng.com, or visit https://compression-engineering.com/.

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Sauer Compressors Offers Custom High-Pressure Solutions

In addition to high-pressure compressors, Sauer Compressors also offers a wide range of accessories. These include compressor controls, air and gas dryers as well as storage and distribution solutions.

When it comes to high-pressure applications, it is a challenge for many users to find equipment that is tailored perfectly to the compressors. However, carefully tuned components are essential for a flawless and efficient high-pressure system. For this reason, Sauer Compressors also offers an extensive range of accessories specially designed for medium- and high-pressure solutions.

Sauer offers solutions for drying and storage that are individually tailored to the requirements of the individual application. There are two dryer series specially designed for high-pressure applications. The high-pressure refrigerant dryers of the Sauer SRD series are suitable for drying air and gases with final pressures of up to 6,000 psi and achieve a pressure dew point of 37-41 °F. They can also be used as gas coolers. The high-pressure adsorption dryers of the Sauer SDD series, on the other hand, achieve reliable dew points of up to -40 °F at final pressures of up to 5,000 psig. They are specifically designed and optimized for use with Sauer high-pressure compressors.

Also available is a wide range of high-pressure storage systems for wet and dry gases with capacities of up to 158 gallons and for pressures of up to 5,000 psig. Versatile condensate management solutions are available for proper condensate collection. Customers benefit from tailor-made solutions from a single source, carefully matched components and short delivery times.

Air dryers like this Sauer SDD high-pressure desiccant dryer are part of the large accessory portfolio by Sauer Compressors.

About Sauer Compressors

Sauer Compressors is a medium-sized German group of companies with twelve international subsidiaries: including Sauer Compressors USA. The company was founded more than 130 years ago and has over 80 years' experience in compressed air technology. Today, it focuses on the development, production and sale of medium- and high-pressure compressors for applications in commercial shipping, industries, the petroleum industry and the defence sector. The four product lines SAUER, HAUG, Girodin und EK focus on specific fields of application. The SAUER line comprises oil-lubricated high-pressure compressors for a wide variety of applications, while HAUG stands for oil-free and hermetically gas-tight compressors. The Girodin and EK lines offer special compressors for the naval market. Sauer Compressors' modern reciprocating compressors for the compression of air and various gases reach pressures of 290 to 7,000 psi. Besides standard products, it offers customized solutions for individual customers, OEMs and companies that operate on a global stage. With a global network of agents and representatives, Sauer maintains close proximity to its customers. By supplementing the compressor range with high-quality accessories, engineering services, assembly and service concepts, Sauer offers system solutions right up to complete turnkey installations. For more information please go to www.sauerusa.com or reach out to sales@sauerusa.com

ELGi's Heat Recovery System Enables 96% Energy Reuse

Elgi Equipments, a leading air compressor manufacturer, has witnessed wide adoption of the ELGi Heat Recovery System (HRS), a solution for utilizing waste heat energy from an air compressor. Approximately 96% of the heat generated during the compression process, normally dispelled into the atmosphere, can now be recovered through the heat recovery system and then utilized to heat air (space) and water. This eliminates the need for additional equipment to heat air or water, thereby reducing CO_2 emissions and energy consumption significantly.

The HRS is best suited for customers across process industries spanning paper, sugar, food and beverages, dairy, textiles etc., mainly companies who require compressed air and use hot water for their process requirements. The Heat Recovery System is a perfect solution

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TECHNOLOGY PICKS

for utilizing waste heat energy from the compressor and finds applicability across companies committed to building energy efficiency in their compressed air system and paving the way for a clean environment.

One of our customers, a paper mill, experienced the benefits of the HRS system, within the first few hours of installation, by way of continuous warm water availability with no external heating. With the implementation of HR 110, the customer was able to recover a heat load of 89.14 kWh through the continuous water supply of 2000 lit/hr. at a temperature of 70°C throughout the year. This resulted in an annual energy savings of 800-900 tones of LP steam and a carbon emission reduction of 170-190 tones of CO_2 / Yr. With ELGi's energy efficient compressor and heat recovery system, our client was able to achieve significant energy savings resulting in accomplishing the target stipulated by PAT Scheme I and winning the prestigious GREENCO award.

ELGi, is a pioneer in cutting edge compressed air technology with a presence across over 100 countries, offering a complete range of compressed air solutions from oil-lubricated and oil-free rotary screw compressors, oil-lubricated and oil-free reciprocating compressors and centrifugal compressors to dryers, filters and downstream accessories. With state-of-the-art manufacturing units and a product portfolio of 400+ compressed air systems, ELGi redefines reliability, efficiency and cost-effectiveness across 2+ million installations all over the world.

About ELGi

Elgi Equipments Limited is a global air compressor manufacturer with a broad line of innovative and technologically superior compressed air systems. ELGi has consistently worked towards ensuring that companies achieve their productivity goals whilst keeping the cost of ownership low. ELGi offers a complete range of compressed air solutions from oil lubricated and oil-free rotary screw compressors, oil-lubricated and oil-free reciprocating compressors and centrifugal compressors, to dryers, filters and downstream accessories. The company's portfolio of over 400 products has found wide application across industries. For further information on the organization and its products, please visit www.elgi.com.

Yaskawa America Introduces Innovative Microdrive

The Drives & Motion division of Yaskawa America, Inc. proudly introduces the GA500 Industrial Microdrive, reflecting Yaskawa's continued customer commitment to providing sustainable, flexible, and easy-to-use products.

The Yaskawa GA500 Industrial Microdrive.

TECHNOLOGY PICKS

"This drive builds on the deep history of Yaskawa's product quality," said Ed Tom, Product Manager. "The GA500 provides high reliability with its design to deliver a minimum of 10 years of continuous operation."

It is designed to meet RoHS2, providing a sustainable and an environmentally friendly drive. Its TUV safety rating allows our customers to meet the most stringent safety ratings for their machine and provides a long mission time for the life of their equipment.

The GA500 also provides customers a wide range of flexibility. The drive is rated up to 40 HP and can be applied to 240 VAC single-phase, 240 VAC three-phase, or 480 VAC three-phase incoming power. For customers that use DC as their power source, the drive is [UL] rated to accept DC as its primary power source. The GA500 can operate a variety of motors, which include induction, permanent magnet (SPM and IPM), and synchronous reluctance (SynRM).

For customers that require network communications with their drives, the GA500 offers a variety of industrial protocols that help be part of the Industrial Internet of Things (IIoT), which include EtherNet/IP, PROFINET, Modbus TCP/IP, and EtherCAT. Traditional fieldbus protocols like DeviceNet, PROFIBUS, and Modbus RTU (embedded) are also available. The easy-to-use GA500 is designed to maximize one of the most valuable user resources, time. The GA500 can be programmed without main power applied, which means users can set up the drive, so it is ready to run before main power is available. A highly visual LED status ring provides drive status at a glance.

Yaskawa's mobile app, DriveWizard Mobile, provides the ability to program and/or monitor the GA500 through mobile devices like a smartphone or tablet. DriveWizard Mobile instantly accesses the Yaskawa Drive Cloud, providing a safe location to store drive information with instant access anywhere. Learn more about the GA500 at https://www.yaskawa.com/GA500

About Yaskawa America, Inc.

Yaskawa America's Drives & Motion Division manufactures industrial automation equipment, including low and medium voltage variable speed drives, servo motors and amplifiers, machine controllers, spindle drives and motors, and low voltage industrial switch products. The company's Motoman Robotics Division makes industrial robots that can weld, assemble, cut and handle goods for manufacturers.

Yaskawa products are used in a wide variety of industries, including automotive, building automation, machine tool, material handling, metal forming, packaging, pumping, water/wastewater treatment, plastics, rubber, solar, irrigation, and textile. Yaskawa America, Inc. employs more than 1,000 people in its headquarters in Waukegan, IL, its manufacturing facilities in Buffalo Grove, IL and Oak Creek, WI, and in offices across the United States. For more information about GA500 and other Yaskawa products visit our website at https://www.yaskawa.com.

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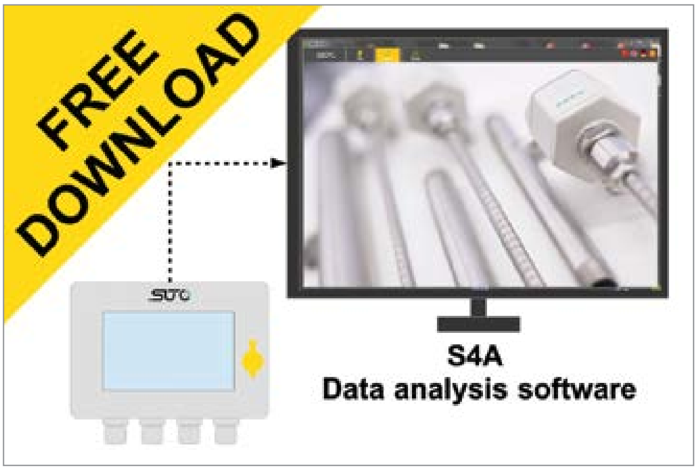
About SUTO iTEC

SUTO iTEC has been a trusted global partner for reliable measurement and monitoring solutions for compressed air and other gases for over 20 years. They offer measurement solutions for parameters of compressed air systems including flow, consumption, dew point, oil vapor and particulate For more information, visit www.suto-itec.com.



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Advertising Editorial Rod Smith
rod@airbestpractices.com
Tel: 412-980-9901

Subscriptions Administration Patricia Smith
patricia@airbestpractices.com
Tel: 412-980-9902

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SONOTEC Offers Customized Transducers for Ultrasonic NDT

SONOTEC has established itself over the past 25 years in the global NDT market as a specialist for customized ultrasonic testing solutions. With a powerful R&D team and a state-of-the-art in-house piezo-composite production, SONOTEC accompanies its customers from the first product idea to serial production.

Being an expert in ultrasonic solutions enables SONOTEC to offer customized probes for a broad range of applications – such as smart pigs for pipeline corrosion inspections, immersion transducers or even air-coupled ultrasonic probes.

The outstanding know-how of our engineering and application specialists including many years of experience ensure that our OEM UT transducers can easily be integrated into your systems. The high reproducibility of our probes is one of our core strengths.

All our transducers are made 100% in Germany to ensure highest flexibility and quality. Send us your application or probe requirements. We develop a reproducible and optimal manufacturing process for you to ensure a reliable supply.

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Founded in 1991, SONOTEC GmbH has developed into one of the world's leading product and solution specialist for innovative measurement technologies. With more than 170 employees and a modern corporate structure comprising three independent business units – Preventive Maintenance, Non-destructive Testing and Non-invasive Fluid Monitoring – the technology leader operates its global sales activities from the Halle (Saale) based German headquarter. The distributed portfolio includes customized ultrasonic transducers and sensors as well as testing devices and measurement solutions for a variety of different industries. For more information, visit www.sonotec.eu.

SONOTEC transducers are made 100% in Germany to ensure highest flexibility and quality.

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