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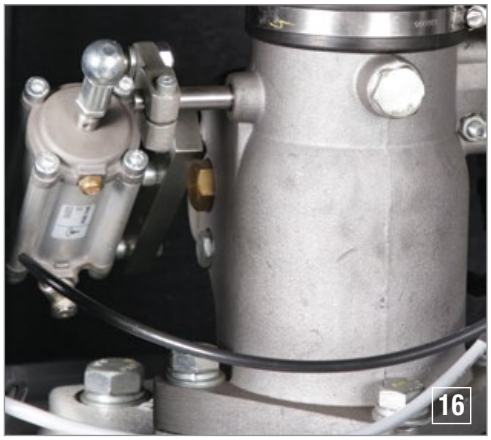

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EVERY ISSUE

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FROM THE EDITOR

Our lead article is worthy of the maintenance department. Titled, "Importance of Maintaining Screw Air Compressor Valves," the article provides solid guidance on maintaining the air inlet, minimum pressure, blow-down and safety valves. We thank author Gershom Joel, from ELGi North America.

When selecting an air compressor, Richard Huguenor from Sullair, suggests considering all technologies in his article, "Why a Centrifugal Air Compressor May be the Better Choice."

Personnel, from the manufacturers of pneumatic technology, enable automation on the production lines in plants. We were very pleased to receive an article from Emerson's Andre Abreu and Mark Densely titled, "Three Ways to Make Packaging Lines More Sustainable."

We have begun a series of "Fundamentals" articles authored by Hank and Don van Ormer, from Air Power USA. The second installment is titled, "The Impact of Altitude on Air Compressor and Tool Sizing."

We are accepting speaker abstracts for the Best Practices 2022 EXPO & Conference being held October 4-6, 2022 at Cobb Galleria in Atlanta. Abstracts can be sent to Clare Heinl at clare@airbestpractices.com. Save the date and visit https://cabpexpo.com for more information!

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COMPRESSED AIR INDUSTRY NEWS

Comairco Celebrates 50th Anniversary

Comairco Equipment is celebrating its 50th anniversary this year. Since the beginning, they have capitalized on all the opportunities that changes in the industry have presented to evolve, diversify and to remain a viable and innovative partner for its customers.

Since 1972, Comairco has been the leader in the field of compressed air. During these 50 years, they have always been an important player in the sale of new and used equipment, rentals and service. Comairco's value package has greatly diversified and now offers a wide range of specialized services, such as management of complex projects, construction of custom units, in-depth analysis of compressed air networks and support applications for energy subsidies. Today, thousands of companies in the food, mining and manufacturing sectors have benefited from their expertise.

Comairco has adapted over the decades, focusing on innovative products that offer added value for our industrial and institutional customers. For example, in the 2000s, they introduced an exterior cabinet for air compressors. This product, entirely designed and manufactured in North America, makes it possible to install electric compressors outside, in a weatherproof compartment. This unique solution offers significant interior space savings for several customers.

To support its growth over the past 50 years, the family business has distinguished itself through numerous acquisitions as for to maintaining a leading position in the current market. During these acquisitions, Comairco ensured that each of the branches offered unparalleled local service while maintaining that personal touch that only a family-owned company can offer. Another strength of the organization: the training of employees, specifically technicians, which has always been a priority for Comairco to stand out and offer the best after-sale experience in the industry.

"In business partnership for more than 50 years with our manufacturer Sullair, we have continued over the years a progressive expansion in Canada and the United States. Our expertise, reinforced by our acquisitions, as well as our increased geographical presence allows us to sustain our market shares in all sectors of activity. Comairco's commitment, the quality of service and the wide range of products have led us to the success we are currently enjoying," said Eddy Nadeau, President of Comairco, United States division.

To highlight the event and thank its employees and customers, various celebrations will take place in Comairco branches during 2022. These events will then be shared with the public on the company's social networks. Follow us to discover these privileged moments!

Comairco Equipment is celebrating its 50th anniversary this year.

About Comairco Equipment

Founded in 1972 by Roland Nadeau and a business partner, Comairco quickly established itself as the solution to all compressed air needs in industrial and institutional centers. Comairco now has 22 locations in four American states, and eight provinces of Canada. The family business is headquartered in Laval, Quebec, Canada. Comairco operates today with nearly 300 employees. For more information, visit www.comairco.com.

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Compressed Air Industry News

Atlas Copco Acquires Italian Condensate Drain Manufacturer

Atlas Copco has acquired SCB S.r.l., an Italian manufacturer that develops, produces and distributes electronic condensate drains for the industrial market.

SCB S.r.l. is located in Villar San Costanzo, near Cuneo in Piedmont. They have 16 employees and are privately owned. In 2021 they had revenues of MEUR 5 (MSEK 51).

The company manufactures condensate drains for the industrial market, such as energy saving electronical drains, mechanical drains, timer drains and level-controlled drains. The products serve the compressed air and vacuum market by removing water from the air stream.

"SCB is a well-established company with many years of experience and a high level of expertise in condensate management," said Vagner Rego, Business Area President Compressor Technique. "We have a long history of working with SCB and see many possibilities for accelerated growth in this area going forward."

The purchase price is not disclosed. SCB S.r.l. will become part of Walker Filtration which is part of the Medical Gas Solutions Division within the Compressor Technique business area.

About Atlas Copco Group

Our industrial ideas empower our customers to grow and drive society forward. This is how we create a better tomorrow. Atlas Copco is a global industrial group, founded in 1873 in Stockholm. In 2021 we had revenues of BSEK111and at year end about 43 000 employees. For more information, visit www.atlascopcogroup.com.

Dearing Pump & Compressor Announces Leadership Transition

Dearing Compressor and Pump (the Company), a family owned, and operated business known as the leader in compressor distribution since 1945, announced today that Richard H. Dearing, President and Chief Executive Officer, will retire from his positions at the Company effective immediately. Dearing will serve as the Chairman of The Board of Directors where he will remain faithful to the company's success and work by continuing to drive the strategic direction and set the mission, vision and values of the company. The Board of Directors unanimously appointed Dearing's successors, naming Rebecca Dearing Wall as Chief Executive Officer and Albin Dearing V. as President of the 76-year-old organization.

"On behalf of the entire Board of Directors, management team, and Dearing's 200 employees, we want to thank Rick for his leadership, impact and dedication serving almost four decades with our organization," said Becky Wall, Spokesperson for the Board of Directors. "A steadfast and strategic leader, Rick guided Dearing since 1995 after assuming the positions from his father. He cultivated a customer-first culture and grew the business by establishing a highly skilled workforce who never wavered from his father's strong philosophy that Service was the key to the sale. The Board is sincerely grateful to Rick for his dedication to Dearing and wishes him nothing but the best as the new Chairman of the Board of Directors for the company."

During his tenure, Rick established the company as a true market leader in the engineering, packaging and installation of quality compression equipment representing manufacturers that provide the equipment and support that's the best available in the marketplace today.

"Having served as my father's successor as President since December 1992 and as President-CEO since December 1995, I appreciate the trust that you put in me to fulfill these duties. I will remain faithful to the company's success and I will continue to drive the strategic direction and set the mission, vision and values of Dearing from my Board position," said Richard Dearing.

The selections of Rebecca Dearing Wall and Albin Dearing V., is the culmination of a strategic, multi-year leadership development and succession planning process, led by the Board, to ensure the integrity, values and direction of the company continue with confidence through the next generation of Dearing family leadership.

"With a history of leadership rooted in a rich, family tradition embracing service, reliability, integrity, and innovation as the benchmarks to success, the foundation for success has been laid," said Rick. "Rebecca and Albin have exemplified the drive, leadership, determination and understanding of how to drive the company to reach new heights on a global scale."

Since 1981, Rebecca "Becky" Dearing Wall has been a steadfast leader of the company her grandfather founded. Her commitment

Rebecca Dearing Wall named CEO (seated). Standing behind Dearing Wall are Ryan Wilson, Vice President and fourth generation active in the company; Richard H. Dearing who will continue to serve as board chairman; and Albin P. Dearing V., President.

Compressed Air Industry News

to manufacturing and to giving back to the community has enabled her to become one of the most recognizable and successful leaders within the industry and organization. With four decades of service to her family's company, she has been instrumental to the financial stability and strategic direction of the organization, most recently serving as its Vice President and Chief Financial Officer. Her new role as CEO will enable her to leverage the lessons learned from her brother, Rick, while confidently forging a new path for the company.

"When I joined the company in 1981, I could not have imagined the journey Rick and I would take or the deep satisfaction I would feel having been his partner in this family business. His shoes will be difficult to fill but the continued success of Dearing will always remain my highest priority and I am excited to lead our family's company into the next era," said Dearing Wall.

Albin P. Dearing, V. will serve as the company's new President. For more than 17 years, Albin has demonstrated consistent results in designing and implementing business operations and establishing policies that promote the company culture and vision. As its Vice President of Operations, Albin has devoted his career to diagnosing problems, relentlessly finding, providing and executing solid solutions that the company and its customers. Named after his grandfather and the company's founder, Albin is poised to enhance the value Dearing Compressor & Pump provides its clients and employees.

"Over my career, I have been mentored and guided by many voices to help me proudly carry on the tradition of leading this company with our family name," said the company's new President. "I pledge to continue to follow the mission, vision and values our family founded this company upon, ensuring the preservation of the company so that it continues on for generations to come."

About Dearing Pump & Compressor

Founded in 1945, Dearing Compressor and Pump Co. continues to be the industry leader in compressor distribution. For over 70 years, we have based our reputation on service, reliability, integrity, and innovation and have responsibly served our industrial and energy customers with dependable equipment and systems for compressed air, gas, process gas, and hydraulic applications. We've been able to maintain success over the years by doing three things: treating employees like family, focusing on our clients and partners, and being a local company with a national reach. For more information, visit www.dearingcomp.com.

Universal Compressed Air to Supply Compressed Air to John Deere

Universal Compressed Air (UCA) has been selected by John Deere to install a Compressed Air System at John Deere's foundry in Waterloo, Iowa. UCA will build, own and operate a state-of-the-art facility to provide compressed dry air to John Deere under its long-term Pipeline Air™ performance contracting model. A Pipeline Air™ contract

System shown is similar but not actual facility at John Deere's foundry.

combines UCA's compressed air supply expertise with the capabilities of highly efficient centrifugal air compressors, air dryers, cooling systems and master control system.

UCA will execute the design, construction, commissioning, startup, maintenance and operations of the new plant. Pipeline Air™ is designed to allow companies to outsource compressed air needs as a utility, reduce energy and carbon footprint, preserve capital, and focus on their core business. UCA is delighted to deliver Pipeline Air™ to another leader in the manufacturing industry.

About UCA

Universal Compressed Air is a privately-owned and thriving high-technology business in Pennsylvania's Lehigh Valley focused on compressed air systems for industry. UCA brings decades of Industrial Gas expertise to Compressed Air Supply Systems. The systems are optimized to deliver compressed air as a utility and, in every case, an efficient and reliable solution will be designed and built to maximize savings. As a compressed air supplier, the systems are proven, trusted, and designed to optimize the end user's success. UCA's Pipeline Air™ enables large air users to benefit from a solution tailored to their site's specific requirements. For more information about UCA, visit https://ucaair.com/.

Compressed Air Industry News

PneuTech/Unipipe Appoints West & Midwest Sales Managers

PneuTech/Unipipe announced two veterans of the compressed air piping industry have joined its team. Lance Frederick will be working to connect compressor dealers, piping supply houses and mechanical contractors in the Western United States and will continue to be based near Phoenix, AZ. John Vicat is joining the company with a similar resume and will focus on markets throughout the Midwest from his home office near Kansas City, MO. The addition of these two industry leaders now positions PneuTech and Unipipe to fully support a dealer/reseller network across the entire country.

John was exposed to the industry when he was 12 years old at a trade show in Tulsa. His dad owned a company that sold air feeders and needed help manning the booth. That experience sparked an interest in manufacturing that lasted throughout high school and led to a position as a manufacturer rep for motors, drives and automation supplies. He then was a distributor for Sturgis Automation, where he really got into compressed air and piping. John also worked for Kaeser Compressors and Air Capital Equipment, a Sullair distributor in Springfield, MO.

Through those experiences, John also became an expert in compressed air systems through performing audits and working with his customers to improve the efficiency of their systems. Most recently, John was a manufacturer's rep for AirCom piping.

"I'm so excited to represent this company, this team and this product. I am looking forward to growing the visibility of Unipipe throughout the Midwest," said Vicat.

Lance started his career with Legris (Parker Hannifin) in sales for the TransAir product line. He then was involved with Compressed Air Distribution, where he also focused on blue pipe. There, he had the opportunity to perform air audits, gaining a true understanding of the bigger picture of energy efficiency and the real cost of compressed air. Most recently, Lance was with AirCom, establishing inventory and distribution in the Western US. He has worked with notable manufacturing leaders like Boeing, Tesla, Space-X, Apple, Applied Materials and Honeywell.

"I am proud to be part of this team and excited to offer complete solutions to our partners. I look forward to working with design-build, mechanical contractors, and those that support our American manufacturing," said Frederick.

Both new regional sales managers love bringing new technologies and best practices in aluminum pipe systems to their customers. They have a true appreciation for US manufacturing and love working in these environments. They are on a mission to show project managers that traditional compressed air distribution piping is not the best way to go and they need to think differently. Unipipe is a versatile, lightweight and reliable aluminum piping system for compressed air, nitrogen and multi-fluid distribution. Compared to

John Vicat (Midwest), and Lance Frederick (West), Regional Sales Managers (left to right).

black iron or copper piping, Unipipe is easier to install, longer-lasting and has more secure fittings, minimizing leaks in the distribution system. With these new hires, the company is now poised to bring Unipipe's advantages to a broader audience across the US and bring enhanced product support to new and current customers and dealers across the US.

About PneuTech/Unipipe

Unipipe is the premier aluminum compressed air piping system offered by PneuTech and is distributed nationwide. The Unipipe system is engineered for fast installation, secure leak-free fittings and superior longevity. The aluminum piping system is available in a wide range of sizes and high working pressures for compressed air, nitrogen and multi-fluid distribution. PneuTech specializes in providing best-in-class rotary screw compressors, air dryers, and in-line filtration for manufacturing, production, processing, automotive and any industrial application that requires clean, reliable, efficient and dry compressed air. Its products are developed and distributed through partners in the US, UK, Australia and New Zealand. For more information, visit www.pneutech.com/usa/.

Howden Acquires Compressor Products International

Howden announced that it has completed the acquisition of Compressor Products International ("CPI"), a leading provider of aftermarket components and services to the global reciprocating compressor market. Headquartered in Houston, Texas, USA, CPI manufactures precision-engineered, custom aftermarket products which are vital to the longevity, efficiency and safety of reciprocating compressors.

This marks Howden's sixth acquisition of 2021 and is well aligned with Howden's strategy of expanding its global aftermarket presence in the compressor market. By leveraging CPI's strategically located service centers, Howden will expand its aftermarket services and coverage across North America and Europe. CPI's valves and aftermarket products are complementary and strategically important additions to Howden's existing aftermarket compressor technology portfolio. As a result of this acquisition, Howden's addressable markets will increase by $1 billion.

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Compressed Air Industry News

As part of Howden, CPI will be able to access growth opportunities through additional technology support from Howden and by leveraging Howden's existing global distribution and services network in China, Asia Pacific and South Africa. With CPI's predominantly aftermarket revenues, this acquisition will be accretive to both Howden's aftermarket mix and overall margins.

This acquisition also reinforces Howden's role in supporting the ongoing energy transition towards renewable sources of energy. Howden will leverage CPI's reciprocating compressor technology to support customers through their energy transition.

Ross B. Shuster, CEO of Howden, said, "Reciprocating compression technology is critical to the energy transition, with applications in hydrogen production and infrastructure, as well as biofuel production. CPI's technology, expertise and aftermarket presence will allow us to serve customers looking to improve the performance and extend the life of their vital compressor assets across a wide range of industries. The acquisition of CPI will bring benefits to customers of both Howden and CPI. We're proud to welcome the CPI team and the CPI brand into Howden."

About Howden

Originally founded by James Howden in Scotland as a marine engineering firm in 1854, Howden has grown and evolved into a global leader in manufacturing air and gas handling solutions. With the power of our engineering expertise and technology, our equipment plays an integral role within our customers' processes, which provide safe and reliable solutions that are both sustainable and efficient. Howden supports multiple sectors including infrastructure, power generation, oil & gas, wastewater, metals, mining and transportation. For more information, visit www.howden.com.

CPI manufactures precision-engineered, custom aftermarket products.

Importance of Maintaining Screw Air Compressor Valves

By Gershom Joel, Product and Support Manager, ELGi North America

Conventionally when we talk about oil lubricated screw air compressor maintenance, it is mostly about replacing consumables such as filters and lubricant on time. While these consumables have a defined usable life and have a direct effect on the efficiency and the life of the air compressor itself when not replaced on time, there are a few critical valves in the air compressor that require maintenance as well. Compressor valves directly affect the efficiency, safety, and the functionality of the screw air compressor. Let us understand some of the commonly available valves in a screw air compressor, why they need maintenance, and discuss some of the frequently asked questions about screw air compressor valves.

Types of valves and how they impact the performance of a screw air compressor

A screw air compressor is very similar to a human heart. While a human heart has tricuspid, pulmonary, mitral, and aortic valves, a screw air compressor has four critical valves namely air inlet, minimum pressure, blow down, and safety valves.

Air Inlet Valve

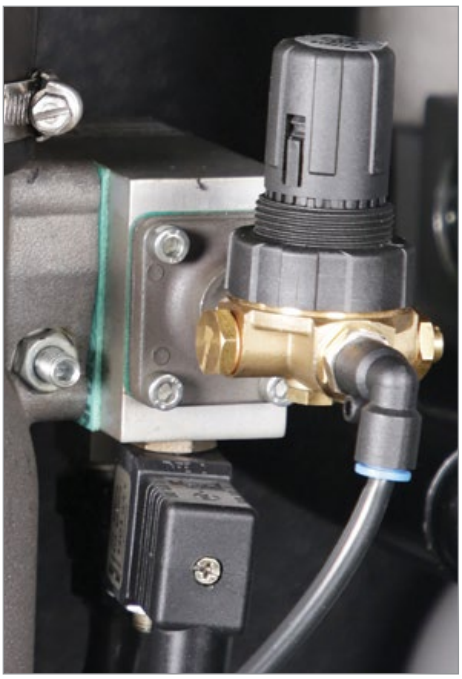
Air inlet valve is also commonly known as the "Intake valve" which is typically assembled on the airend's intake. The air inlet valve of a conventional fixed speed screw air compressor controls the air intake into the compressor. It remains closed when the compressor starts to lower the starting load on the main motor and when the desired working pressure is attained in the compressed air circuit and thus enabling the compressor's motor to run without any load. In some compressors that are capable of providing a variable output by modulating the amount of air it sucks in, the inlet valve holds various opening positions to regulate the volume of air entering the compressor. The effective performance of the inlet valve directly affects the compressor's capacity and its power consumption during load and no-load conditions.

The **minimum pressure valve** is typically assembled on the exit of the air-oil separation tank of a compressor. The minimum pressure valve acts as a check valve preventing back flow of compressed air into the airend, retains a minimum pressure in the compressor system for lubrication, offers a restriction to avoid a collapse of the air-oil separation filter, and ensures a suitable velocity of flow across the air-oil separator that ensures efficient air-oil separation. The effective performance of the minimum pressure valve directly affects the compressor's lubrication, air-oil separation efficiency, and power consumption during load and no-load conditions.

The **blow down valve** is typically found on a dedicated exhaust line from the air-oil separation tank. The blow down valve evacuates the compressed air in the air-oil separation tank each time the compressor runs on a no-load and when the compressor shuts down to ensure there is no back pressure when the compressor starts to load next time. The blow down valve of a conventional screw compressor is typically

Minimum Pressure Valve

Importance of Maintaining Screw Air Compressor Valves



Blow Down Valve

actuated by a solenoid valve. The effective performance of the blow down valve affects the compressor's power consumption during un-load, capacity of the compressor when running on load, and the life of the motor.

The **safety valve** is typically mounted directly on the air-oil separator tank. The only function of the safety valve is to blow off the compressed air in the air-oil separation tank when the pressure in the air-oil separation tank exceeds the set pressure of the safety valve and there by prevents the tank from cracking under high pressure. A malfunctioning safety valve affects the safe operation of the air compressor or results in leakage of compressed air continuously.

Safety Valve

Why do screw compressor valves lose efficiency over time?

Though each compressor manufacturer has their own unique valve design, compressor valves in general contain moving parts such as springs, valve plates, and plungers that affect the opening and closing of the valves and rubber seals / seats that offer perfect sealing when the valves remain closed. These moving parts wear or lose their mechanical properties over a period of time and the sealing components typically "age" over time and lose their effectiveness and will need to be replaced.

Compressor manufacturers typically design these components to operate efficiently for several thousand or millions of operation cycles. However, several factors such as variability in the demand pattern, sizing of the air compressor against a certain air demand, the environment in which the air

compressor operates, promptness of preventive maintenance, etc. determine how long these valves efficiently operate.

Why do screw compressor valves need preventive maintenance?

Many times, it is difficult to identify a malfunctioning valve or a valve operating with worn-out parts as the compressor continues to generate air. The typical symptoms of a malfunctioning valve are loss in compressor's capacity, increase in power consumption during load or/and unload, drop in discharge pressure, increase in oil carry-over and more load on motor. These symptoms are either difficult to notice or have other frequently common assignable causes such as air leak before suspecting the compressor valves.

Case studies show that operating a screw air compressor with a worn-out / malfunctioning valve could increase its overall power consumption by 10–15%. Power cost contributes to more than 75% of the compressor's total life cycle cost over ten years and hence this is a significant impact. Unserviced valves also lower the life span of downstream accessories by half. In some cases, a malfunctioning safety valve may result in a catastrophe.

Air compressor manufacturers typically offer convenient valve maintenance kits for customers that contain the internal parts of the valve that wear or age out. Changing the valve kits is a much more sensible and economical option than changing the complete valve.

What is the recommended frequency to maintain a screw compressor valve?

It is difficult or almost impossible to identify a malfunctioning valve unless it is opened for inspection. Hence it is absolutely mandatory that these valves are inspected for effectiveness every year and the internal moving parts replaced as a part of preventive maintenance once every year or two depending on the operating conditions of the air compressor. It is typical for compressor manufacturers to

Importance of Maintaining Screw Air Compressor Valves

mandate a valve kit replacement once every two years as a proactive measure.

In particular, the safety valve must be inspected and certified every year per the local safety laws to ensure they are functional and efficient. Sometimes, replacing the safety valve entirely with a valid certificate for one year is more economical as the certification procedures could be equally expensive on an existing valve.

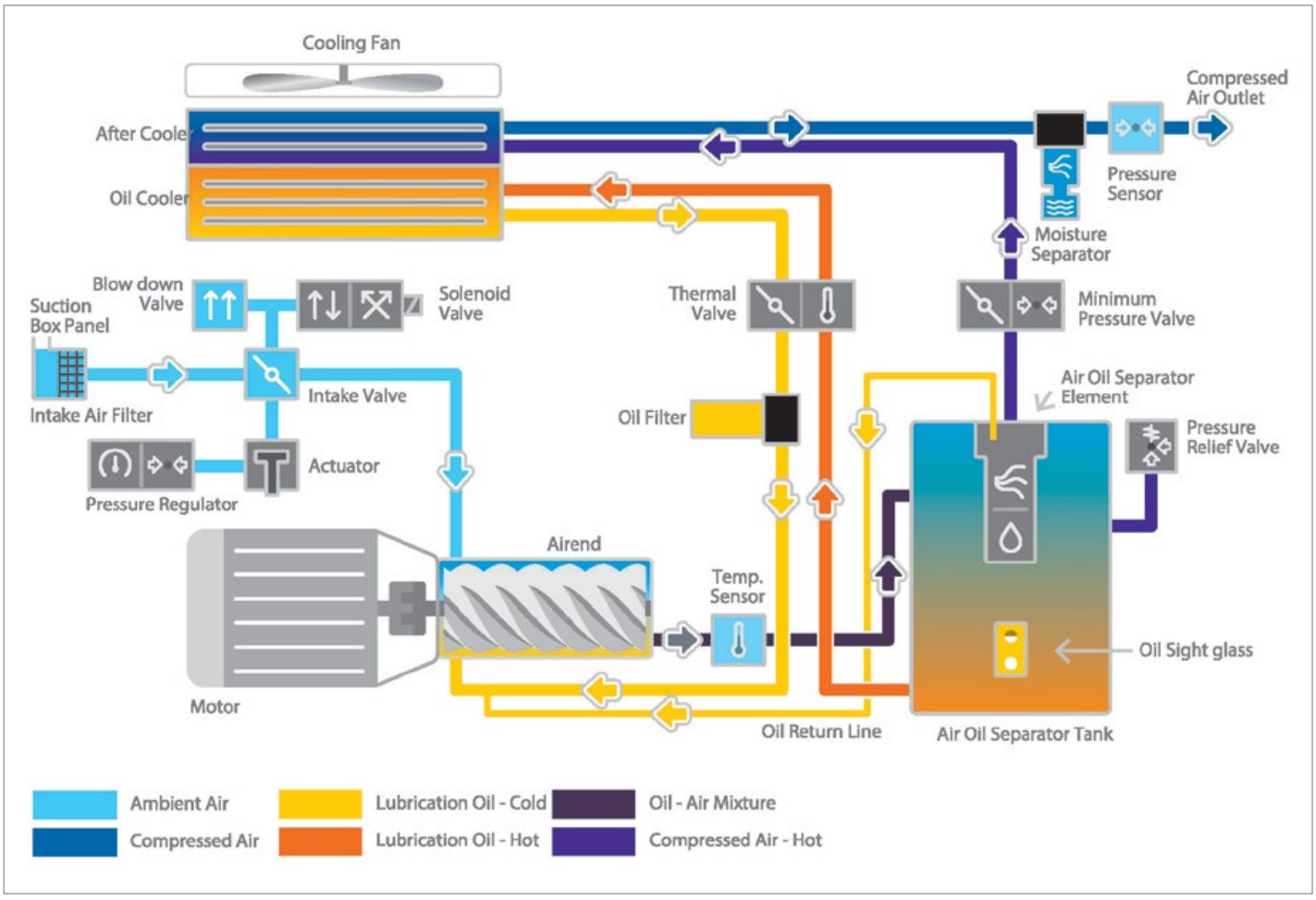
A timely preventive maintenance on these valves pays back several times as the compressor operates efficiently and safely.

How to identify a compressor that could potentially have a worn-out valve?

As stated before, it is challenging to identify a valve that is worn out unless it is opened and inspected, but there are a few indicators that a qualified compressor technician can use to deduct a malfunctioning valve.

Based on Operating Conditions

- **Low duty cycle operation:** A sophisticated screw air compressor in today's day and age carries a convenient microprocessor-based human-machine interface that keeps track of operating hours of the compressor under load and un-load conditions and the number of load/unload counts the compressor is subjected to over a period of time. A higher un-load hours and load/unload count indicates that the air compressor is oversized against the actual air demand. This in turn indicates the air compressor "cycles" frequently between load and un-load mode as opposed to running continuously on load. Every time a compressor "cycles", the inlet valve, blow down valve, and minimum pressure valve is brought into play where their internals "actuate". Frequent actuation of these valves results in a faster wear of the internals and hence results in shorter life.



- **Extreme operating environment:** An abusive environment that is dusty or abrasive also at times impacts the lifespan of these valves.

Based on Operating Parameters

- **High operating temperature:** A compressor that runs on a high operating temperature affects the life of the valve's sealing components, which causes them to "age" fast.

- **Compressor not building pressure:** If the air demand has not changed over time and the facility is relatively free of any air leakage, the air compressor is probably not delivering the rated output. There is a high probability that there is a malfunctioning valve.

- **Increase in compressor's power consumption:** An increase in the air compressor's power consumption profile over a period of time where there has been no abnormal change in the air demand and usage pattern indicates an increase in either the load or un-load power. There is a high probability that this is because of a malfunctioning valve.

Can an oil lubricated screw compressors have valves other than these 4 critical valves?

Based on the design philosophy adopted by the air compressor manufacturer, the oil lubricated screw air compressors could have a few more valves that are critical to functional performance that must be maintained as well. Some of the other valves frequently used in an air compressor are as follows:

- Temperature control valve (also known as thermal valve) is used to regulate the flow of oil through the oil cooler based on the operating temperature.

Importance of Maintaining Screw Air Compressor Valves

- Oil stop valve is used to prevent the back flow of oil from the airend through the oil injection port.
- Discharge check valve is used to prevent back flow of compressed air into the airend through the discharge port of the airend.
- Flow regulation valve (ball valve or gate valve) is used to isolate the compressor's output and is located in the outlet of the compressor.
- Drain valves are used to drain lubricant at the time of lubricant change over or cleaning. Air compressors equipped with a moisture trap at the outlet of the after cooler also has a drain valve (automatic or timer based) to discharge water collected.
- Oil sampling valve is used to take lubricant samples while the compressor is still running.
- Flow check valves are used in control lines and lubrication lines to regulate the flow of lubricant or control air in a certain direction.

The presence or absence of one of these valves and the type of actuation of these valves (electronic / mechanical) depends on air compressor's design architecture. The Operation and Maintenance Manual (OMM) and the Piping and Instrumentation Diagram (P&ID) supplied by the air compressor manufacturer are excellent resources that explain the purpose, functioning, and maintenance requirements of these valves.

Why is it important to use genuine valve kits supplied by the air compressor manufacturer?

Many of the air compressor valves are highly specialized and exclusive. Their designs are usually complex and some even need special tools to service them. The internal components' build quality and material selection are extremely important

and proprietary. Hence it is highly critical that only genuine valve kits issued by the air compressor manufacturer are used to maintain the valves. An inferior after-market replacement will most certainly compromise the performance of the entire compressor, void the original manufacturer's warranty of the compressor, cause consequential damage to other parts of the compressor, and above all, be a safety hazard.

In conclusion, while it is important to change the screw air compressor's filters and lubricants on time, it is equally important to perform preventive maintenance on these critical valves in a screw air compressor as recommended by the air compressor manufacturer. While the intake valve, minimum pressure valve, safety valve, and blowdown valve are critical to the performance and safety of the compressor, there could be other valves in the compressor that are critical and need maintenance. The air compressors sizing and the environment in which it operates are crucial factors that affect the life of the air compressor. Finally, it is critical to proactively service these valves using genuine kits issued by the compressor manufacturer to enable the air compressor performs efficiently and safely.

Healthy Valves = Healthy Screw Air Compressor BP

About the Author

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Gershom Joel has over 15 years of experience in the compressed air field and specializes in helping industries such as Pharmaceuticals, Textile, Electronics, and Food and Beverage find compressed air solutions to meet their unique requirements. Gershom holds a Mechanical Engineering Degree from Anna University and a Masters in Business Administration from University of North Carolina.

About ELGi North America

ELGi North America, headquartered in Charlotte, NC, is a subsidiary of ELGi Equipments Limited, a leader in compressed air solutions for over 60 years. Established in 2012, ELGi North America, in conjunction with its subsidiaries, Pattons, Pattons Medical, and Michigan Air Solutions, offers a comprehensive range of compressed air products and services. Our product offering includes oil-lubricated and oil-free rotary screw and reciprocating compressors, dryers, filters, and ancillary accessories. ELGi and its subsidiaries serve multiple industry verticals spanning medical applications, pharmaceuticals, food & beverage, construction, manufacturing, and infrastructure. For more information, visit https://www.elgi.com/us/.

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Why A Centrifugal Air Compressor May be the Better Choice

By Richard Huguenor, Business Development Manager for Oil Free Products, Sullair

Centrifugal compressor at glass manufacturer.

The demands of maintaining an efficient and productive manufacturing operation are many. With an increased focus on environmental concerns and constant cost optimization initiatives, machinery purchase decisions are more important than ever. When selecting an air compressor for your manufacturing operation, the common choice is the industry-standard rotary screw compressor. Known as the work horse of compressed air machinery, the rotary screw compressor comes in a multitude of sizes and power levels. However, centrifugal compressors have seen some exciting technological progress in recent years and offer a wide range of pressures, flow and turndown. Long known for their longevity and durability, they offer higher efficiency, even qualifying for energy rebate programs offered by local utilities and all, notably, produce Class 0 oil free air.

When choosing your air compressor many factors play into making the right choice. Whether it is the variety of applications, cost and energy savings, reliability and longevity, modern centrifugal compressors can often be the smartest choice – depending on your application and manufacturing environment – making them worth a second (and first) look.

But First, a Little History…

Before we take that look into why a centrifugal air compressor may be worth examining for your operation, it is interesting to note that centrifugal compressor technology has been around a long time. The origin can be traced

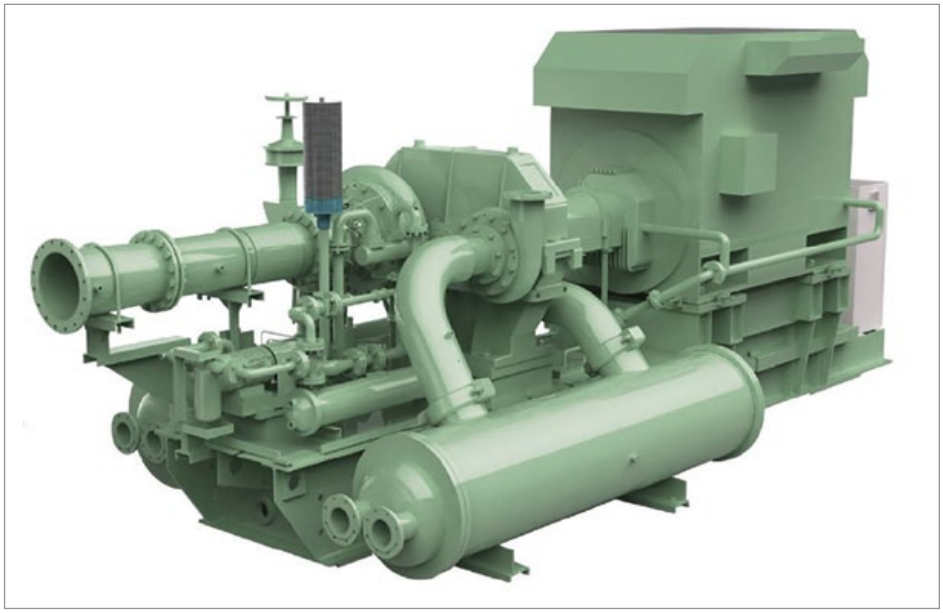
back to the year 1689, when French physicist Denis Papin and Dutch physicist Christian Huyghens collaborated by experimenting with an air compressor, using centrifugal force to compress air. As the physics community gained a better understanding of fluid and thermal dynamics, the centrifugal compressor evolved from a crude single impeller blower into the multi-stage modern compressor we use today.

A Compressor for Every Plant Demand Scenario

History aside, this century, centrifugal compressors have traditionally been known as a baseload compressor and not suitable for compressed air systems with large changes in demand. This may be true of older models where the typical inlet modulation turndown using a butterfly style inlet valve was only 10-20 percent less than full flow. This means the compressed air system flow demand drops from 100 percent to 60 percent, the older design centrifugal compressor would inlet modulate down to 80 percent flow, deliver 60 percent flow to the compressed air system, and blow-off 20 percent to atmosphere. Wasting 20 percent of the air product is less than ideal, especially when efficiency matters.

Modern centrifugal compressors, however, have much more flexibility in turndown using a modern inlet guide vane inlet valve and can modulate beyond the 10-20 percent less air flow of early machines, up to 50 percent turndown. This is in part due to fast and powerful microprocessor controllers that run many control loops simultaneously as well as advances in computer aided impeller design. The modern inlet guide vane is mounted very close to the first stage impeller and imparts a beneficial "swirl" to the inlet airstream reducing turbulence and improving energy efficiency

Why A Centrifugal Air Compressor May be the Better Choice



Centrifugal f-series.

up to 8 percent compared to a butterfly inlet valve. The inlet guide vane precision blade design results in faster control valve responses, to changing demand, along with better overall energy efficiency. Having more turndown means the centrifugal compressor can be installed in a compressed air system with large flow variability and not blow-off during low flow applications. And, because of the nearly endless turn down scenarios, one centrifugal compressor can do the job of several smaller rotary screw compressors.

With this turndown flexibility, a wide range of pressures and flow, and with up to 10,000 hp, the modern, multi-stage integrally geared centrifugal air compressors can cover most applications. Automotive, steel, glass, food and beverage, air separation, large industrial manufacturing to chemical and petroleum processing applications are all possible. There are also custom seal designs available for specialty gas processing.

Oil Free Air Comes Standard

The issue of oil free or Class 0 oil free air is becoming a hotter topic in manufacturing. The International Standards Organization (ISO) 8573.1 Air Quality Classes for compressed air defines contaminants allowed in the end product air. Oil free applications require Quality Classes "1" or "0" for total oil concentration. Less than 0.01 mg/m³ is Class 1 and anything lower than Class 1 is Class 0. As the most stringent air quality class, Class 0 ensures that a compressor discharges compressed air free of oil aerosols, oil vapors or oil liquids coming from the compressor.

In any application, compressed air directly or indirectly contacts the manufactured product.

When using oil flooded air compressors, it is possible for the air to make it downstream and contaminate the product. In applications such as food and beverage, pharmaceuticals or sensitive technology manufacture, this contact with residual oil from a compressed air system has obvious consequences, making Class 0 air vital for maintaining product quality and the health and safety of consumers.

Thankfully, centrifugal air compressors are oil free by design. They produce Class 0 oil-free air making them ideal not only for sensitive manufacturing environments, but also for manufacturers looking to move away from oil flooded for sustainability or maintenance reasons. Sustainably speaking, centrifugal compressors use less oil than oil-flooded screw compressors – upwards of 55 more gallons of oil every 6-12 months. This oil along with oil-contaminated condensate needs to be disposed of properly. Condensate from a (oil-free) centrifugal compressor does not need special handling/disposal and may even be recycled.

Further, many multi-national manufacturers are moving to oil-free compressed air systems to protect themselves against potentially damaging effects – such as contaminating end product, damaging production equipment, causing downtime or damaging their brand's reputation due to the low quality of the end product and/or product rejections. Class 0 oil free compressors help eliminate potential contamination as no oil or lubricant is introduced into the air compression process. Oil free just may be the wave (or at least a ripple) of the environment-forward future for most processes.

Efficiency and Cost Savings to Boot

As previously mentioned, centrifugal compressors provide superior energy efficiency for large volumes of air as advanced technology impellers are designed to match the required airflow and pressure. This means additional energy savings – in excess of $100,000 in some cases – and opportunities to qualify for most local government energy rebate programs. As an added bonus, oil-free air in general requires less filtration downstream and less product and equipment contamination. This means less maintenance and more cost savings, especially over the long-term life of the machinery.

Centrifugal compressors also provide low maintenance costs as they're designed with many non-contacting internal components. This means less friction wear and minimal maintenance needs. Most centrifugal compressors run continuously up to two years between shutdowns for basic maintenance allowing more uptime and less downtime compared to other compressor types. And, that long life can be from 40-60 years as compared to 20-30 years for rotary screw air compressors. Not having to replace your mission-critical air compressor for decades to come is a comforting thought.

Understanding that centrifugal air compressors can and should be part of your short list when shopping for air compressor solutions for your manufacturing operation is half the battle. Knowing that there are benefits and options

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Why A Centrifugal Air Compressor May be the Better Choice

Sullair Centrifugal TRE 1000 hp Installation at chemical producer.

available beyond rotary screw compressors means more choices and better performance, efficiency and results – depending on your application. Do your research, but when the time comes, don't forget to look at centrifugal compressors as a viable, durable and environmentally-sound option. BP

About the Author

Richard Huguenor is the Business Development Manager for Oil Free Products at Sullair and brings 22 years' experience in the centrifugal compressor industry to his position. Richard joined Sullair in 2015 as a sales engineer in oil free products. He is currently responsible for market growth in the oil free in the North American region.

About Sullair

Sullair, founded in Michigan City, Indiana, in 1965, is a leading global provider of compressed air solutions. The company was one of the first to execute rotary screw technology in air compressors, and its machines are known throughout the world for their reliability, durability and performance. Sullair became a Hitachi Group Company in July 2017. For more information, visit www.sullair.com.

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Three Ways To Make Packaging Lines More Sustainable

By Andres Abreu, Packaging Business Development Manager, Assembly and Welding, and Mark Densley, Director Business Development Factory Automation, Emerson

Pneumatics and ultrasonic welding technologies can help consumer packaged goods companies optimize energy use and improve OEE.

Sustainability is a high priority for today's consumer packaged goods (CPG) companies. Driven by environmental responsibility, government regulations and customer preferences, CPGs are actively seeking ways to decarbonize their packaging lines and use eco-friendly packaging materials. Many have started monitoring the energy consumption of their equipment in real time and upgraded critical areas of their packaging processes using two key technologies: pneumatics and ultrasonic welding.

While companies have long relied on the proven performance of pneumatic technologies in their packaging lines, the latest pneumatic devices feature specialized capabilities and connectivity that can help optimize energy use, improve overall equipment efficiency (OEE) and maximize performance. Compared to traditional heat sealing, ultrasonic welding offers precision, reliability and efficiency that can minimize waste, improve packaging compostability and reduce energy consumption.

Here are three ways that CPG companies can incorporate these sustainability technologies to improve the environmental impact – and boost the OEE – of their packaging lines.

Optimizing Compressed Air Use

Compressed air is used to help operate equipment and power processes throughout packaging lines, including bottle production. While its prevalence can mean a high potential for energy loss, the right tools can turn it into a valuable opportunity for energy savings.

Not long ago, there was no reliable way to evaluate compressed air consumption. The digital transformation of pneumatics has changed that. Today's smart pneumatic devices provide a more complete picture of pneumatic system performance as well as actionable insights that give companies the ability to better understand and effectively control the energy use of their packaging lines.

Smart sensors, combined with an edge computing device, can continuously monitor system airflow and capture real-time flow, pressure and actuator speed. When properly analyzed, this data can help detect leaks and optimize compressed airflow. (Figure 1)

Using the edge analytics, operators can see the relationship between air pressure, flow and the speed of the actuator more clearly. By better understanding the true nature of this relationship, operators can determine the optimal consumption point of compressed air for their packaging processes.

If the analyzed incoming pressure is higher than process requires, and more compressed air is being used than needed, operators can reduce the pressure and modulate airflow while maintaining the same cylinder cycle time. By optimizing the amount of compressed air to meet operational requirements without affecting production, companies can minimize energy use.

Figure 1: By continuously monitoring pneumatic systems in real time, Emerson's AVENTICS™ Series AF2 Series flow sensor can help CPGs detect and address compressed air leaks early. (image courtesy of Emerson)

In addition to optimizing compressed air use, software monitoring can also help operators detect leaks in near-real time. Once it detects a leak, the monitoring system sends an alert to maintenance personnel, who can then investigate the equipment in question. In this way, operators can address compressed air leaks much sooner, preventing compressed air loss and reducing emissions. (Figure 2)

In analyzing individual companies that have implemented pneumatic solutions to control air leakages, their improved overall equipment efficiency (OEE) has shown that facilities can typically save 10-20% in compressed air energy costs and see a carbon footprint reduction of up to 10% through early leak detection and optimized air consumption.

Three Ways To Make Packaging Lines More Sustainable

System monitoring can help reduce downtime and improve OEE, too. Companies no longer need to plan downtime and have technicians test each machine for leaks, and leaks are sealed before they can cause fluctuations in system pressure. Leak-related fluctuations can make machines cycle more than needed, and this extra work wastes energy, prematurely wears equipment and components and increases maintenance.

Perfecting PET Bottle Production

The polyethylene terephthalate (PET) bottle is the most widely used bottling product in the world. It is so popular, about 3,500 stretch blow molding (SBM) systems are built and deployed annually to meet demand. The latest systems combine the SBM process with the bottling process in one continuous production flow.

This combination production system obviously makes lines more compact and reduces a bottler's carbon footprint by eliminating the shipping step that occurred between bottle production and filling. Pneumatic technology is a key part of their construction.

Pneumatics power several key areas of SBM machines. Pneumatic air preparation systems improve efficiency and offer better control of the low- and high-pressure air that preform actuators and stretch blow bottle expansion steps use. And compact, high-performance blowing blocks provide bottle volume growth control through pre-blow, blow, recycling and exhaust functions.

Some suppliers have advanced SBM pneumatic performance, and sustainability, even further.

Figure 2: Operators can view pneumatics data and valuable insights on an easy-to-read local dashboard, making it simple to quickly respond to issues if they arise. (image courtesy of Emerson)

For example, one supplier offers a proportional control valve developed for the pre-blow expansion step in PET production that replaces an on/off high-pressure flow and, quite honestly, revolutionizes this bottle production step. Where the previous on/off high-pressure flow set a uniform flow rate throughout the blow process, the new control modulates the flow to fine-tune each bottle's expansion within the mold. (Figure 3)

This advanced proportional valve technology combines a specially designed proportional valve, control electronics and software, which can either store the blowing sequence setpoints in the valve or respond to control directions from the stretch blow molding (SBM) programmable logic controller (PLC) that directs the blowing process. The resulting bottle grow is intelligently modulated, giving end users the ability to perfect how the heated bottle expands within the mold. (Figure 4)

The system can also capture feedback results for the quality of each blow, providing critical data needed by bottle manufacturers to perfect the process and minimize the number of rejected, wasted bottles. It also provides condition monitoring data to support routine and preventive maintenance programs.

Proportional technology for PET blowing moves pneumatics to a whole new level of sustainability for this process. It offers the potential to reduce material consumption with the capability to fine-tune bottle wall and shape formation, to create thinner, more lightweight containers. It also saves energy by potentially reducing blow air pressure required for high-quality bottle formation and by reducing the heating temperature in the pre-blow oven.

Three Ways To Make Packaging Lines More Sustainable

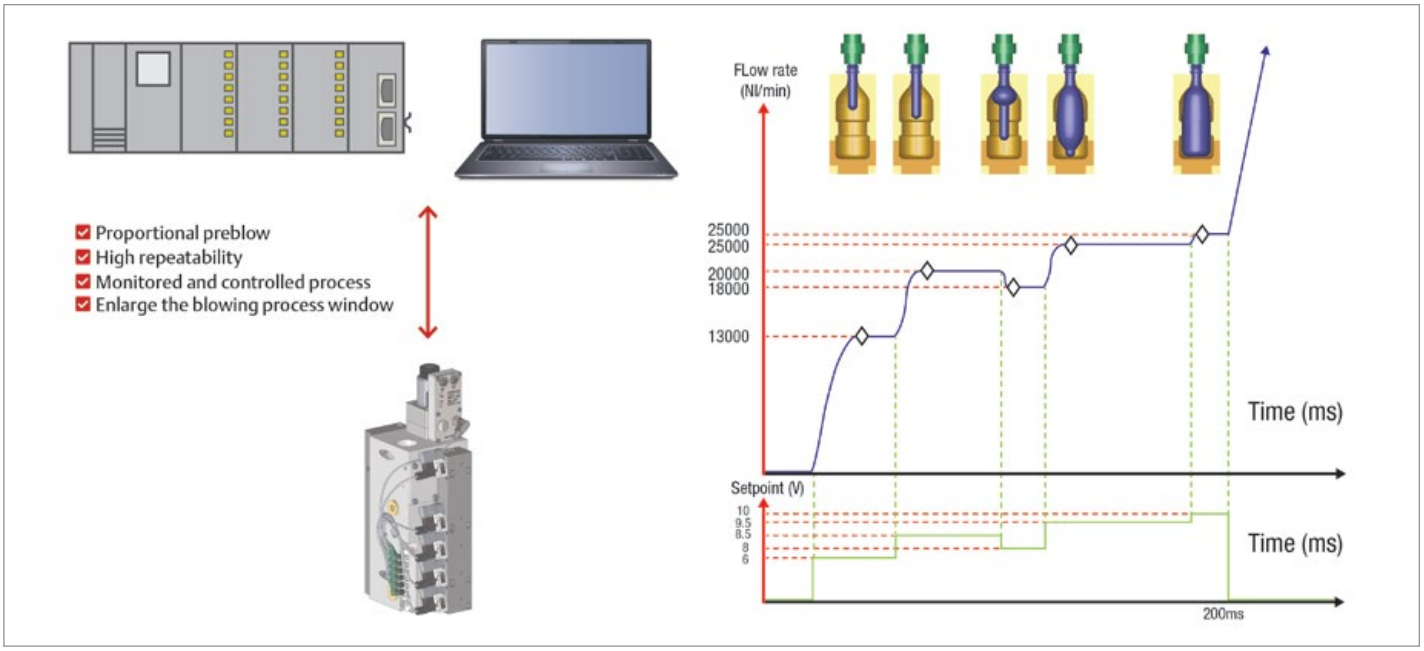


Figure 3: By integrating a proportional control valve instead of using on/off high-pressure airflow in their pre-blow expansion step, PET bottle manufacturers can better modulate bottle growth.

In addition to its energy saving benefits, proportional technology for PET blowing also enables the high throughput production of more complex bottle shapes, which is a critical goal for a bottler's marketing purposes. It also increases manufacturing flexibility, since the process can be easily changed via software/PLC formula specific to each blowing station on the machine and fine-tuned for further improvement without stopping production.

Implementing Ultrasonic Welding

To make sealing applications greener, ultrasonic welding offers many advantages compared to traditional heat sealing. Its precise, reliable capabilities and efficiency allow end users to reduce energy consumption, confidently use biodegradable packaging, minimize product and packaging waste and improve packaging recyclability and compostability. This sustainable technology can ultimately save energy by up to 25% and reduce carbon footprints by up to 75%.

Ultrasonic welding systems simply use less energy than conduction heat-sealing systems. Ultrasonic welding processes consume energy in short bursts compared to the continuous energy supply that conduction sealing processes require to complete the same production capacity. For example, to complete 100 welds/min over two eight-hour shifts per day, a typical conduction sealing process needs four, 500-watt cartridge heaters (2,000 watts/hour or 32,000 watts/day) to constantly maintain its operating temperature, while an ultrasonic welder of the same capacity would be equipped with a power supply rated at 1,500 watts but would use power in short bursts (e.g., ~200 ms/weld) totaling about 20 seconds/min of total power consumption.

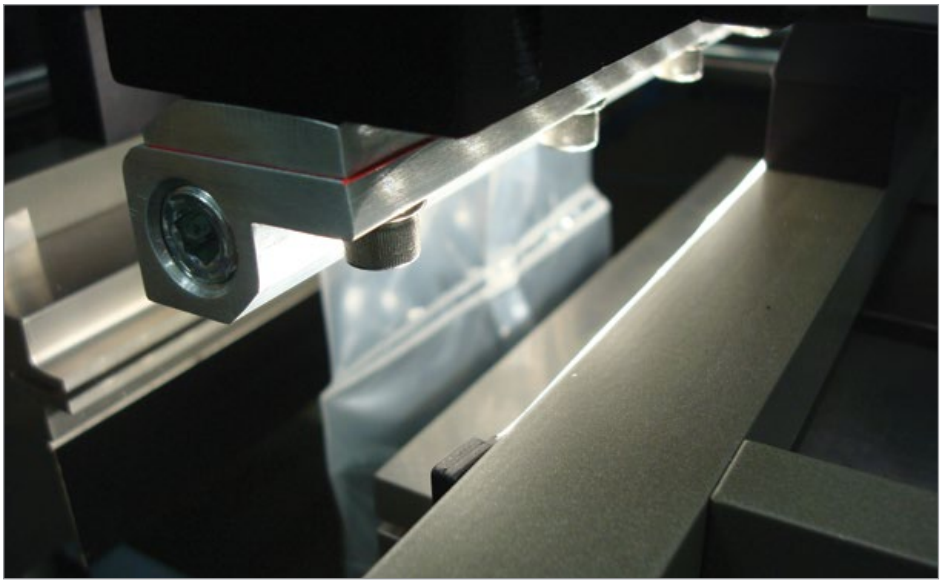


Figure 4: The precision and control of Branson ultrasonic welding components for vertical form fill and sealing (VFFS) systems by Emerson can hermetically seal bio-based materials more reliably than traditional heat-sealing tools.

Three Ways To Make Packaging Lines More Sustainable

Ultrasonic welding is also more compatible with bio-based materials, such as polylactic acid (PLA), than traditional heat sealing. Because biopolymers contain significantly less polymer content, it can be difficult for the simple time, temperature, and pressure settings of a heat sealer to reliably bond this type of biodegradable, single-use packaging and achieve a commercial-grade, hermetic seal. However, the precision and control inherent to ultrasonic welding offers far more capability to manage the narrower processing windows of bio-based resins. (Figure 5)

Ultrasonic welding produces high-quality, consistent package seals without adhesives or consumables. The plastic-to-plastic bond it creates not only simplifies package design, but, since there is no contamination within the seal surface, it also improves material recycling and/or compostability.

In addition to creating a more reliable seal, an ultrasonic weld can reduce packaging material consumption as well as eliminate seal failures due to contamination. To reduce packaging material consumption, ultrasonic welds require only 0.25 inches of total package length when sealing the ends of small snack bags, while conventional heat seals consume about 1.0 inches. Comparably, ultrasonic welding returns 0.75 inches of package length.

To prevent seal failures, the high-frequency, vibratory motion (usually 20, 30 or 40 kHz) of the ultrasonic welding process vibrates potential residue out of the seal area that conventional heated tools often seal in. Because encapsulation of these residues results in contamination, leaks or failures, the clean weld that ultrasonic welding achieves reduces waste while improving seal quality and repeatability.

Achieving a More Sustainable Packaging Line

Consumer packaged goods companies have long counted on pneumatics as an effective, reliable machine technology to package items from soda bottles and cereal boxes to single-serve snack pouches and pharmaceutical blister packs. And

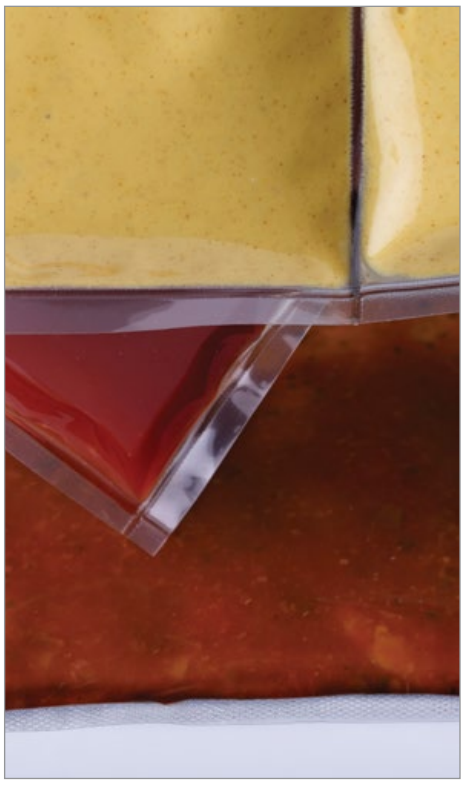


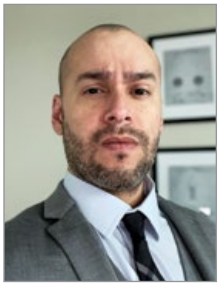
Figure 5: CPGs can eliminate contaminants, decrease waste and reduce weld failures using ultrasonic welding, which creates neat, hermetic seals between package contents — even liquids and purees.

the latest advances in pneumatics, including the digital transformation of the packaging line, promise even greater benefits.

While the right technology will power greener, more compact packaging lines, it's important that CPG companies work with an automation expert who understands smart pneumatics and the distinct characteristics of fluid power applications to achieve their most ambitious sustainability and performance goals. By using a range of pneumatic technologies, including smart pneumatics, companies have the potential to significantly reduce their carbon footprint – while considerably improving OEE. BP

About the Authors

Andres Abreu



Andres Abreu

Andres Abreu is a Packaging Business Development Manager, Assembly and Welding at Emerson. He has over 15 years of experience working primarily for fortune 500 companies, responsible for business development and generating sustainable retrofits in the industrial sector to increase company valuation and reduce environmental impact. He has a bachelor of science in electronic engineering from the University of Akron.

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Mark Densley is a Director of Business Development for Factory Automation at Emerson, specializing in AVENTICS products. In his role, Mark acts as a consultant on Emerson's IIoT Team, which focuses on delivering customers IIoT insights and clear return on implantation investments. Mark has an outstanding understanding and practical application knowledge of automation technologies and engineering solutions.

About Emerson

Emerson is a global technology and engineering company providing innovative solutions for customers in industrial, commercial and residential markets. Emerson's Automation Solutions business helps process, hybrid and discrete manufacturers maximize production, protect personnel and the environment while optimizing their energy and operating costs. Emerson's Commercial & Residential Solutions business helps ensure human comfort and health, protect food quality and safety, advance energy efficiency and create sustainable infrastructure. For more information, visit www.emerson.com.

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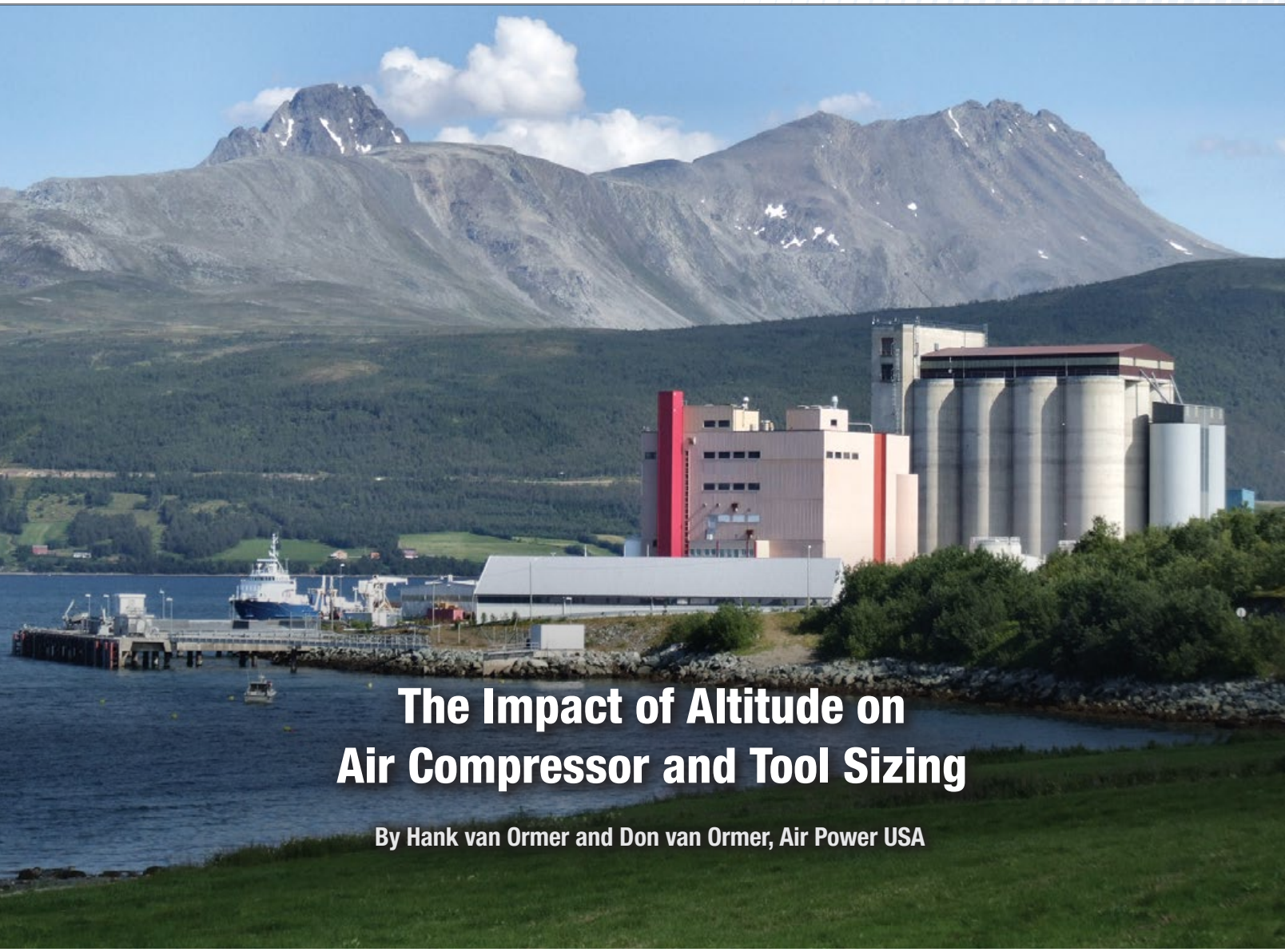


The Impact of Altitude on Air Compressor and Tool Sizing

By Hank van Ormer and Don van Ormer, Air Power USA

➤ Introduction

Two things happen to the air at higher altitude:

1. The air pressure is reduced. Air pressure is a factor of the weight of the air above; as altitude increases there is less air above...so less pressure.

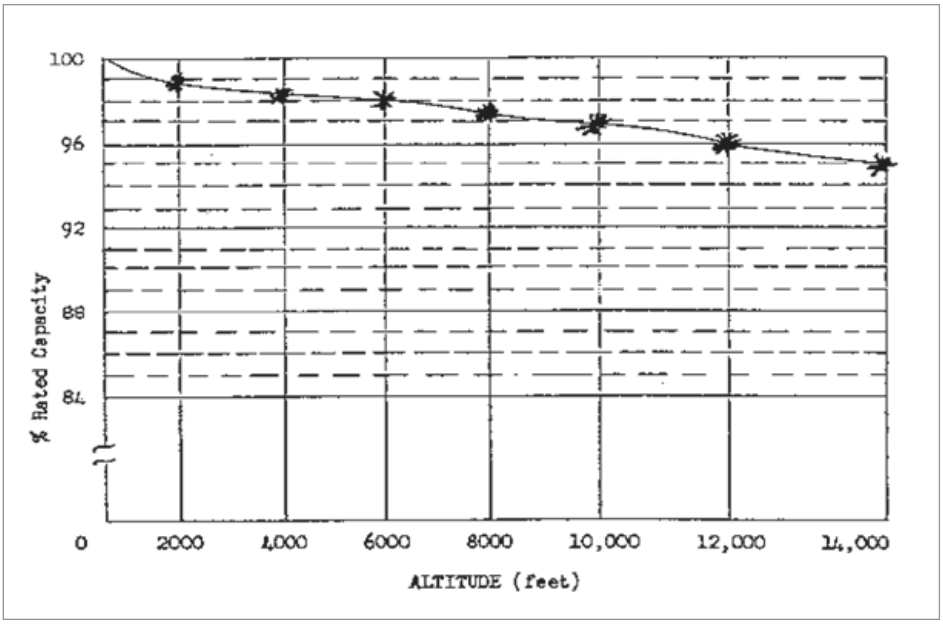
For Example: At Sea Level the air pressure is 14.69 pounds per square inch (psi), while at 5,000 ft. above sea level it is only 12.22 psi. This decreased air pressure causes something else:

2. The air is lighter or less dense. Another way to say this is that there are less molecules of air (or less weight) in a given volume; i.e.: One cubic foot of air weighs less – or has fewer air molecules in it at 5,000 ft. above sea level than at sea level.

The purpose of this article is to analyze what effect this has on the air compressor and using

TABLE 1. CORRECTION FACTORS (MULTIPLIER) FOR ESTIMATING PERFORMANCE AT ALTITUDES (SINGLE STAGE)

	Altitude – Feet Above Sea Level									
	0		3000		5000		7500		10000	
Pressure PSI	Act. Cap.	BHP	Act. Cap.	BHP	Act. Cap.	BHP	Act. Cap.	BHP	Act. Cap.	BHP
40	1.00	1.00	.977	.973	.962	.953	.944	.930	.925	.907
80	1.00	1.00	.957	.960	.928	.934	.892	.901	.856	.868
100	1.00	1.00	.947	.959	.912	.932	.868	.898	.824	.864
150	1.00	1.00	.924	.956	.874	.928	.811	.892	.748	.856



tools/or air motors. Keep in mind the following definitions:

1. **FAD / ACFM –** This is the actual air delivery of the compressor in cubic feet per minute rated at inlet conditions of the compressor. ACFM is also called **"cubic feet of free air per minute."** Most air compressors are rated in ACFM.

2. **SCFM = "Standard" cubic feet per minute is ACFM / FAD** converted to "Standard" intake conditions – (60˚F., 60% RH & 14.7 psig usually) for rating using equipment. To size for other than standard conditions, i.e. Altitude or Hot Weather **"corrections"** must be made.

The Effect of Altitude on Air Compressors

Reciprocating compressors – Single Stage

Because of the increased compression ratios and consequent increased effects of re-expansion when operating at higher altitudes, single stage reciprocating compressors lose volumetric efficiency considerably more than injected-cooled rotaries. We have included a table that can be used for correcting the capacity (and horsepower) of an air system from a single stage reciprocating compressor. These multipliers are good for **estimating only...**and for exact details the compressor manufacturer should be contacted.

Reciprocating Compressors – Two Stage

Two stage reciprocating compressors, although not losing capacity as much as single stage, also will lose more than injected-cooled rotaries. Some manufacturers offer special altitude units. We have included a table that can be used for correcting the capacity (and horsepower) of a two stage reciprocating system. Again, these multipliers are only for *estimating* and for exact details the compressor manufacturer should be consulted.

Rotary Compressors – Injected Cooled – Vane or Screw

Non-lube rotaries will have about the same

The Impact of Altitude on Air Compressor and Tool Sizing

losses as a comparable single/two-stage reciprocating and other similar positive displacement units.

The **air intake pressure** is reduced so the *compression ratio is increased to obtain the same discharge pressure.* For example: At Sea Level we have a compression ratio for 100 psig of 114.69/14.69 = 7/8:1 where at a 10,000 ft. elevation we have an intake pressure of 10.10 psia and a **corresponding compression ratio of:** 110.10 psia/10.10 psia = 10.9:1.

FEET	1000	2000	3000	4000	5000	6000	7000	8000	9000	10,000	12,000	15,000
METERS	305	610	915	1220	1526	1831	2136	2441	2746	3,050	3,660	4,577
MULTP.	1.000	1.065	1.100	1.136	1.174	1.213	1.255	1.298	1.343	1.391	1.520	1.665

*Based on 80 - 100 psig Air Pressure.

Example: A given air tool has an actual free air consumption of 600 cfm at 90 psig at sea level. How much air will it use at 10,000 ft. elevation?

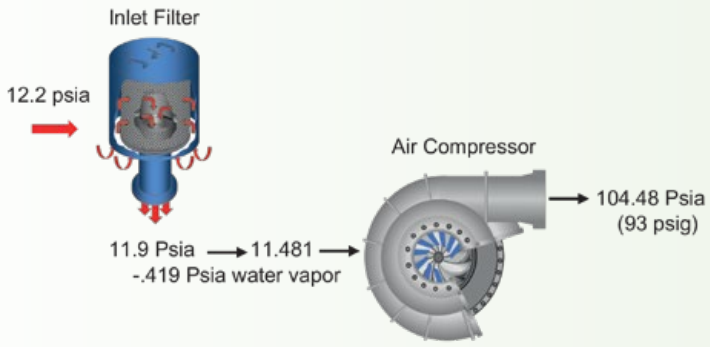
On the table we find that the 10,000 ft. elevation requires a factor or multiplier of 1.391 more air. Therefore 1.391 x 600 = 834.6 acfm of free air required to run the tool at 10,000 ft.

(FAD/ACFM to SCFM) at Altitude

Standard Conditions	(FAD(ACFM) Delivered)	Site Conditions	Actual Room Cond
Psia = 14.5	953 FAD	Psia = 12.2	10.2 psia
Relative Humidity = 0%	Input kW FL 172	RH = 60%	RH = 60%
Air Temp In = 68°F		Air Temp In = 90°F	90°F
Cooling Water = 68°F		Cooling Water = 80°F	80°F

ACFM / FAD to SCFM

.3 Psia = Pressure loss with clean inlet filter
.419 Psia = Water vapor pressure loss (.6198 particle pressure x.6)
10.2 Psia compressor room pressure (Actual Compressor Inlet)



Ambient FAD to SCFM = (953 FAD) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ 953 SCFM = $\frac{(12.2 - .3 - .418)}{14.5} \times \frac{(528°R)}{550°R}$ = 722 SCFM

Actual FAD to SCFM = (953 FAD) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ 953 SCFM = $\frac{(10.2 - .3 - .418)}{14.5} \times \frac{(528°R)}{550°R}$ = 594 SCFM

THIS REFLECTS SCFM IN POSITIVE DISPLACEMENT & DYNAMIC COMPRESSORS – IT DOES NOT NECESSARILY REFLECT THE ABILITY OF DYNAMIC COMPRESSORS TO REACH THE NEEDED PRESSURE (CR's/Discharge Pressure)

1. This increased compression ratio causes a loss in volumetric efficiency (VE) because the increased pressure differential causes greater leakage back to the intake and greater re-expansion effect.

   The following chart shows the actual loss in capacity of an injected-cooled single-stage rotary compressor is only slightly more than 3% at 10,000 ft.

   Example: Using this chart, what acfm will we get from an injected-cooled rotary at 10,000 ft. from a compressor delivering 600 acfm at sea level? The chart shows a 96.8% of rated capacity at 10,000 ft. altitude; therefore, .968 x 600 = 581 acfm air available from acfm lubricated rotary compressor at 10,000 ft. elevation.

2. You would expect the horsepower requirement of the compressor to be increased because of the increased compression ratio, and it is . . . but this increase is offset by the fact that the volume of air being handled is less dense and lighter – meaning that even though the compressor is handling almost the same volume of inlet air it is a lower "mass flow" or "weight" of air. The net result is that the horsepower draw of a lubricated rotary

compressor remains almost constant as altitude increases.

Effect of Altitude on Air Tools

To visualize what happens in an air tool with regard to air flow, think of the tool as an orifice that will pass a given amount of air by weight with a given pressure differential. For example: a given air tool (orifice) will pass 600 acfm of air at sea level with a 100 psi pressure differential. If we go to a higher altitude with the same tool and the same pressure differential we are now using a lighter, less dense air by weight and consequently the tool (orifice) offers less resistance and will be able to pass a higher volume. In other words . . . **a *greater volume* of less dense (lighter weight) air is required to establish the same working pressure against the orifice (or tool).**

Conclusion

In order for a compressed air system to be designed properly, altitude must be taken into consideration. In order to calculate the demand profile, tool air consumption must also be adjusted for altitude. BP

For more information contact Hank van Ormer, Technical Director, or Don van Ormer, Senior Auditor, Air Power USA at tel: 740.862.4112, email: support@airpowerusainc.com or https://www.airpowerusainc.com/contact/

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JUN 09 — **Sizing and Maintaining Compressed Air Systems**
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JUN 23 — **Compressed Air System Design for Lowest kW/100scfm**
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Thursday, June 23, 2022 – 2:00PM EST

JUL 21 — **Applications for Adiabatic Cooling Technology**
Presenter Bert J. Wesley, Sr. Principal Industrial Plant Engineering Practice Leader, Woodard & Curran – *Sponsored by Evapco*
Thursday, July 21, 2022 – 2:00PM EST

JUL 28 — **ASME PTC 13 Wire-to-Air Performance Test Code for Blower Systems Part 2**
Presenters Hiran de Mel, Senior Project Manager and Principal Technologist, Jacobs – *Sponsored by Howden*
Thursday, July 28, 2022 – 2:00PM EST

AUG 18 — **Liquid Ring Vacuum Pump Sizing Fundamentals & Best Practices**
Presenter Chris Halbach, Senior Applications Engineer, Wintek Corporation
Thursday, August 18, 2022 – 2:00PM EST

AUG 25 — **Avoiding Production Downtime: Realtime Compressed Air Quality Monitoring and Audits**
Presenter: Francisco Lara, Manager, Airtec Global LLC – *Sponsored by SUTO-iTEC*
Thursday, August 25, 2022 – 2:00PM EST

OCT 20 — **Two Factors for Cooling Tower Efficiency: Site Selection & VFD Fan Control**
Presenter Nick McCall, P.E., Technical Manager, Woodard & Curran – *Sponsored by SPX Cooling Technologies, Inc.*
Thursday, October 20, 2022 – 2:00PM EST

OCT 27 — **Compressed Air: What You Don't Know Can Hurt You**
Presenter Ron Marshall, Chief Auditor, Marshall Compressed Air Consulting – *Sponsored by VPInstruments and Kaeser Compressors*
Thursday, October 27, 2022 – 2:00PM EST

NOV 10 — **ASME PTC 13 Wire-to-Air Performance Test Code for Blower Systems Part 3**
Presenters John Conover, Consultant, Mark Addison, Senior Engineer, Artesian Water Company, and Fred Constantino, S&C Project Engineering Advisor, ASME – *Sponsored by APG-Neuros*
Thursday, November 10, 2022 – 2:00PM EST

DEC 08 — **Compressed Air: Reliable Source for Nitrogen Generation**
Presenter Loran Circle, Senior Consultant, Circle Training & Consulting – *Sponsored by Rogers Machinery and Parker*
Thursday, December 8, 2022 – 2:00PM EST

Hiran de Mel
Senior Project Manager and Principal Technologist, Jacobs

Mark Addison
Senior Engineer, Artesian Water Company

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COMPRESSED AIR TECHNOLOGY NEWS

New Kaeser 900 cfm Portable Compressor with Variable Pressure

The M255 is Kaeser's latest addition to our extensive Mobilair portable compressor line. The M255 has two pressure ranges: 848-935 cfm at 125-150 psig and 696-900 cfm at 125-203 psig. This powerful unit is perfect for heavy duty construction, utility and demolition uses and is designed for maximum flexibility and reliability on site.

The M255 is the first Mobilair to feature the new Sigma Control Mobil 2 – offering intuitive touch screen control and real time operational data. Kaeser's exclusive pV Control is standard and can adjust the unit pressure in 1 psi increments. This intelligent controller optimizes compressed air availability and fuel efficiency with our Sigma Profile airend. The 6-cylinder Cummins diesel engine meets Tier 4 Final emission standards and includes both a diesel particulate filter and an SCR catalytic converter.

The M255 has great road handling and is easily towed on the road and at the jobsite with a half-ton pick-up. Kaeser's service friendly design, including wide-opening gull wing doors, spin-on filter cartridges, and easy-filling port access make routine maintenance a breeze.

About Kaeser Compressors, Inc.

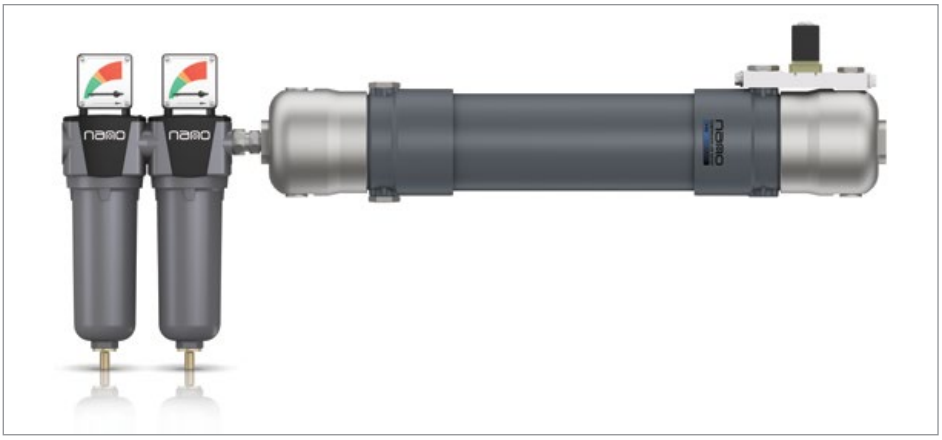
Kaeser Compressors is a leader in reliable, energy efficient compressed air equipment and system design. We offer a complete line of superior quality industrial air compressors as well as dryers, filters, SmartPipe™, master controls, and other system accessories. Kaeser also offers blowers, vacuum pumps, and portable gasoline and diesel screw compressors. Our national service network provides installation, rentals, maintenance, repair, and system audits. Kaeser is an ENERGY STAR Partner. For more information on this new unit or our wide range of portable compressors, visit us.kaeser.com/mobilair.

The new 900 cfm M255 Mobilair portable compressor with variable pressure settings can be towed with a pick-up truck.

Nano Introduces DMH Range Membrane Dryers

Suitable for a broad range of installation and conditions, the new energy efficient nano DHM membrane dryer has a wide performance range to offer you the exact level of dry compressed air required to meet your needs.

Designed for the most demanding applications, the range provides clean, dry air in environments with strict safety or environmental requirements such as low flow environments, noise and corrosion sensitive areas, areas without electrical supply and locations with explosion proof requirements. It is the perfect design for environments



nano-purification solutions introduces a new range of membrane dryers for your most demanding applications.

Compressed Air Technology News

with space restrictions, widely fluctuating temperatures, or high vibration areas.

With pre-filtration as standard, the DHM range is easy to install either horizontally or vertically, is safe and reliable and with no moving parts and is easy to maintain.

For more information, contact: nano-purification solutions at 704.897.2182, visit www.n-psi.com.

Kingston Stainless Steel API 527 Compliant Soft Seat Safety Valves

Kingston Valves, California-based industrial valve manufacturer, releases new stainless-steel soft seat models for the KSV Soft Seat Safety Valve line. The new low profile, stainless-steel KSVCR models offer long-lasting performance in corrosive environments.

The KSVCR ASME Section XIII and National Board-certified valves feature a stainless-steel body and components. They are available in a broad range of sizes, ranging from 1/4" to 1 ¼" and achieve some of the industry's best flow rates. Additional options include oxygen cleaning, thread sealant, and steam service. Suitable for air, gas, and steam mediums, Kingston's KSCVR valves provide application and design flexibility.

The stainless-steel models allow for maximum operating temperatures up to 400°F. Kingston safety valves are factory set to the designated pressure. Available now, with 5-to-7-day lead times.

About Kingston

Established in 1908, Kingston has been a leader in the safety relief valve manufacturing business; primarily focused on the brass industrial valve market, they have an expert understanding of industrial OEM and Distribution customer needs and challenges. The Kingston brand has a longstanding history within the

Kingston Valves expands full soft seat safety valve product line with the addition of stainless-steel offerings.

compressed air/gas/steam/liquid markets. Kingston Valves is an ISO 9001 certified company with world class lead-times. Consolidated within The Storm Manufacturing Group, Kingston brand valves continue to represent the performance and reliability that have been the industry standard for over a century. For more information, visit www.kingstonvalves.com.

KOBOLD Offers New DOG-6 Oscillation Flow Meter

Precision gas measurement is essential for applications found in biogas plants, sewage treatment plants, and in applications utilizing hydrogen. For decades, KOBOLD has been designing and manufacturing a wide range of industrial instrumentation that delivers both ideal solutions and customer satisfaction. Our unique oscillation flow meter technology offers an ideal and more economical solution than other principles of measurement for certain applications and has now been expanded to a new DOG-6 model that opens the door to an even wider range of applications, especially for wet gases.

While the popular DOG-4 is suitable for use with dry gases, the new DOG-6 oscillation flow meter can accurately measure both dry and wet gases. A special design alteration on the new DOG-6 offers clear advantages for use with damp media as it offers natural, gravity induced condensate drainage. The DOG-6 also offers an optional shut-off valve, calibration software, and a flow computer. It can also be custom made to user specifications, opening the door even wider to fields of application.

During the flow through the flow body, part of the media is routed through a bypass into a flow oscillator, which is the element where measurement occurs. Here, the media flows through a chamber with two flow channels, and a bluff body in the flow stream directs the flow to either the left or the right. A channel on the side of the bluff body connects both sides and the flow creates a positive pressure on one side and a negative on the other and this difference in pressure redirects the flow to the other side. The flow begins to oscillate, and the rate of oscillation is used to compute the flow measurement.

Compressed Air Technology News

The DOG-6 is designed for heavy-duty industrial applications and operates without any moving parts which delivers low maintenance and a long service life. The sensor is built to withstand aggressive media, moisture, and dirt particles. Biogas produced by fermentation is an ideal candidate for the DOG-6 as it also is resistant to sulfur. It also works at extremely low operating pressures and has a low pressure drop. It is also well suited for compressed air, natural gas, nitrogen, carbon dioxide, oxygen, propane, argon, and other medical or technical gases.

The DOG-6 is available in a wide variety of measuring ranges and fittings. It offers exceptional accuracy, long-term stability, and ATEX/IECE approvals. If necessary, the sensor can be replaced on site without process interruption with the optional shut-off valves and recalibration is not needed.

The DOG-6 is not affected by pressure or temperature changes and individual evaluations are made possible by the flow computer. In addition to continuous and cumulative flow rates, temperature and pressure can be evaluated by separate inputs. Data storage and communication can be implemented by numerous output options.

The many unique design advantages and low cost of the DOG-6 bring it to the forefront as the solution for a wide variety of current applications and for future energy applications using biogas and hydrogen.

For more information, visit www.koboldusa.com.

New KOBOLD DOG-6 Oscillation Flow Meter.

Norgren Offers Valve Manifold Series with Connectivity Options

Norgren's extensive portfolio of VR Series valve manifold solutions has expanded with a comprehensive array of connectivity options for industrial users. With new communication protocols, Norgren's valve offering paves the way for a complete connected pneumatic solution as well as a one-stop-shop for valve manifolds.

Adding to the existing Multipole connectivity option, the VR Series now includes Ethernet/IP, PROFINET, EtherCAT, and IO-Link to support a wide range of customers connecting to new or existing systems. Using a connected valve, users can gain further performance insights on how their system is performing plus easier installation and less analog hardware.

With 10mm and 15mm valve manifold body sizes available, the VR Series is a compact solution bringing flexibility and modularity. A simple plug-in, sub-base design allows valves to be exchanged quickly with up to 24 solenoids for prompt installation and no plumbing interruptions while supporting ongoing maintenance requirements.

With Norgren's established expertise in the market, the enhanced VR Series builds on this legacy by creating a simple, high performing and connected solution for industrial applications in sectors such as food and beverage, machine tools, mechanical, packaging, material handling, and paper.

Bradlee Dittmer, Product Manager said, "The connectivity enhancements to the VR Series valve manifolds allows us to meet the growing demand for connected technology. Our comprehensive portfolio offers a wide spectrum of connectivity solutions from simple multipole to more complex communications such as EtherNet/IP and EtherCAT systems. Linking the new VR Series manifold range with industrial Ethernet or IO-Link ensures engineers gain further data-driven performance insights for better operational efficiencies. As our valve product lines continue to evolve, expect big things to come from Norgren."

About Norgren

A well-respected world leader in motion control and fluid technology, Norgren is ideally placed to unearth Breakthrough Engineering solutions and play

an active role in important industry sectors that contribute to the quality and success of everyday life. Norgren offers insight, technical excellence and, a collaborative approach, to help our customers forge a brighter future. Norgren's reputation rests on a world-class portfolio of high-performance products comprising of Bimba, Buschjost, FAS, Herion, Kloehn and Maxseal; and an ability to deliver exceptional local service. Part of the £1.8 billion engineering group IMI plc, Norgren has a sales and service network in 55 countries, technical centers in the USA, Germany, UK and China, and manufacturing facilities around the world. For more information, visit www.norgren.com

VR Series now includes Ethernet/IP, PROFINET, EtherCAT, and IO-Link to support a wide range of customers.

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"Some of our plants have created Air Strike Teams to focus on compressed air, particularly compressed air leaks. The teams have purchased ultrasonic leak detectors, and we expect these will help us with our Energy Treasure Hunts."

— Michael Jones, Director of Corporate Energy, Intertape Polymer Group

"We have had supply-side compressed air audits performed, within the last three years at around forty percent of our plants. Generally, we are looking for a ten to fifteen percent energy savings from most of the projects we identify and execute."

— Daniel K. Pemberton, Corporate Project Engineer, Berry Global

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Solberg	31	www.solbergmfg.com
Emerson	33	www.emerson.com/aventics
Kellogg-American	35	www.kellogg-american.com
ENMET	36	www.enmet.com
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Beyond saving energy, SAM 4.0 lowers maintenance costs by minimizing run time which extends service intervals. Reduced cycling and idling means less wear and tear on the motor, starter, valves, etc. SAM 4.0 also provides full time energy monitoring and easy integration into plant control/IIoT systems.

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