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March 2025

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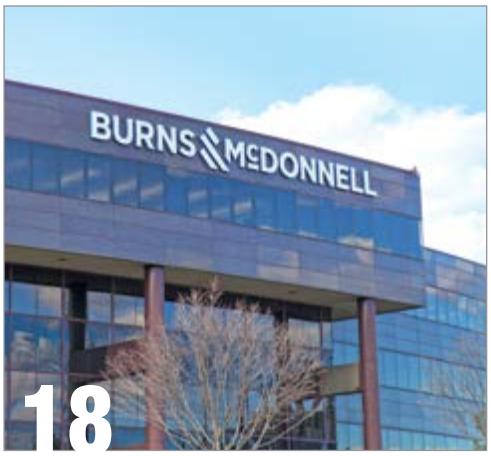

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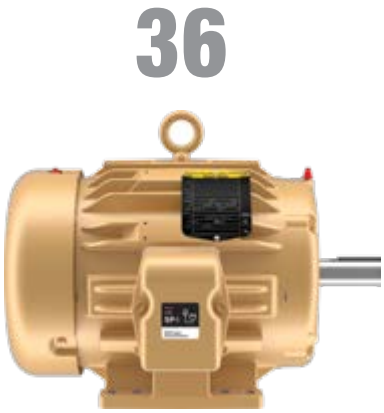

Cover image: Burns & McDonnell's Kansas City, MO, headquarters (courtesy of Burns & McDonnell)

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FROM THE EDITOR

Engineering and On-Site Utilities

This month, we're excited to present a profile of the OnSite Energy & Power practice at Burns & McDonnell, a major construction, architecture and engineering firm based in Kansas City, MO. OnSite Energy & Power helps companies achieve their sustainability goals. We spoke to Kevin Fox, Engineering Manager, and Jeff Easton, Department Manager, about the movements to electrification and dry cooling, and why manufacturing clients now have a role in the refrigerant conversation. A sidebar on the pharmaceutical Amgen explains how OnSite Energy & Power helped it achieve a 40% reduction in energy costs.

We're introducing a recurring feature called Premium OEM Components, examining the parts that go into quality machinery. We spoke to Brandon Canclini, NEMA Motors Division Global Product Manager, ABB, about his company's new SP4 Super Premium motor technology, which expels up to 20% less energy as heat compared to previous motors.

Food packaging safety is paramount for our many readers in the food industry. Thanks to Brad Taylor of Fluid-Aire Dynamics for his story explaining the air purity standards food processing and packaging plants need to know, as well as compressed air treatment options for delivering clean, dry compressed air.

This issue includes stories from two compressed air distributors. Frank Melch, Vice President of Sales & Marketing (ret.), Zorn Compressor & Equipment, shares the results of an experiment running a 50-hp, 240 cfm air compressor with three different sizes of compressed air storage tanks (80 gallons, 400 gallons and 800 gallons). The experiment carefully measured the outcomes and quantified why compressed air storage is a valuable investment.

Next, Juan Londono, Applications Engineer, Air Unlimited, shares the results of a compressed air leak audit for a Canadian cabinet manufacturer that uncovered 358 leaks!

We also bring you the story of Fluid Equipment Solutions of New England, an EVAPCO rep firm. We spoke with Ben McLaughlin, Senior Sales Engineer, about why hybrid coolers lead to big energy and water savings for some customers.

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Subscribers From Around the World

We salute all Best Practices Magazine subscribers from around the world who own, operate, maintain, engineer and provide expertise for the on-site utilities (compressed air, nitrogen generation, vacuum, blowers, chillers, cooling towers and pumps) powering modern plant automation. This subscriber-driven monthly column hopes to build community and recognize all subscribers!

We caught up with these two subscribers in November, at GlobalVac & Air's grand opening of a 75,000-square-foot headquarters and production facility in Brockton, MA. Bob Littman (left) is Vice President of Sales for Air Energy, and Eric Painter (right) is a Sales Engineer. Air Energy is an air compressor and vacuum pump sales and service specialist based in South Easton, MA. It represents Quincy Compressor air compressors and GlobalVac & Air medical/lab vacuum systems. Visit https://airenergy.com.

Joe D'Orazio, National Sales Manager, Kaeser Compressors; Joseph Buckman, Vice President, APSCO and Al Moreno, District Manager, Kaeser Compressors (left to right) were all smiles at the Kaeser Compressors booth during the WEFTEC 2024 conference and exhibition in New Orleans, LA. Visit https://us.kaeser.com.

In January, the Blower & Vacuum Best Practices team visited the Cuyahoga Falls, OH, headquarters of Becker Pumps to meet with Travis Dingee, Director of Sales and Operations; Greg Marciniak, Product and Applications Engineer; McKenzie Flick, Marketing Specialist; Stacey Ankeny, Marketing Operations Manager and Jason Rathbun, Managing Director (left to right). We congratulate Becker's German parent company on 140 years in operation and the U.S. branch on 50 years. Visit https://beckerpumps.com.

Submission Guidelines

We invite our subscribers to send in pictures so we can see the people who read our Best Practices magazines! Those holding a recent magazine issue will receive first consideration. Please send a high-resolution picture as a JPG with a note describing the team and company to Troy Dreier at troy@airbestpractices.com.

People flew in from around the world for the Best Practices 2024 EXPO & Conference, held in Atlanta, GA, in October. Pictured here are Lijah Doell, Industrial Systems Engineer, and Ryan Connor, Industrial Systems Engineer, (left to right) of Efficiency Manitoba. Efficiency Manitoba's goal is helping homes and businesses save energy. Visit https://efficiencymb.ca.

Salvador Sanchez Franco, CEO, Chuck Industrial de Mexico, also made the trip. Based in Mexico City, Chuck Industrial is a mechanical and industrial engineering company with experience in oil and gas, energy production and industrial efficiency. Visit https://chuckimexico.com.

NEWS Compressed Air Industry & Technology

FS-Curtis Launches NX GEN$_2$ Rotary Air Compressor Series, Available from 75-250 Horsepower (55-185 Kilowatt)

FS-Curtis announced the launch of the NX GEN$_2$ Rotary Air Compressor Series (75-250 hp/55-185 kW), the most efficient NX series yet. Engineered to deliver superior efficiency, maximized cost savings and enhanced reliability, the NX GEN$_2$ represents a significant advancement in industrial air compressor technology.

The NX GEN$_2$ delivers unparalleled performance, featuring an exclusive FS-Curtis airend with precision-cut rotor profiles that optimize efficiency. Its premium efficiency TEFC (IP55, Class F) main motor ensures durability by protecting against dust and high operating temperatures, extending its lifespan.

FS-Curtis launched the NX GEN$_2$ Rotary Air Compressor Series (55-185 kW).

The NX GEN$_2$ transforms the user experience with its innovative DBA Shield technology. It includes:

- A centrifugal cooling fan and compartmentalized air flow for smooth and quiet performance
- Oil-proof, laminated sound insulation to minimize noise
- Optimized cooling airflow to further reduce operational noise levels
- A robust gear/VSD drive system for long-lasting performance
- An enhanced cooler flow design to reduce pressure drops and improve system efficiency
- eCOOL® Technology, protecting critical components from heat and ensuring long-term reliability with optimized airflow and efficient heat removal

For more information, visit https://fscurtis.com.

The Compressed Air Challenge Joins Forces with the Compressed Air & Gas Institute as Its Education Foundation

The Compressed Air Challenge (CAC) joined forces with the Compressed Air & Gas Institute as its new education foundation. By combining CAC's valuable educational programs with CAGI's industry expertise, reach and resources, these organizations are poised to provide enhanced training, resources and support to industry professionals.

"The integration of the CAC with CAGI marks a significant milestone in advancing the efficiency and sustainability of compressed air systems. By aligning our mission with CAGI's vast industry resources, we can expand our reach and empower even more facilities to adopt best practices in energy management. Together, we are building a stronger foundation for education and innovation in the compressed air industry," said Steve Briscoe, President, CAC.

The Compressed Air Challenge has partnered with the Compressed Air & Gas Institute as its new education foundation.

CAGI® Compressed Air & Gas Institute www.cagi.org

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Frank Mueller, President, CAGI said, "We are excited to welcome the CAC as our new Education Foundation. This partnership reinforces our commitment to providing the highest quality resources and training for the industry. By combining CAGI's technical expertise with CAC's proven track record in training, we are poised to deliver unparalleled value to professionals, manufacturers and end users. This collaboration represents the future of knowledge-sharing in compressed air." For more information, visit https://www.cagi.org and https://www.compressedairchallenge.org.

Atlas Copco Group Acquires Metalplan Equipamentos in Brazil

Metalplan Equipamentos, a Brazilian company manufacturing screw compressors, air treatment equipment, chillers, gas generation and renewable energy products, as well as providing service in the compressed air market, has become part of Atlas Copco Group.

Metalplan was founded in 1986, and main customers can be found in research and development, design, production, sales and service. The company has 90 employees and is located in the state of São Paulo, Brazil.

"By acquiring Metalplan, Atlas Copco Group will grow its presence in Brazil and Latin America," said Philippe Ernens, Business Area President Compressor Technique. "Metalplan's products and services stretch across many industries and segments, which will be beneficial for our customers."

The purchase price is not disclosed. During 2023, the company had revenues of approximately 120 MSEK* (58 MBRL). For more information, visit https://www.atlascopcogroup.com.

*Average exchange rate 2023.

Hitachi Donates to Benefit ARA Foundation, Wounded Warrior Project

Hitachi Global Air Power US announced it will donate a custom-designed Sullair 185 Series Tier 4 Final Portable Air Compressor to the ARA Foundation Charity Auction. The company will also make a separate $10,000 charitable donation to Wounded Warrior Project® in support of wounded veterans, their families and caregivers.

Hitachi Global Air Power has proudly supported the American Rental Association (ARA) Foundation auction by donating a specially designed Sullair 185 portable air compressor.

"We are long-time supporters of the ARA Foundation, and we are honored to continue this partnership in 2025," said John Randall, President and CEO, Hitachi Global Air Power. "This year, we are also proud to expand our charitable efforts by honoring the service and sacrifice of our veterans through our support of Wounded Warrior Project. These donations reflect our commitment to supporting our industry and giving back to our community, while paying tribute to the heroes who have made profound contributions to our country."

To date, Hitachi Global Air Power's contributions have raised over $120,000 for the ARA Foundation Auction and an additional $40,000 for outside charities. The donated air compressor features hand-written messages of support and gratitude.

The custom WWP-themed Sullair 185 Series portable air compressor is powered by a 49-horsepower (hp) Kubota 1803 diesel engine delivering 185 cfm of air at 100 psi. For more information, visit https://www.hitachiglobalairpower.com.

ABB Unveils Food Safe SP5+, Ultra-Efficient, IP69 Stainless-Steel Motor

ABB, a global leader in food processing motor and drive technologies, introduced its next generation of energy-efficient motor solutions for the food and beverage industry.

Baldor-Reliance® Food Safe SP5+

The Baldor-Reliance® Food Safe SP5+ is the world's first IP69 ultra-premium efficient motor. Engineered for seamless inverter duty operation with advanced bearing protection, it uses cutting-edge rotor technology to achieve peak efficiency, reducing energy costs and supporting sustainability goals. Designed to meet NSF and Meat Institute standards for food processing, all ABB Food Safe motors are easy to clean and maintain, offering durability and reliability in demanding environments. With local manufacturing and comprehensive service support, the Food Safe SP5+ ensures exceptional performance and longevity.

With the launch of the Food Safe SP5+, ABB continues to set the standard for innovation in motor-driven systems. The entire Food Safe SP5+ portfolio offers unrivaled energy efficiency, exceptional hygiene standards and extended motor longevity. For more information, visit https://global.abb.

NEWS Compressed Air Industry & Technology

Hideki Fujimoto Appointed New President and CEO of Hitachi Global Air Power

Hitachi Global Air Power US, an industry leader in innovative compressed air solutions, announced Hideki Fujimoto will be appointed President and CEO of Hitachi Global Air Power, effective April 1, 2025. Fujimoto succeeds John Randall who has been promoted to President and CEO of Hitachi Industrial Equipment Systems (HIES). Hitachi Global Air Power is part of HIES, a wholly-owned subsidiary of Hitachi.

Hideki Fujimoto will be appointed President and CEO of Hitachi Global Air Power, succeeding John Randall.

Fujimoto, currently Deputy Group Executive of the Global Air Power division at HIES, brings extensive experience in leadership, engineering and innovation development, and has been instrumental in the building of Hitachi Global Air Power's global new product development program – the first of its kind in Hitachi's history. The program harnesses global expertise to drive efficient, customer-focused product innovation. Throughout his tenure at Hitachi, Fujimoto has assumed increasing responsibility, including serving as Vice President Engineering at Hitachi Global Air Power. He will relocate from Tokyo to Michigan City, IN, in the coming months.

"Hitachi Global Air Power has been undergoing a significant transformation, and I'm excited to return to the United States and build on the momentum John Randall and the team have created," said Fujimoto. "The reliability and durability of our compressed air solutions have always been the foundation of our work, and we'll continue to push innovation forward while staying focused on what matters most – our customers."

John Randall who has led Hitachi Global Air Power for the past four years, has been pivotal in modernizing the company's manufacturing capabilities and expanding the company's go-to market strategy. In his new role, Randall will oversee the HIES group and relocate to Tokyo, Japan, in the coming months.

"The past four years at Hitachi Global Air Power have been an incredibly rewarding experience," said Randall. "I've had the privilege of working alongside a talented and dedicated team and together, we've made great strides in transforming the business. I look forward to supporting the company's continued growth and seeing all the great things ahead." For more information, visit https://www.hitachiglobalairpower.com.

Proportion-Air Launches Proportion-Air Supply, a Benchtop Device for Pneumatic Pressure and Flow Testing

Proportion-Air is expanding its expertise in proportional electro-pneumatic pressure and flow control into the testing equipment field with its newest product, the Proportion-Air Supply. This benchtop unit for lab or manufacturing use is designed to regulate compressed air and other gases within prescribed pressure and flow limits for easy use.

The compact, all-in-one unit replaces the need for separate regulators and flow gauges attached to needle valves, a common setup for pneumatic testing. Each device includes two channel options. One output channel is solely for pressure regulation, ideal for simple testing processes. A second channel regulates flow or pressure at the same time, similar to the way a variable DC power supply regulates voltage or current. Easy-to-read digital panel meters show the pressure or flow being achieved, and LED lights indicate power and when the desired pressure or flow has reached its setpoint.

The Proportion-Air Supply works with shop air, instrument air or inert bottle gases. Standard pressure ranges are 0-50 psi (0-3 bar) or 0-100 psi (0-7 bar). Channel 1 can deliver flow rates up to 16.2 scfm at 50 psi (3 bar) and up to 28 scfm at 100 psi (7 bar). Channel 2 offers a flow testing capability of up to 10 scfm. For more information, visit https://proportionair.com.

Save time and space in laboratory and manufacturing environments with the Proportion-Air Supply.

Air Compressor Manufacturer VMAC Announces Rafael Marcao as the Director of Enterprise Excellence

VMAC, a leader in compressed air innovation, welcomes Rafael Marcao as Director of Enterprise Excellence. Rafael brings significant Lean manufacturing and continuous improvement experience to VMAC and has earned a Lean Six Sigma Black Belt from Caterpillar in Brazil.

"Rafael Marcao is a valuable addition to VMAC's senior leadership team and will be instrumental in further developing our Lean organizational strategy," said Brent Johnston, CEO, VMAC. "Rafael will develop and implement strategies to improve overall enterprise efficiency and manufacturing capacity to support growth while fostering a positive and collaborative work environment."

Marcao holds a Technologist Degree in Industrial Automation, a Post-Graduate degree in Lean Manufacturing Engineering (6 Sigma) and an Executive MBA. With diverse experience in automation, manufacturing and quality engineering, Marcao is well-suited to lead VMAC's further development of Lean as an overall organizational strategy focused on delivering increased value to VMAC's customers.

Rafael Marcao, Director of Enterprise Excellence

"I'm excited to join VMAC and collaborate with its talented teams to develop a cohesive Lean strategy across all departments," said Marcao. "Lean is traditionally production-focused, but I aim to extend this mindset throughout the entire company. VMAC is primed for continuous improvement success because the coworkers embrace new ideas and constantly challenge the status quo."

VMAC is a diverse group of people who work together to deliver innovative mobile compressed air products and technology. For more information, visit https://www.vmacair.com.

NEWS Chiller & Cooling Industry & Technology

Johnson Controls Launches YORK® YK-CP Centrifugal Chiller

Johnson Controls announced the launch of the YORK® YK-CP Centrifugal Chiller designed to deliver high-efficiency performance, meet stringent sustainability standards and aid in the decarbonization of large commercial buildings.

Available in 2,000 to 3,000 tons, it is optimized specifically for the use of the ultra-low GWP refrigerant R-1234ze(E) without requiring a larger chiller footprint or sacrificing on efficiency. It can be equipped with an optional variable-speed drive for optimal utilization at both full and part loads, as well as under design and off-design conditions at varying ambient temperatures, resulting in operation up to 30% more energy-efficient than conventional chillers.

"With an installed base that spans tens of thousands of installations in over 100 countries, YORK® YK chillers have built a reputation for delivering systems that are fully optimized for their environments and that have proven to operate more efficiently in real-world conditions," said Greg Shirk, Associate Product Manager, Global Centrifugal Chillers, Applied Equipment, Johnson Controls. "The YK-CP model builds upon this legacy, allowing building owners to reduce costs and carbon impact with this long-term solution."

An evolution of the YK-EP centrifugal chiller, the YK-CP offers real-world efficiencies as low as 0.15 kW/ton (23.4 COP). This is due in part to the system's high-efficiency

The new YORK® YK-CP Centrifugal Chiller is optimized for high-efficiency use with low-GWP refrigerants across the 2,000 to 3,000-ton range.

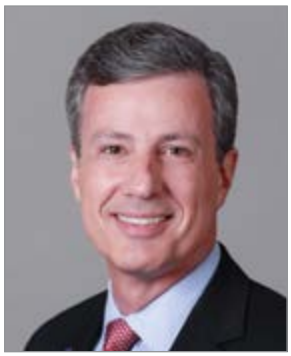
economizer, which improves system efficiency and reduces operating costs. Further, it features heat exchangers that use JCI's proprietary, falling film evaporator design that allows the unit to operate more efficiently and with up to 40% less refrigerant charge than conventional chiller designs. For more information, visit https://www.johnsoncontrols.com.

Trane Technologies Announces Appointment of Mauro Atalla as Chief Technology and Sustainability Officer

Trane Technologies announced the appointment of Mauro Atalla as Chief Technology and Sustainability Officer. Atalla will report to Chair and CEO Dave Regnery as part of the executive leadership team and will lead the product development, innovation and sustainability strategies for Trane Technologies globally.

"We're excited to welcome Mauro as our new Chief Technology and Sustainability Officer," said Dave Regnery, Chair and CEO, Trane Technologies. "Innovative technology is paramount to advancing our purpose-driven strategy. Mauro will be a great addition to our team as we continue to innovate for our customers, create value for our shareholders and contribute to a sustainable future."

Atalla succeeds Paul Camuti, who has retired. Camuti joined Trane Technologies in 2011 as Executive Vice President and Chief Technology and Sustainability Officer. For more information, visit https://www.tranetechnologies.com.



Mauro Atalla has been appointed as Chief Technology and Sustainability Officer at Trane Technologies.

Frigel Commits to Safe and Sustainable Cooling Solutions by Offering Non-Flammable R-513A

Frigel, a leading process cooling equipment supplier headquartered in Florence, Italy, and U.S. operations in East Dundee, IL, has made a strategic decision in its latest product offerings. Offering R-513A non-flammable, this choice reflects the company's commitment to sustainability, safety and performance.

R-513A, is a low-GWP refrigerant, maintaining an A1, non-flammable safety rating under the ASHRAE 34 Standard. In comparison, R-454B maintains an A2L, low flammability safety rating under the same standards. This fundamental difference in flammability and flame propagation has several effects for the design, operation and maintenance of chillers.

Another significant advantage is the reduced complexity in maintenance and staff training. When handling a non-flammable refrigerant such as R-513A, technicians do not need special training that is required when handling flammable substances.

Chillers using R-513A offer a balance between energy efficiency, safety and sustainability, making them an attractive option for projects where safety is priority without compromising performance. For more information, visit https://www.frigel.com.

Vertiv Introduces High-Capacity Models of its Vertiv™ Liebert® AFC Inverter Screw Chiller Range

Vertiv announced the introduction of the high-capacity models of its Vertiv™ Liebert® AFC inverter screw chiller range with low-global warming potential (GWP) refrigerant. Available in Europe, the Middle East and Africa, the new models provide up to 2.2 MW of cooling capacity in a single frame, resulting in a smaller carbon emission footprint, requiring fewer units to be installed for capacity, and reducing installation and maintenance time and costs.

The newest Liebert AFC models are high-density, outdoor, free-cooling chillers that provide the industry's highest capacity in a single frame.

"Our latest Liebert AFC low-GWP chillers reach up to 2.2 MW, in form factor that significantly reduces the time, cost and complexity of deploying these systems. This solution supports our commitment to environmental responsibility and compliance with the latest regulatory standards, and aligns with our objectives to continue our industry-leading expertise in air and liquid cooling applications," said George Hannah, Senior Global Director for Chilled Water Systems, Vertiv.

Vertiv Liebert AFC offers up to 20% lower annual energy consumption compared to fixed screw solutions. The inverter-driven compressor allows for the reduction of energy consumption and, in particular, the electrical power required during peaks, which in turn allows more power availability for the IT equipment. The innovative regulation algorithms offer accurate control of the fluid delivery temperature to the indoor units, enhancing cooling continuity and reliability. The unit is designed to operate with a more eco-friendly refrigerant R1234ze HFO, which allows data center owners to comply with the EU F-Gas Regulation 2024/573 and enables customers to support pressing sustainability goals. For more information, visit https://www.vertiv.com.

Vertiv™ Liebert® AFC chiller family range extension now offers the industry's highest single-frame cooling capacity, with up to 2.2 MW.

NEWS Chiller & Cooling Industry & Technology

Hoffman & Hoffman Acquires Borie Davis, Expanding Georgia Market Presence

Hoffman & Hoffman, a leader in HVAC and building solutions, announced its acquisition of Borie Davis Inc., an established provider of commercial HVAC solutions based in Alpharetta, GA. Since 1978, Borie Davis and every member of the organization have worked to create a culture of excellence in service to customers. This strategic acquisition strengthens Hoffman & Hoffman's presence in the Georgia market, allowing both companies to deliver expanded resources, innovative service offerings and reliable solutions to a broader range of clients.

"We are thrilled to welcome Borie Davis into the Hoffman & Hoffman family. Their reputation for excellence in Georgia aligns perfectly with our values and vision. By combining our strengths, we are positioned to offer enhanced services and innovative solutions to make us a better company in every territory," said Jim Mangini, President, Hoffman & Hoffman.

Partnership brings expanded resources to better serve Georgia's growing market.

The Borie Davis commitment to customers remains the same, offering the same level of trusted support and service. However, customers can expect exciting developments, such as expanded access to e-commerce tools for faster, more convenient service. For more information, visit https://www.hoffman-hoffman.com and https://boriedavis.com.

CTI Releases Standard for Mechanical Testing of Cooling Tower Bottom-Supported Fill Blocks

The Cooling Technology Institute (CTI) announced the release and availability of a new standard: Mechanical Testing of Cooling Tower Bottom-Supported Fill Blocks (STD-171). This document establishes a standardized protocol for evaluating the mechanical properties and performance of bottom-supported fill blocks used in cooling towers, ensuring a consistent approach to testing across different manufacturers.

The document is now available for purchase at the CTI Publications Marketplace for $20. It offers invaluable insights and a standardized approach to mechanical testing, ensuring comparability and reliability in data across different manufacturers' products.

This standard is crucial for designers, purchasers and manufacturers within the cooling technology industry, aiming to align practices and enhance the safety and efficacy of cooling tower components. As part of CTI's commitment to maintaining high industry standards, this publication reflects the latest advancements and collective expertise in cooling technology.

For more information on this standard and other CTI publications, or to purchase your copy, please visit the CTI Publications Marketplace. For more information, visit https://www.cti.org.

EVRCOOL Announced the Launch of Its Industrial Process Chiller

"Industrial process chillers have seen incremental innovation over the past few decades, but fundamental changes have been limited. Today, that changes," said Josh Roby, Co-Founder and Head of Technology & Sales, EVRCOOL.


EVRCOOL industrial process chiller

The EVRCOOL industrial chiller's major breakthrough in design, featuring an easy swing-open door and slide-out compressor skid, will revolutionize the way maintenance is performed in the field. Its custom designed I/O interface PCB dramatically reduces the electrical points that are known to be prone to failure. Additionally, the EVRCOOL chiller boasts one of the smallest footprint on the market.

The EVRCOOL process chiller is poised to gracefully handle the future as well. Its low-GWP refrigerant meets current California EPA standards and 2026 EPA emission standards outlined in the AIM Act. Its integrated IoT and smart technologies enable enhanced monitoring and diagnostic feedback today, and support future predictive maintenance algorithms for uninterrupted operation. For more information, visit https://www.evrcool.com.

ASHRAE Announces First Group of Certified Decarbonization Professionals

ASHRAE announced its inaugural cohort of Certified Decarbonization Professionals (CDPs), marking a significant step forward in the global effort to reduce carbon emissions in the built environment.

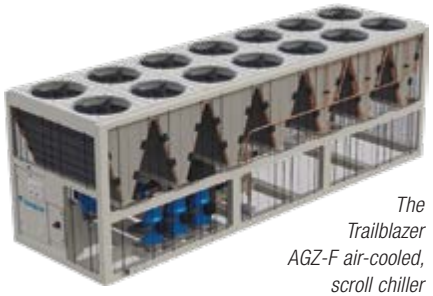
The Certified Decarbonization Professional program, initiated and funded by the ASHRAE Center of Excellence for Building Decarbonization, is an international certification that validates the competency of decarbonization professionals to assess, analyze and develop effective and sustainable strategies to reduce or eliminate the life-cycle carbon footprint of buildings.

The June-July exams resulted in 64 new certificants.

"Decarbonization is essential to our global sustainability goals, and ASHRAE is committed to empowering professionals with the skills and knowledge necessary to lead the charge," said 2024-25 ASHRAE President M. Dennis Knight, P.E., BEMP, Fellow Life Member ASHRAE. "The Certified Decarbonization Professional program is not just a milestone for ASHRAE, but a much needed tool for the industry as we work toward a net-zero future."

The CDP certification program is designed for professionals who are responsible for decarbonizing new and existing buildings. Eligibility requirements include education and work experience, a code of professional conduct and passing a rigorous certification exam validating competency in building decarbonization job tasks across eight domains, which include decarbonization drivers, project planning and development, construction and renovation, passive and active efficiency, facility management and distributed energy resources. For more information, visit https://ashrae.org.

Daikin Applied Showcases Redesigned Products Featuring R-32 Refrigerant



The Trailblazer AGZ-F air-cooled, scroll chiller

Daikin Applied introduced enhanced versions of the Trailblazer® AGZ-F air-cooled scroll chiller, Maverick® II packaged rooftop system and SmartSource® water source heat pump (WSHP) – all featuring R-32, an ultra-efficient, low-global warming potential (GWP) refrigerant. These products are now part of Daikin's extensive lineup of low-GWP solutions, giving consulting engineers, contractors and building owners and operators an array of technologies to decarbonize facilities and deliver sustainable comfort.

"All HVAC manufacturers are transitioning to low-GWP refrigerants per EPA rule, but that doesn't mean all low-GWP refrigerants are the same," said Jim Macosko, Vice President of Product and Sustainability Solutions, Daikin Applied. "We decided to reengineer our equipment specifically for R-32 to provide a range of benefits beyond the GWP value of the refrigerant. With the Trailblazer AGZ-F, for example, we were able to drop a bank of V coils and reduce the size of the chiller because of R-32's superior capacity and efficiency. Smaller, lighter, more efficient – these are benefits that provide value across the entire lifecycle of the machine and system." For more information, visit https://www.daikinapplied.com.

NEWS Industrial Energy & Water Conservation

Beko Earns Highest ESG Score in DHP Household Durables Industry in S&P Global Corporate Sustainability Assessment

Beko, a global leader in consumer durables and electronics, has achieved an outstanding score of 89/100 in the 2024 S&P Global Corporate Sustainability Assessment (CSA) highlighting its commitment to sustainable practices. The CSA evaluates the environmental, social and governance (ESG) efforts of the world's largest corporations. In addition to this achievement, the company has also been included in the Dow Jones Sustainability Indices for the eighth consecutive year.

Beko has committed to achieving net-zero greenhouse gas emissions across its entire value chain by 2050. As part of its near-term objectives, the company is targeting a 42% reduction in absolute Scope 1 and 2 emissions and a 42% cut in Scope 3 emissions from product use by 2030, compared to its 2022 baseline. For its long-term targets, Beko aims to slash its absolute Scope 1 and 2 emissions by 90%, and absolute Scope 3 emissions by 90% in 2050, also compared to a 2022 base year.

Beko has achieved a score of 89/100 in the 2024 S&P Global Corporate Sustainability Assessment.

"Achieving net-zero emissions in line with the 1.5°C climate pathway is our ultimate priority. To realize this vision, we are continuously developing advanced technologies to improve the energy efficiency of our products while reducing carbon emissions. At the same time, we are scaling up investments in renewable energy and bolstering our capabilities. It is rewarding to see these efforts recognized globally as proof that we are on the right track. Sustainability is not just a goal – it's a responsibility we owe to our business, our planet and to future generations," said Hakan Bulgurlu, CEO, Beko. For more information, visit https://www.bekocorporate.com.

Flex Releases its 2024 Sustainability Report, Highlighting its Global Sustainability Performance

Flex published its 2024 sustainability report, highlighting the company's global sustainability performance and progress from calendar year 2023.

"Taking meaningful steps forward on our sustainability journey and toward our goals is made possible through the contributions of our talented, passionate global workforce and valued partnerships with our customers and suppliers," said Kyra Whitten, Senior Vice President, Corporate Marketing, Communications, and Sustainability, Flex. "As an advanced, end-to-end global manufacturer, we remain committed to embedding sustainability into our practices as we design, source, build, deliver and manage our customers' products."

2023 sustainability accomplishments:

- 33% decrease in absolute scope 1 and 2 greenhouse gas emissions (GHG) from 2019 baseline[1]
- 25% of electricity usage powered by renewable energy[2]
- 51% of preferred suppliers and 80% of specified customers[3] had greenhouse gas emissions reduction and science-based targets, respectively

Additionally, the company maintained an "A" CDP score for Climate Change and an AA rating from Morgan Stanley Capital International, acknowledging global industry leadership in managing financially relevant sustainability. For more information, visit https://flex.com.

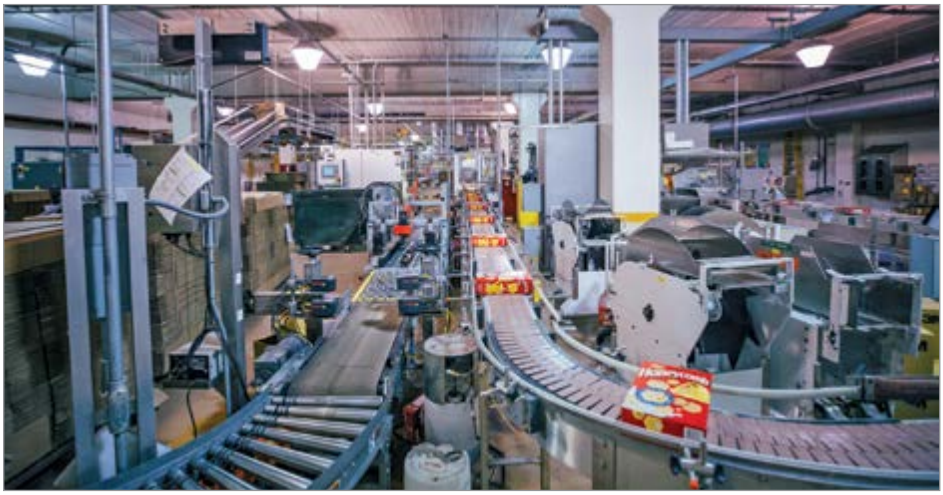
1 The target boundary includes biogenic emissions and removals from bioenergy feedstocks.

2 Percent of renewable energy is considering purchased and on-site generation divided by the total of electricity used for tracking sites.

3 Flex committed that 70% of customers as measured by emissions covering purchased goods and services, capital goods, and use of sold products will have science-based targets by 2025.

Post Holdings Releases its 2024 Sustainability Report

Post Holdings, a consumer packaged goods holding company, released its 2024 sustainability report. The report details Post's enterprise-wide approach and progress with sustainability efforts across four strategic pillars: sourcing, operations, people and products.



Post Holdings has released its 2024 sustainability report. Photo courtesy of Post Holdings, Inc.

In fiscal year 2024, Post made meaningful progress in sustainability, including the following highlights:

- Developed an evolved framework and approach to sustainability.
- Reduced scope 1 and 2 greenhouse gas (GHG) emissions by 6% compared to fiscal year 2023.
- Continued to engage key suppliers in the CDP Supply Chain and Supplier Leadership on Climate Transition programs to accelerate reductions in scope 3 greenhouse gas (GHG) emissions.

"Each year we gain more insight into how to effectively pursue sustainability efforts across the organization and all four of our pillars," said Nick Martin, Vice President, Corporate Sustainability, Post Holdings. "I hope in reading this report, this maturation is apparent in our pragmatic approach, evolved framework and core principles." For more information, visit https://www.postholdings.com.

Owens Corning Completes Multisite Energy Treasure Hunt Through Better Plants In-Plant Training Program

Through the U.S. Department of Energy's Better Plants In-Plant Training (INPLT) program, two Owens Corning manufacturing facilities collaborated on an Energy Treasure Hunt to determine energy efficiency opportunities. Owens Corning is a manufacturer of a broad range of insulation, roofing and fiberglass composite materials.

A group of 15 Owens Corning employees representing six locations traveled to Danville, IL, for the first week of the Treasure Hunt. There, the group was divided into four teams to cover utilities (compressed air and HVAC), ovens and process heating, process and city water, and "miscellaneous" (looking for opportunities related to lighting, pumps, and fans).

Once the team had identified energy-saving opportunities, they turned to the MEASUR suite of tools to evaluate additional projects. The MEASUR tool encompasses efficiency calculators like:

- Motors (replacement versus rewinding, motor drive upgrades)
- Electricity consumption (adjusting usage, lighting enhancements)
- Compressed air, natural gas, steam
- Water/wastewater

Owens Corning Manufacturing Facilities participated in an energy treasure hunt through Better Plants In-Plant Training program.

In total, the team identified 22 recommended projects that would provide a total emissions savings of 18% and site-wide cost savings of 17%.

To kick off the second week of the Treasure Hunt, the team traveled to a new facility in Kansas City, KS. This time, 22 employees representing 11 locations joined the event. Together, the group identified 25 more projects that would provide site-wide cost savings of 12%. For more information, visit https://www.owenscorning.com and https://betterbuildingssolutioncenter.energy.gov/better-plants.

Burns & McDonnell's OnSite Energy & Power Group

By Troy Dreier, Senior Editor, Chiller & Cooling Best Practices Magazine

Above: The Burns & McDonnell headquarters in Kansas City, MO (Photo: Burns & McDonnell)

Burns & McDonnell is a construction, engineering and architecture firm based in Kansas City, MO. Started in 1898, it now has more than 12,000 employees with over 75 office locations in cities and countries around the world. The firm is 100% employee owned.

Burns & McDonnell's OnSite Energy & Power Group plays an important role at the firm, helping major clients achieve their energy and sustainability goals. The group is one of the eight business lines inside the firm's Global Facilities business unit. The group operates in two ways: It owns its clients and sees projects from inception to completion, and it supports other business lines within Global Facilities (including Food and Beverage, Aerospace, Space and Defense, Industrial, Consumer Products, Life Sciences and Technology, Mission Critical and Commercial Architecture), as well as other Burns & McDonnell business units (including Power, Oil, Gas and Chemical, Transmission and Distribution, Environmental, Aviation and Federal, Transportation, Construction and Water). The group itself employs more than 100 people, mostly consisting of engineers and project managers.

Although it may seem like the engineers in the OnSite Energy & Power Group must master a wide range of areas, they specialize in a specific set of services which they apply across a broad spectrum of markets and industries.

"OnSite Energy & Power exists between a customer's buildings, facilities or campus and the utility services coming from a grid or transmission network. That interface is what we specialize in. It's electrical and thermal utility

Kevin Fox, Engineering Manager, OnSite Energy & Power (Photo: Burns & McDonnell)

infrastructure," explained Kevin Fox, National Engineering Manager for OnSite Energy & Power.

Primary markets for the group include district energy systems, such as campus-wide chilled water, steam or hot water plants, as well as their distribution systems. Core competencies include customer-owned substations, electrical distribution and distributed generation.

A Movement Towards Decarbonization and Sustainability

Clients approach the group to help meet ambitious sustainability and decarbonization goals. Services the group provides include front-end consulting and utility and decarbonization master planning. It helps clients make decisions about lifecycle equipment replacements or upgraded utilities to serve a capital expansion, then translates studies about those decisions into a full engineering design. As an integrated design-build firm, it constructs the designs it provides to clients.

Historically, the group has always provided infrastructure master planning involving lifecycle replacement of chillers or projects involving efficiency gains achieved by

Jeff Easton, Department Manager, OnSite Energy & Power (Photo: Burns & McDonnell)

Burns & McDonnell's OnSite Energy & Power Group

Burns & McDonnell added a new plant building with two 2,650-ton chillers, five cooling towers and primary/secondary pumping for a chilled water plant for a healthcare client in the Midwest. (Photo: Michael Robinson)

centralizing operations or getting away from building-level chillers. But, as sustainability efforts have taken hold, its clients' goals have shifted. Rather than being concerned with dollars and kilowatts, today's clients are equally concerned with the decarbonization impact of their decisions, water consumption and the refrigerants used.

"If we're using sustainability as a broader term, there's waste management, water, carbon, renewable power and more. Those are some of the units now part of the equation we're solving for. It sometimes ends up with a different set of solutions than you would typically end up with if you were only looking at dollars," said Jeff Easton, OnSite Energy & Power Department Manager for the Mountain

region. "Infrastructure decisions are moving more toward carbon-neutral solutions and energy storage. The chillers are still here, we're just deploying them differently. No matter the industry they're in, all our major clients have aggressive decarbonization goals."

Electrification Takes the Place of Natural Gas

From its position, OnSite Energy & Power sees common ways facilities are reducing their demand for natural gas and joining the industry shift to electrification. That could mean removing some boilers and installing large heat pumps that produce 150°F to 170°F (66°C to 77°C) water. Rather than relying on natural gas, this solution uses more electricity, which increasingly comes from renewable sources.

Some states, especially New York and California, have put measures in place to spur the drive to electrification by making it the least expensive option. Some markets impose a penalty or tariff on carbon emissions. Boston is implementing a significant tax on carbon emissions. All of that propels facilities toward electricity and away from natural gas. The shift to renewables moves from the individual sites to the supply side.

"One big trend we've seen is the movement away from steam toward hot water, where it's possible," Fox said. "I know in some cases the user process requires the temperature and the steam just to operate. But, where possible, the movement is away from steam to hot water because it's easier to maintain. In some cases, it's more efficient. Heat recovery chillers still produce chilled water, but instead of rejecting that heat to the atmosphere through a cooling tower where you have evaporation, you're capturing that heat instead to generate hot water that can be used in the process or for comfort heat. One of the biggest areas where

Burns & McDonnell provided engineering, procurement and construction for the $377 million expansion of a district energy plant in the South that included an 8.8 million-gallon chilled water thermal storage tank and a new plant with four 8,000-ton electric drive chillers. (Photo: Paul Howell)

Burns & McDonnell's OnSite Energy & Power Group

The phase 2 expansion at Burns & McDonnell's Kansas City headquarters (Photo: Burns & McDonnell)

Amgen Reduces Energy Costs by 40%

Amgen is a biopharmaceutical company with its headquarters in Thousand Oaks, CA. In 2020, it began working with Burns & McDonnell's OnSite Energy & Power Group to help meet its 2027 sustainability goals, which included a 40% reduction in energy costs. Amgen had three active plants on its 194-acre Thousand Oaks campus when it started working with the group, and one inactive. Seven of its 12 chillers were reaching their end-of-life. Because it had sustainability goals tied to water, power and lower carbon emissions, Amgen created a chilled water master plan and began working with Burns & McDonnell.

For the first phase of the project, the OnSite Energy & Power Group revitalized the inactive plant, as it was located in the center of the campus, and this allowed the group to maximize piping already in the ground. Work involved removing out-of-service equipment and installing new chillers, cooling towers and pumping equipment. This allowed Amgen to add thousands of tons of cooling to the facility, increase the capacity per inch of pipe already in ground and avoid making any distribution replacements.

Phases 2 and 3 included replacing constant speed chillers with variable frequency drive (VFD) chillers in two of the other plants. Calculations showed enough variation in temperatures and load to justify the change. Amgen was able to save on pumping energy by pumping less.

Amgen also worked with a separate company to provide optimization software on the backend, to further enhance its system.

"We write a sequence of operations to deploy the equipment in a stable and reliable way. There are companies that will come in and put their proprietary algorithms on top of that, running things a little differently. They

we're seeing the ability to knock out water losses through evaporation is use of that type of equipment."

Making use of surplus heat instead of sending it to a cooling tower makes the entire system more efficient, Easton said. The group recently installed a 500-ton heat pump for a university client that will save 15 million gallons of water per year simply because the university's cooling tower doesn't need to run all year.

Refrigerant Selection Is Now Part of the Conversation

Refrigerant selection is another active area for the OnSite Energy & Power Group. Rather than simply letting clients know what refrigerants major suppliers offer, it's able to provide clients with more choices. Discussions center on the varying performance characteristics of refrigerants and their impacts on chillers. While future-proofing is hard, facilities are at least part of the conversation now.

Historically, some industrial sectors have been more focused on first costs. These days, that's changing. The OnSite Energy & Power Group is seeing a greater focus on lifecycle performance, as well as water use, which wasn't always considered previously.

"We have to factor in things like, 'What is a ton of carbon emissions worth to us? What is a gallon of water consumption worth to us?'" Fox said. "It all comes into the calculus for making investment decisions in infrastructure." BP

For more, visit https://info.burnsmcd.com/delivering-sustainable-and-resilient-campus-and-district-energy-infrastructure

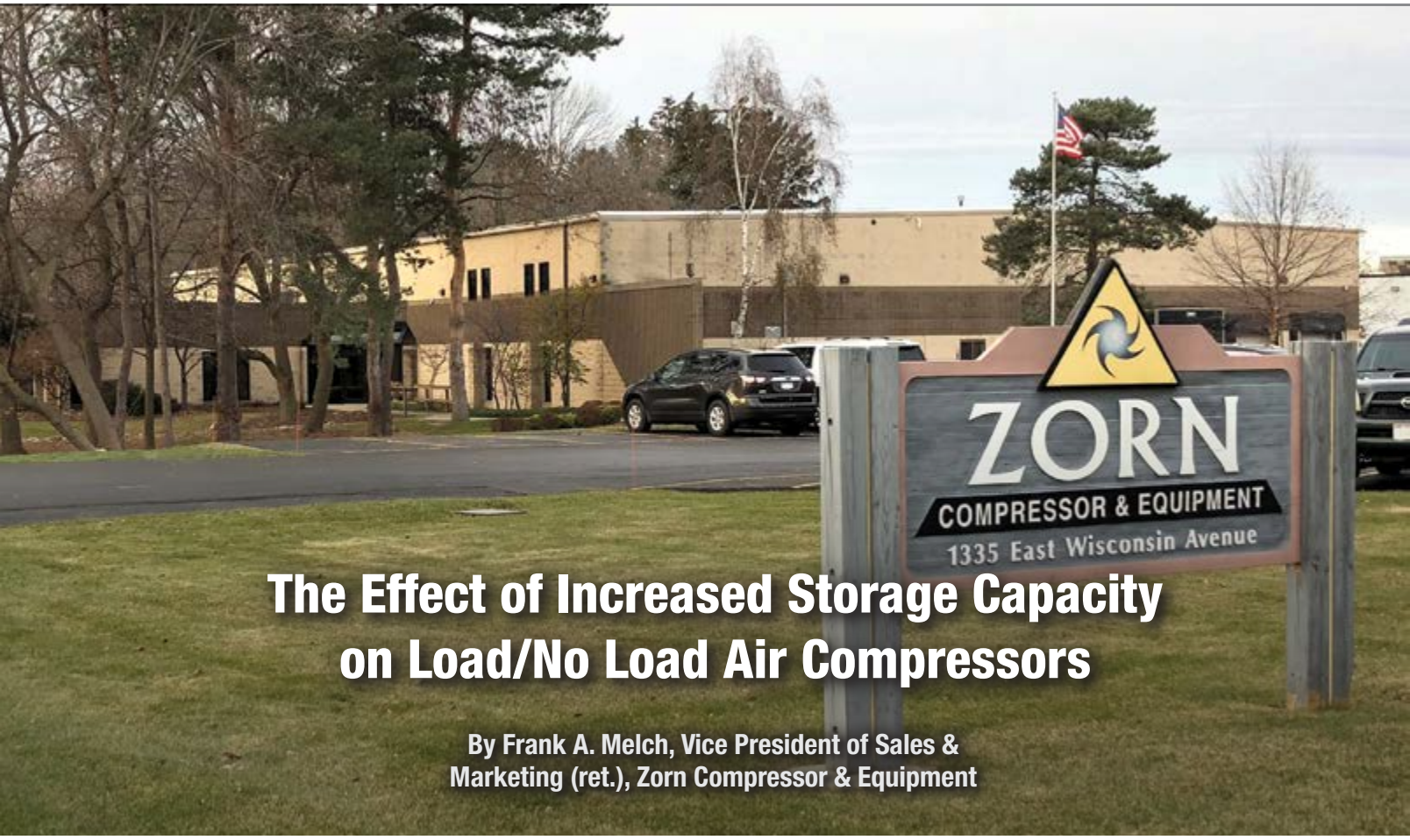
might minimize the kW per ton of that system for every single hour, every single day," Easton said. "That's something to take it beyond a typical sequence of operations or what a human operator can achieve.

"These micro-adjustments happen all the time across all the VFDs. It takes everyone pulling on that same rope including the equipment vendors, engineers and operators to maximize efficiency. Controls all have a feedback loop to make sure that's happening. Amgen was a good example of all that coming together and resulting in good success."

By working in three distinct phases, OnSite Energy & Power was able to avoid any major outages during the three-and-a-half-year project. The group was commissioning the final plant at the time of this interview. The full project should be completed in August 2025.

To read articles about ***Chillers,*** visit https://coolingbestpractices.com/technology/chillers.

For expert presentations on ***Chillers,*** visit our Webinar Archive Section at https://coolingbestpractices.com/magazine/webinars.



The Effect of Increased Storage Capacity on Load/No Load Air Compressors

By Frank A. Melch, Vice President of Sales & Marketing (ret.), Zorn Compressor & Equipment

Fixed speed, lubricated, rotary screw air compressors offer three different part-load control methods: inlet modulation, load/no load and variable displacement. Over the years, load/no load has become the predominant control method offered by fixed-speed air compressor manufacturers.

Load/no load control uses an airend inlet valve to regulate flow and match part load demands. The inlet valve reacts to a pressure band with two reaction points: a load pressure and an unload pressure. When loaded, the air compressor delivers full flow and over-supplies the system causing system pressure to rise. Once the unload pressure setting is reached, the inlet valve closes, and the air compressor delivers zero flow, under-supplying the system and causing pressure to drop. The air compressor control operates in this range. The percentage of time loaded is called the duty cycle.

Above: Zorn's Corporate Headquarters, Pewaukee, WI

During the unloaded cycle, despite the zero-flow condition, the airend still pushes against internal pressure, which requires power. When the air compressor unloads, internal pressure is relieved through a blowdown valve, which relieves pressure slowly to avoid foaming in the sump (think of a shaken bottle of soda). As pressure is relieved, the power required is reduced.

Operating efficiency improves when the air compressor runs loaded longer, as this is

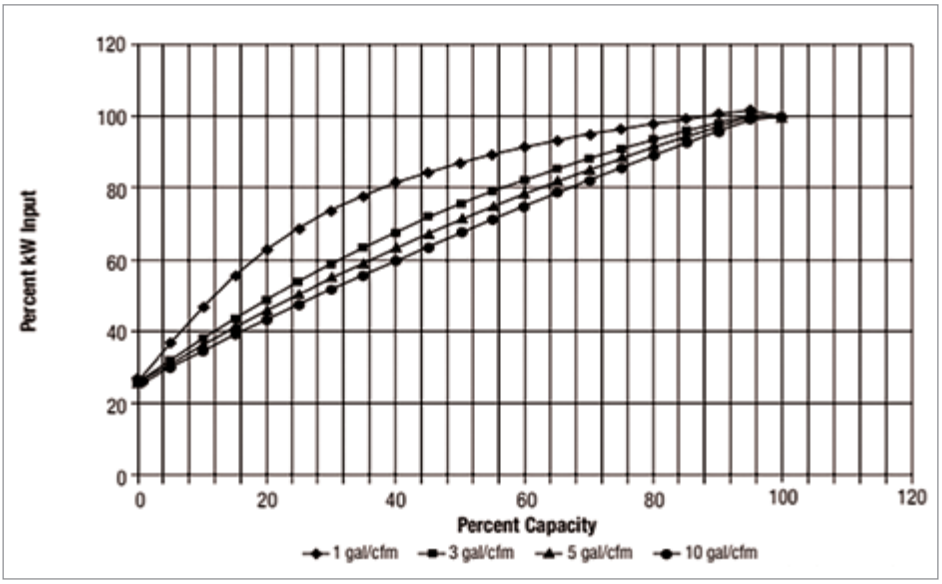


Figure 1 (courtesy of Compressed Air Challenge)

the optimum design point, and is unloaded longer while internal pressure reduces. The lower internal pressure drops, the less energy is required. The best way to achieve this is by increasing the volume of the compressed air system with storage tanks. The total amount of storage in a compressed air system is expressed as a ratio of gallons of storage to the full load capacity of the part-loaded air compressor. For example, a 240-gallon tank applied to a 50-horsepower (hp), 240 cfm air compressor yields a 1:1 storage ratio. The greater the storage ratio, the longer it takes to fill and empty the system, resulting in lower energy consumption.

Figure 1 depicts the Industry-accepted graph showing the relationship between part load capacity and power consumption, factoring in various storage-to-capacity ratios.

Load/No Load Test Procedures

Zorn Compressor & Equipment's Technical Solutions Group charted the effect of different storage ratios on load/no load-controlled air compressors to determine the optimal storage-to-capacity ratio. While we understand the

The testing area used by Zorn Compressor & Equipment

The Effect of Increased Storage Capacity on Load/No Load Air Compressors

concept and have encountered different loading profiles when conducting customer studies, we wanted to see the effect storage capacity had in a controlled environment. We hoped to create a study we could use for internal training and customer education.

We selected a 30-hp base-mounted air compressor from the company's rental fleet. The air compressor was rated 122 cfm at 125 psig and 25.7 kW. We decided to test the unit at three storage ratios. A data logger took readings every eight seconds, monitoring amps with a current transformer (CT) and pressure with a transducer. We set the unit to operate between 100 and 117 psig. We simulated 50% demand with a ball valve, exhausting compressed air to atmosphere.

Scenario 1: 80 Gallons of Storage

In our first test, we connected the air compressor to an 80-gallon tank. The idea was to simulate a scenario we see often in the field where a new rotary air compressor is paired with the tank

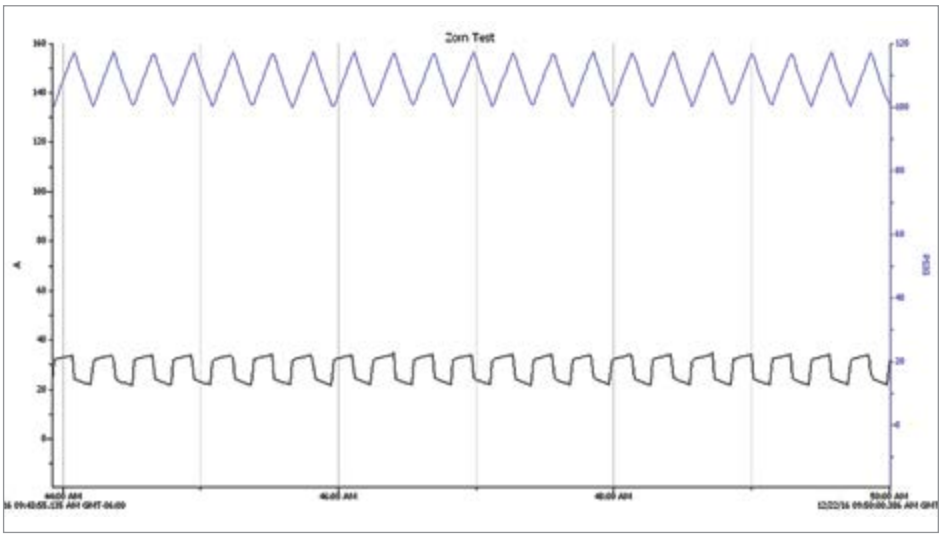


Figure 2, testing with an 80-gallon tank

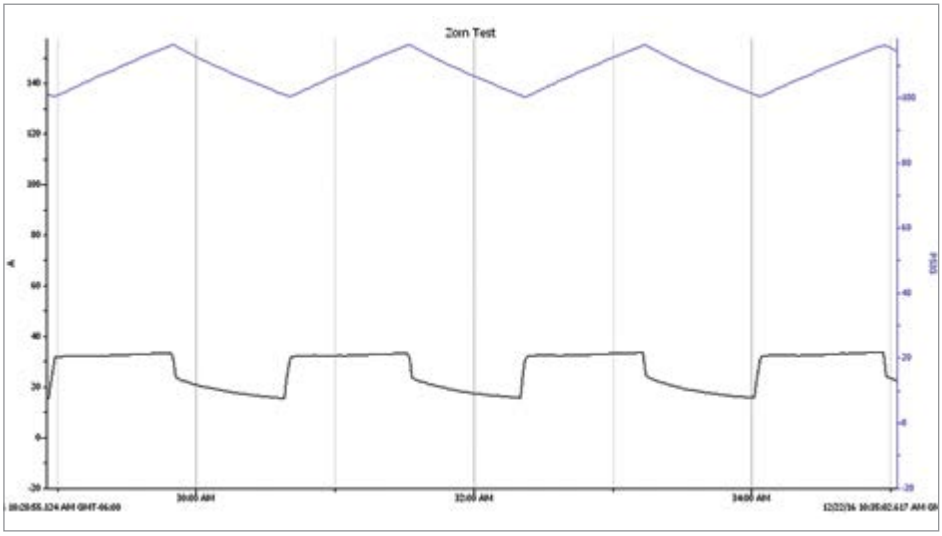


Figure 3, testing with a 400-gallon tank

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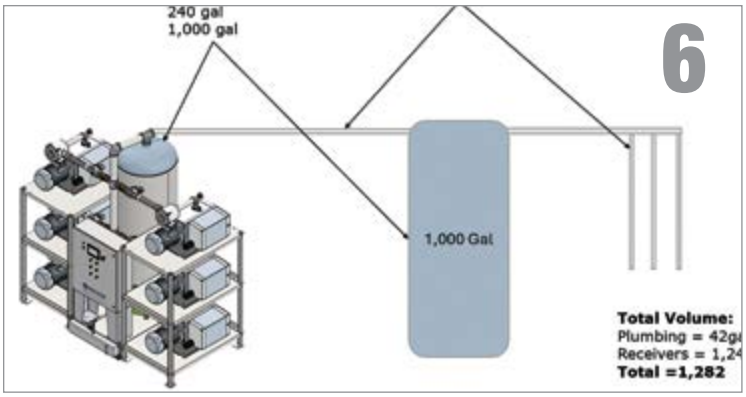


AERATION BLOWER SYSTEMS

EVERY ISSUE

NEWS Blower & Vacuum Industry & Technology

Atlas Copco Group Announces Appointment of Koen Lauwers as President of the Vacuum Technique Business Area

Atlas Copco Group has appointed Koen Lauwers President of the Vacuum Technique business area and member of Group Management.

"Koen is a passionate and respected leader, and he has a broad experience," said Vagner Rego, President and CEO, Atlas Copco Group. "Through the years, he has delivered strong business results and created high value solutions for our customers. I am very pleased that he has agreed to take on this role."

Koen Lauwers has been appointed as President of the Vacuum Technique business area.

Lauwers, a Belgian citizen, joined Atlas Copco in 1997 and has since then built a successful career in the Group, including international assignments in the United States and Germany. In 2023, he was appointed President of the Semiconductor division and prior to this he held the same position for the Industrial Vacuum division, both within the Vacuum business area.

Lauwers holds a master's degree in electro-mechanical engineering from the University of Leuven and an MBA from the Antwerp Management School, both in Belgium.

In 2023, Vacuum Technique had revenues of BSEK 42.8 and approximately 12,600 employees. Lauwers succeeds Geert Follens, who retired at the end of 2024. For more information, visit https://www.atlascopcogroup.com.

Eurus Blower Introduces EBox™ Series to North America Market, a Factory Standard Blower Package

Eurus Blower announced the introduction of the EBox™ Series of blower packages to the North American market. These blower packages are used in pneumatic conveying and other industrial applications.

Features include:

- Pressure to 15 psig (1 bar)
- Airflow to 1,571 cfm
- Separated process and cooling air
- IEC standard UL certified motor, TEFC, IP55, 230/460V, 60HZ, IE3
- Dedicated cooling fan, 460V, 60Hz
- Easy service features
- Extremely low noise (<85 dbA) and low vibration
- Pressure and temperature gauges
- External oil level gauges
- Preinstalled pressure relief and check valves

Eurus Blower has launched the EBox™ Series of blower packages to the North American market.

Roger Blanton, General Manager, Eurus Blower, said, "This exciting EBox Series offers our customers a greater selection of high-quality blower packages. The EBox product introduction complements recent ISB Series Screw Blower, VR Series (steam blower) product introductions and growing success with our multistage centrifugal product. Eurus Blower's customer service focus is unmatched in the North American market as we continue meeting customer needs." For more information, visit https://eurusblower.com.

ROOTS®, America's Oldest Blower Brand, Celebrates 170 Years of Blower and Air Compressor Innovation

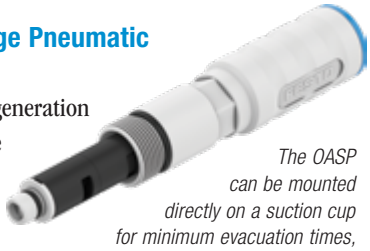
ROOTS®, America's original and oldest blower brand, proudly celebrates 170 years of leadership in blower and air compressor technology. Since its founding in 1854, ROOTS has been at the forefront of industrial innovation, shaping the industry with its groundbreaking technology and unmatched expertise.

Today, ROOTS continues to provide industry-leading blower and air compressor solutions to a wide range of industries, including steel manufacturing, food and chemical production, water and wastewater treatment and textile mills. The brand's products, such as positive displacement blowers, centrifugal compressors and truck blowers, are recognized for their durability, reliability and intelligent engineering.

"Reaching 170 years in business is a remarkable achievement for the ROOTS brand," said John Parrish, Vice President of Sales, Process Flow Technologies, North America. "Since the invention of the rotary lobe blower by the Roots brothers in 1854, our mission has remained constant: to deliver innovative products that meet the evolving needs of our customers. Over the decades, generations of employees have proudly built quality products that serve the global marketplace. We look forward to the next 170 years of innovation and service within the Ingersoll Rand umbrella." For more information, visit https://www.rootsblower.com.

ROOTS is celebrating 170 years of blower and air compressor innovation.

Festo Introduces Multistage Pneumatic Vacuum Generator



The OASP can be mounted directly on a suction cup for minimum evacuation times, or used with the OVPN, and has a suction flow rate of 160 l/min to 245 l/min, depending on the model.

Festo has expanded its vacuum generation solutions to include a multistage generator and a multistage cartridge. These new vacuum components offer exceptional performance on porous materials, such as paper and corrugated board.

The OVPN and OASP meet the increasing demand for high suction flow rate in vacuum generation. A medium-sized single-stage vacuum generator, for example, has a suction flow rate of about 100 liters per minute (l/min). On the other hand, the new OVPN multistage generator's suction flow rate ranges from 245 l/min to 960 l/min, depending on the model.

Festo vacuum generators are characterized by their compact design, low weight, choice of mounting position and low maintenance requirements. They range in suction flow rates from 6.2 l/min to 960 l/min. For more information, visit https://www.festo.com.

Leybold Launches DURADRY Dry Screw Vacuum Pump for Medium-Harsh Industrial Production Processes

Leybold rounds out its new series with a powerful DURADRY that's available as an option with a full or partial housing unit.

Leybold's DURADRY is a dry screw vacuum pump designed for medium-harsh industrial production processes where high temperatures, high oxygen contents and corrosive conditions prevail. Its features make it the perfect solution for applications like crystal pulling, plasma cleaning, heat treatment, coating and battery production.

"The pump's main advantages are its ease of operation and low maintenance requirements," said Darong Li, Product Manager, Leybold, highlighting the strengths of the two models in the 160 and 250 m³/h pump speed classes.

Equipped with sensors and a dynamic seal, the hermetically tight system prevents the introduction of oil particles and contamination. Additionally, the DURADRY impresses customers with its quiet, ergonomic operation. Noise and vibration levels in the vicinity of the vacuum pump are less than 64 dB. For more information, visit https://www.leybold.com/en.

A Guide to Vacuum Pump Sizing

By Michael Ruff, Business Development & Technology Director, Becker Pumps Corporation

Sizing a vacuum pump can seem daunting, but it doesn't have to be. Learn these tricks to make the process easier and less stressful. Keep in mind, you don't need to be exact. A rough estimate is often good enough. Focus on the key factors.

Know Your Vacuum Pump Application

When starting your vacuum pump selection, think about the following:

- **Flow Rate:** What volume of air or gas needs to be moved per unit of time?
- **Vacuum Level:** What is the desired pressure?
- **Gas Properties:** What are the characteristics of the gas being managed?
- **Duty Cycle:** Will the pump operate continuously or intermittently?
- **Environmental Factors:** Are there temperature, humidity or noise restrictions?
- **Total System Volume:** What is the total volume of the space being evacuated?

Key Vacuum Pump Sizing Terms

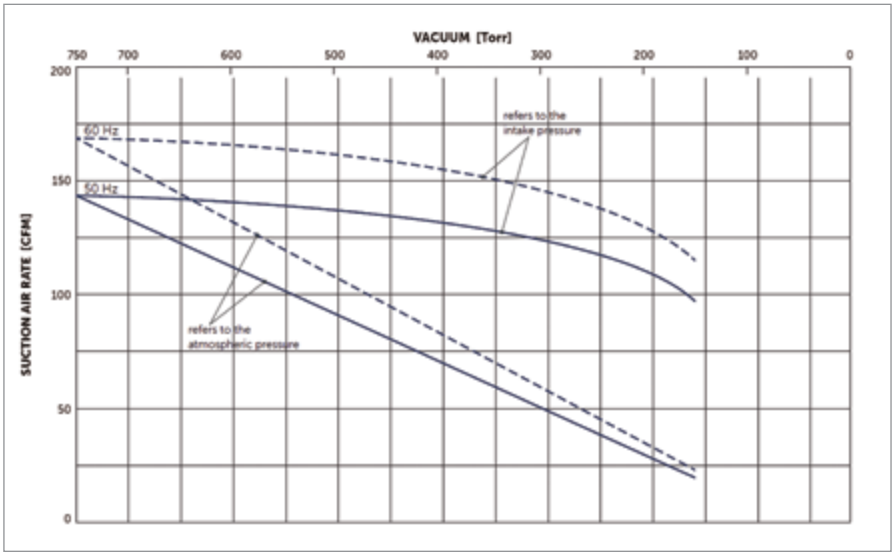
Flow Rate: Are you looking for actual cubic feet per minute (acfm) or standard cubic feet per minute (scfm)?

acfm measures the actual volume of air the vacuum pump can remove in one minute under specific conditions (including temperature, pressure and altitude). scfm measures the volume of air the vacuum pump can remove in one minute under standard conditions (usually 68°F [20°C], 14.7 psi [1 bar], and 0% relative humidity). Standard conditions vary by pump manufacturer.

A vacuum pump removes air from a space. acfm tells you how much air it can remove right now, while scfm tells you how much it can remove under ideal conditions. This is important because the performance of a vacuum pump can be affected by factors such as the size of the space it's evacuating, the type of air it's removing and the altitude.

acfm gives you the real-time performance of a vacuum pump, while scfm provides a standardized measurement for comparison.

It's crucial to specify whether you're working with acfm or scfm measurements when discussing vacuum pump requirements with a supplier. Using the wrong measurement can lead to oversizing or undersizing the



This graph shows the relationship between scfm and acfm on a V/P curve used by vacuum pump manufacturers. It illustrates the relationship between suction air rate (cfm) and vacuum level (torr) at different frequencies (60 Hz and 50 Hz), showing how the suction air rate decreases as the vacuum level increases for both frequencies, with the 60 Hz curve exhibiting a higher suction air rate than the 50 Hz curve at a given vacuum level.

vacuum pump. Volume flow vs. pressure curves are often presented in both acfm and scfm. Using the correct curve ensures an accurate performance evaluation. Also, when comparing vacuum pumps, it's essential to use the same unit for a fair comparison.

When contacting a vacuum pump supplier, state whether you are interested in acfm or scfm flow rates. This will help them provide you with accurate recommendations and ensure the selected vacuum pump meets your needs.

Ambient and Atmospheric Pressure: These are the same thing. Both refer to the pressure of the air around you.

Absolute Pressure: The total pressure, including atmospheric pressure. It's measured relative to a perfect vacuum.

Gauge Pressure: The pressure measured relative to atmospheric pressure. It's what you would see on a typical pressure gauge.

Imagine a jar:

- Atmospheric pressure is the weight of the air pushing down on the jar.
- Absolute pressure is the total pressure inside and outside the jar.
- Gauge pressure is like measuring how much pressure there is inside the jar compared to the outside.

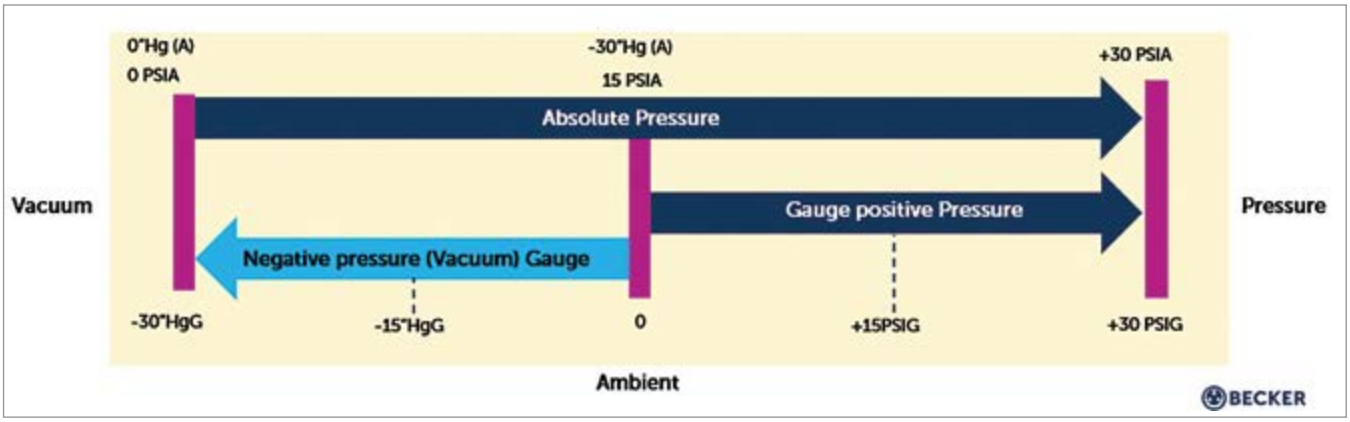
If you remove the air from the jar, the gauge pressure becomes negative. This is because the pressure inside is lower than the pressure outside.

In vacuum applications, absolute pressure is the total pressure, including the atmospheric pressure. Gauge pressure is the pressure difference between the inside and outside of the vacuum chamber. It's negative in a vacuum because the pressure inside is lower. Here's a simple formula to remember: Absolute pressure = gauge pressure + atmospheric pressure.

For example, If atmospheric pressure is 14.7 psi (1 bar) and gauge pressure is -10 psi (-0.7 bar meaning 10 psi or 0.7 bar below atmospheric pressure), the absolute pressure would be 14.7 psi plus -10 psi [1 bar plus -0.7 bar]), or 4.7 psi (0.3 bar).

In vacuum applications, absolute pressure is often used to measure the pressure inside a vacuum chamber. Gauge pressure is often used to measure the difference between the pressure inside the chamber and the atmospheric pressure. Gauge pressure tells you how empty the vacuum chamber is,

A Guide to Vacuum Pump Sizing



Absolute pressure is measured relative to a perfect vacuum, while gauge pressure is measured relative to atmospheric pressure.

while absolute pressure tells you the total pressure inside.

Just as with volume flow, you need to specify whether you are working with relative (gauge) or absolute pressures when discussing vacuum pump requirements with a supplier.

If a customer says, "I need a vacuum pump that can provide 28 cfm and 14"Hg," without asking more, the vacuum pump supplier might size and quote based on these units, as shown in **Figure 1**.

However, the customer could later say the vacuum pump is not working for their application. That's because the customer requires a pump able to maintain a flow rate of 28 cfm while achieving a gauge pressure of 14"Hg, as shown in **Figure 2**.

The first vacuum pump was undersized due to a lack of clarity. By providing additional information, you ensure the selected vacuum pump meets your needs and performs as required.

Moving Different Gasses with a Vacuum Pump

When dealing with gases other than the air we breathe, several factors must be considered. While vacuum pump manufacturers can provide guidance, understanding gas composition is crucial. Incorrect use of equipment could lead to major safety concerns.

The air we breathe is primarily composed of nitrogen, oxygen and argon, with trace amounts of other gases including carbon dioxide, water vapor and ozone. Different gases have different molecular weights and

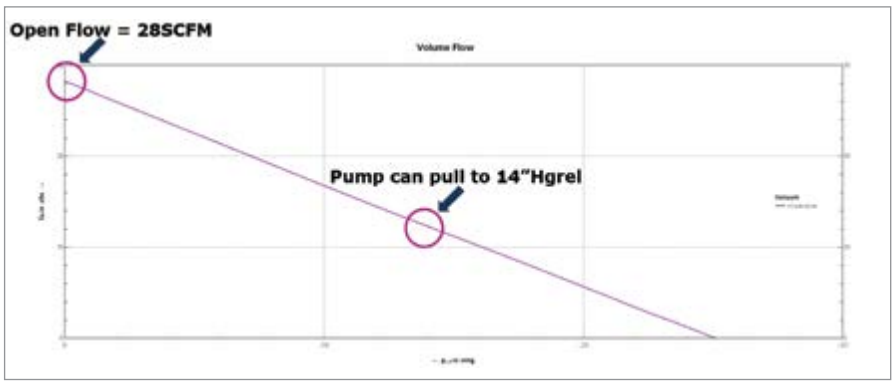


Figure 1. This graph illustrates the performance of a vacuum pump, showing that as vacuum level increases (lower pressure), the volume flow rate decreases.

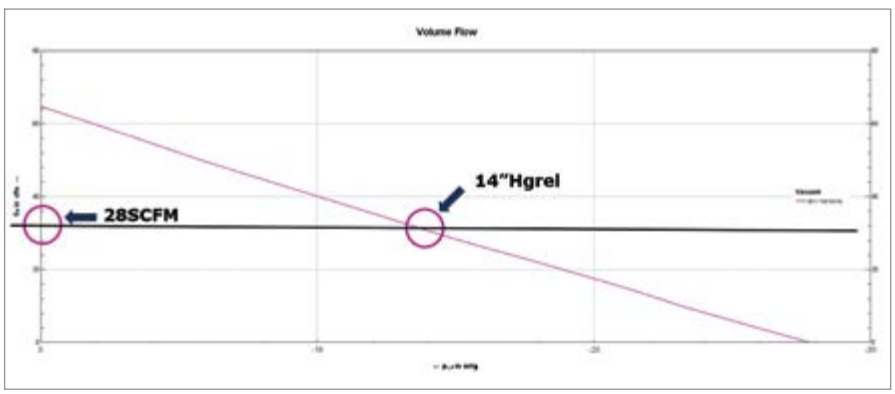


Figure 2. The graph depicts the performance of a vacuum pump, showing an open flow of 61 scfm, an end vacuum of 28"Hg. When running at 14"Hg, the available scfm is 28.

viscosities. Heavier gases like carbon dioxide may need higher pumping speeds.

When working with a mixture of gases, the dominant gas dictates the overall pumping requirements. However, the presence of other gases, especially those with low boiling points or flammable properties, can significantly impact the achievable vacuum level and introduce safety risks.

If a gas mixture contains flammable components, there is a risk of fire or explosion if proper precautions are not taken. Vacuum pumps must be selected and operated in a manner that minimizes the risk of ignition.

Flammable gas types:

- Hydrocarbons: Methane, propane, butane, ethylene and acetylene.
- Solvents: Gasoline, benzene and toluene.
- Natural gas: A mixture primarily composed of methane.

Some gases can react with other substances or with the vacuum pump itself, leading to hazardous conditions. It is essential to consult with the manufacturer to choose a pump compatible with the specific gases being managed.

Reactive gases:

- Halogens: Chlorine, fluorine and bromine.
- Hydrogen: A highly reactive gas.
- Oxygen: It can react with many substances, especially in the presence of a heat source or catalyst.
- Ammonia: A highly reactive gas that can form explosive mixtures with air.
- Nitrous oxide: A strong oxidizing agent that reacts with many substances.

Vacuum Pump Size and Total Volume

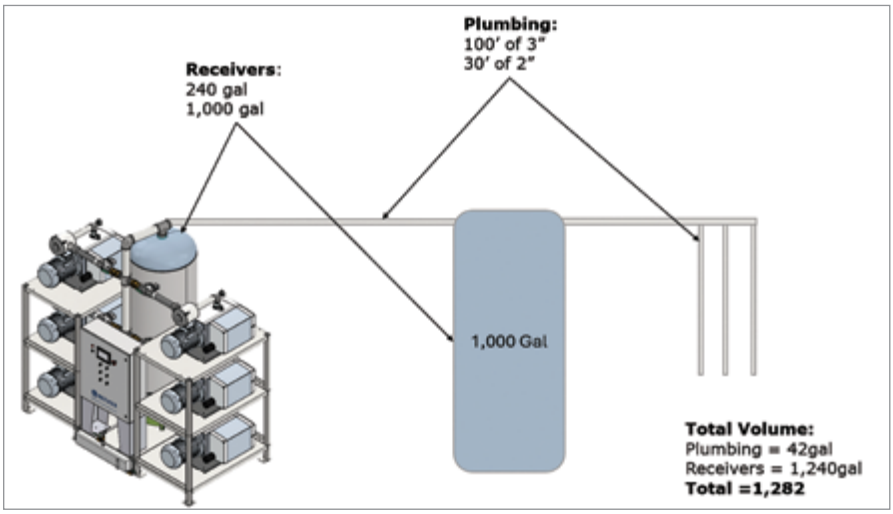
Once we've established the gas properties, flow rate and desired vacuum level, we can focus on vacuum pump size. Vacuum pump manufacturers offer a wide range of vacuum pump sizes, each capable of managing a specific volume of air within a given time.

The system the vacuum pump is connected to represents the total volume that needs to be evacuated each time the pump is activated. This total volume directly influences the pump's required cfm.

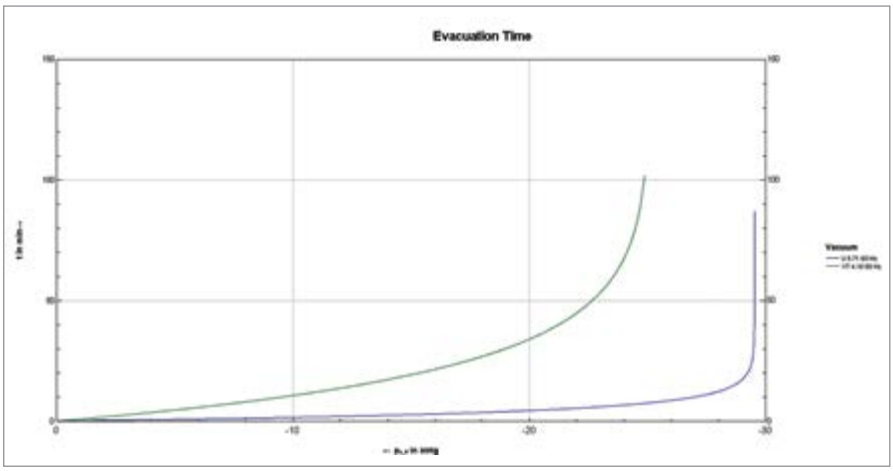
We need to account for all volumes the vacuum pump must evacuate. In this image, we have a total of 1,282 gallons to remove before the vacuum becomes available to the user.

Vacuum and Flow Relationship

Vacuum and flow are inversely proportional. A higher flow rate leads to a lower achievable vacuum level. During startup, the time to reach a specific vacuum level is typically short. However, as the vacuum level decreases, it takes longer for the vacuum pump to remove the remaining volume.



The image depicts a system with two receivers, totaling 1,240 gallons, connected to a plumbing system with 100 feet of 3-inch pipe and 30 feet of 2-inch pipe, resulting in a total system volume of 1,282 gallons.



The evacuation time for the total system volume decreases with increasing pump capacity. A higher capacity pump achieves faster evacuation times compared to a lower capacity pump.

A Guide to Vacuum Pump Sizing

If you have a specific time requirement to reach a desired vacuum level, be sure to communicate this to the vacuum pump manufacturer.

Selecting a Vacuum Pump

Once we have established the essential factors for vacuum pump sizing, we can select the most suitable vacuum pump type. There's an array of vacuum pump styles available, each with unique characteristics.

Common technologies used for vacuum pumps:

- Rotary vane: A rotating rotor with vanes (flat, blade-like components made of a carbon-resin blend) creates a vacuum by displacing air.
- Screw: Two intermeshing screws create a vacuum by compressing and displacing air.
- Claw: Two intermeshing claw-shaped rotors create a vacuum by trapping and compressing air.
- Diaphragm: A diaphragm oscillates to create a vacuum by displacing air.
- Rotary piston: A rotating piston creates a vacuum by displacing air.
- Liquid ring: A rotating impeller creates a liquid ring that traps and compresses air.
- Dry scroll: Two intermeshing scroll-shaped elements create a vacuum by trapping and compressing air.
- Regenerative blower: This uses a rotating impeller with vanes to create a centrifugal force drawing air into the pump and forcing it out.
- Radial blower: This is a type of dynamic vacuum pump. It uses a centrifugal impeller with radial blades to create a high-velocity flow of air or gas.

Equivalent Pipe Length of 90-Degree Elbows										
90-degree elbow (inches)	1/2	3/4	1	1 1/4	2	2 1/2	3	4	5	6
Equivalent length (feet)	0.8	1.2	2	2	3	4.4	5	7	9	10

Tips to Consider When Choosing a Vacuum Pump

Vacuum pipe loss starts to occur around 100 feet of length. Keep the plumbing diameter equal to the inlet port of the vacuum pump for as far as possible. Increase the plumbing diameter by one increment (for example, from one inch to two inches) every 100 feet. For exhaust plumbing, avoid backpressure by increasing the diameter every 30 feet.

When calculating total system length, consider the equivalent pipe length of 90-degree elbows. These can introduce additional resistance to airflow, effectively increasing the system's length. This impacts the overall pressure drop and flow rate.

Altitude significantly impacts the performance of vacuum pumps, especially those relying on atmospheric pressure for their operation. At higher altitudes, atmospheric pressure is lower, which can affect the achievable vacuum level. For every 1,000 feet above sea level, the vacuum level is lowered by approximately one inch of mercury. Higher altitudes can affect the cooling efficiency of the pump's motor, leading to increased temperatures and potentially shortening the motor's lifespan. If you are operating at a significant altitude, it is a good idea to let the pump manufacturer know.

A vacuum pump selection checklist:

- Choose a pump that can achieve the required vacuum level.
- Select a pump with a sufficient flow rate to manage the required volume of gas.
- Consider the gas type, composition and any potential contaminants.
- Evaluate the pump's maintenance needs and costs.
- If noise is a concern, choose a pump with noise-reduction features.
- Consider the initial purchase cost and ongoing operating expenses.

By carefully evaluating these factors, you can select a vacuum pump that provides the best performance, reliability and customer experience for your application. BP

About the Author

Michael Ruff has over 17 years of industrial vacuum pump experience. He specializes in providing clear solutions for complex vacuum pump challenges.

About Becker Americas

Becker is a leading provider of vacuum pumps, air compressors and regenerative blowers. Its global headquarters is in Wuppertal, Germany, and its American headquarters is in Cuyahoga Falls, OH. For more information, visit https://beckerpumps.com.

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Dual Point Aeration Blower Control

By Tom Jenkins, President, JenTech Inc.; Jun Inai, Senior Design and Project Engineer, and Hayato Sakamoto, Principal Project Leader, Kawasaki Heavy Industries

A significant objective for aeration system blowers is matching the air supplied to the process demand. Because of variability in process demand, turndown of the aeration blower system is a critical parameter. Of course, it is also important to provide the required air flow at a high efficiency. These two parameters – efficiency and turndown – are critical to system optimization.

Process variability causes system demand to frequently deviate from the design points for flow and pressure. It is common for an aeration system to need a turndown in flow rate of 5:1 or more. This is often accompanied by variations in the discharge pressure. It is not unusual for the actual discharge pressure to be 1.0 psig lower than the design point.

Aeration blowers must operate across a wide range of inlet densities, and the changes in inlet conditions impact aeration blower performance. Density variations are primarily due to differences in ambient temperatures encountered.

The Kawasaki Heavy Industries MAG Turbo M55

This combination of varying demands presents a challenge to aeration blower suppliers. The design point is usually selected to ensure operation in worst case conditions. However, evaluating performance at the design point is only one consideration. During aeration blower selection it is also common to evaluate performance at multiple air flows, discharge pressures and inlet conditions. The assumed duty cycle is intended to reflect the anticipated operating range. This, in turn, is used to estimate the life cycle cost of operating the aeration blower.

The Difference in Single Point and Dual Point Control

Single stage centrifugal aeration blowers have established a reputation for reliability and efficiency. They are commonly applied to supply air to wastewater aeration basins. These aeration blowers are available in both geared and direct coupled (turbo) configurations.

There are a number of methods employed in modulating the airflow of centrifugal aeration blowers, including:

- Inlet throttling, typically using a butterfly valve (BFV)
- Variable inlet guide vanes (IGV)
- Variable discharge diffuser vanes (VDV)
- Variable speed, typically using a variable frequency drive (VFD)

The Kawasaki Heavy Industries MAG Turbo M55 connected to a blower test stand for a wastewater plant project.

Dual Point Aeration Blower Control

Each of these methods is typically employed separately. This is referred to as single point control. It is also possible to combine two of these methods in a single blower. This is referred to as dual point control. The objectives of dual point control are to provide high turndown and good efficiency while operating at flows and pressures differing from the design point.

Historically, the most common dual point control has been combining inlet guide vanes and variable discharge diffuser vanes. These are both mechanical systems and predate the availability of economical variable speed control.

Recent advances in power electronics technology and improved VFD economics have led to implementing other combinations for dual point control. These include combining VFD control with either VDVs or IGVs.

Aeration Blower Control Techniques

A common aeration blower performance curve plots discharge gauge pressure and inlet volumetric flow at a specific set of conditions. All control methods shift and change this aeration blower performance curve. This results in changing the intersection point of the performance curve with the system pressure curve, modulating the flow rate. Each method has a different effect on the performance curve.

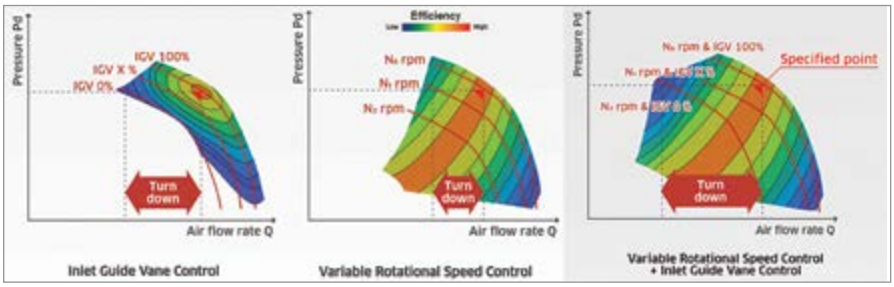
Throttling with a BFV results in a lower and steeper curve. This method is inherently inefficient. It wastes power by creating a pressure drop across the inlet valve. However, it has the lowest initial cost.

The result of IGV control is lower pressure and air flow rate, shifting the blower curve downward and to the left. IGVs change the operating characteristics of the impeller by swirling the air ahead of the impeller. As the IGVs close they present a growing obstruction to air flow, resulting in a throttling effect. This results in some inefficiency and also makes the curve steeper.

VDVs change the conversion of velocity pressure to static pressure in the aeration blower volute. VDV control shifts the aeration blower curve to the left, resulting in a lower airflow for a given pressure.

Using a VFD for control moves the performance curve down and to the left but does not induce any throttling. Varying the blower operating speed is the most efficient method of flow modulation. Centrifugal blowers follow the affinity laws. These dictate that flow is proportional to speed, pressure is proportional to the square of the speed, and power is proportional to the cube of the speed. With VFD control, minimum speed is often limited by the discharge pressure capability at reduced speed.

An aeration turbo blower with dual point control



The effect of combining control techniques on aeration blower performance curves

Calculating the Benefits of Dual Point Control

One example of advanced dual point control is the MAG Turbo from Kawasaki Heavy Industries. This design combines IGV and VFD control. It uses a proprietary control algorithm to coordinate the two mechanisms in the dual point control system. The algorithm optimizes the combination of rotational speed and IGV opening in response to fluctuations in flow rate, inlet conditions and discharge pressure. The effect of combining IGV and VFD into dual point control is improved turndown while maintaining high efficiency.

The impact of dual point aeration blower control on off-design operation can be illustrated by an example application. The design point provided by the end user for aeration blower selection was 25,000

scfm (708 sm³/min) at 9.5 psig (0.7 barg) discharge pressure with 14.7 psia (1.014 bar) ambient pressure. Design point inlet conditions were 98°F (37°C), 14.4 psia (0.993 bar), and 40% relative humidity corresponding to the worst case.

The end user also provided a variety of anticipated flows, pressures and inlet conditions for evaluating life cycle cost.

A set of dimensionless performance parameters were developed by the manufacturer from test data. These parameters were interpolated to calculate the performance at the design point and alternate evaluation points. Separate calculations were made for IGV control, VFD control and dual point control. (See **Table 1**.)

Table 1: Performance Data at 14.7 psia (1.014 bar) Ambient Pressure, 40% Relative Humidity

Flow, scfm	12,500	15,625	18,750	21,875	25,000
Inlet temperature, °F	23	32	50	50	68
Inlet press. psia	14.6	14.6	14.6	14.5	14.4
Discharge press. psig	9.5	9.5	9.5	9.5	9.5
Input power with IGV alone, kW	659 Blow-off Open	644 Blow-off Open	701	784	892
Input power with VFD alone, kW	649 Blow-off Open	655 Blow-off Open	672 Blow-off Open	737	868
Input power with dual point control, kW	469	557	654	737	868

Centrifugal aeration blower turndown is limited by the possibility of surge. Surge is a damaging pulsation in flow rate and pressure that occurs when the system pressure is greater than the aeration blower is able to produce. If the aeration blower's minimum flow exceeds the process demand it is necessary to waste the excess air by venting it to atmosphere through a blow-off valve. This is an inefficient method of flow control. As indicated in the table, opening the blow-off was required for several evaluation points when controlling with only IGV or VFD. Because of the improved turndown with dual point control, the blow-off was not needed.

The results demonstrate that dual point control combining an IGV and a VFD provides more turndown than either IGV or VFD control alone. The data also shows power consumption at the alternate evaluation points is improved by dual point control. This is particularly true in the low

Dual Point Aeration Blower Control

flow range because the improved turndown eliminates opening the blow-off valve.

The end user provided an assumed time of operation for each alternate evaluation point. This information was used to estimate the total annual power consumption for each point. (See **Table 2**.)

Dual point control reduces the calculated annual power consumption by 8% compared to IGV alone. Compared to VFD control alone the savings are 5%. If electricity cost is $0.10/kWh, dual point control reduces the annual cost of electricity by $30,000 compared to VFDs alone and by $50,000 compared to IGVs alone.

Conclusion

Aeration blowers are critical process equipment in aeration applications. Optimizing energy consumption is a significant objective in selecting aeration blower system technology. Reduced energy use lowers operating costs while enhancing sustainability through reduced CO_2 emissions from power generation.

Turndown is key to matching aeration blower output to process demand. Good turndown is essential for both process performance and energy efficiency.

In addition to supporting variations in air flow demand, the aeration blower must accommodate a wide range of operating conditions. The variations in inlet density from ambient temperature changes add to the difficulty of optimizing performance. The control system design will influence turndown and efficiency when the aeration blower operates off the design point.

Dual point control has been used for many years. Originally dual point control was mechanical, combining IGV and VDV. Advancements in technology have resulted in the availability of low-voltage and medium-voltage VFDs for economical speed control. These improvements have led to the use of variable speed operation as part of dual point control strategies. A dual point control system provides excellent turndown

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at high efficiency, both keys to optimizing aeration blower applications. Innovative systems that combine variable speed and guide vanes provide better performance, improved turndown and higher efficiency than older systems with mechanical controls alone. BP

Table 2: Estimated Annual Power Consumption						
Hours per year	438	1752	3066	2190	1314	**Total kWh**
Annual kWh, IGV alone	289,000	1,128,000	2,149,000	1,717,000	1,172,000	**6,455,000**
Annual kWh, VFD alone	284,000	1,148,000	2,060,000	1,614,000	1,141,000	**6,247,000**
Annual kWh, dual point control	205,000	976,000	2,005,000	1,614,000	1,141,000	**5,941,000**

About the Authors

Tom Jenkins has over 40 years of experience in aeration blowers and blower applications. As an inventor and entrepreneur, he has pioneered many innovations in aeration blower control. He is an Adjunct Professor at the University of Wisconsin at Madison and a Fellow of the Water Environment Federation. For more information, visit http://www.jentechinc.com/.

Jun Inai is a Senior Design and Project Engineer with over 30 years of experience in R&D and the design of turbomachinery including compressors for air and other gases, blowers and turbines at Kawasaki Heavy Industries. In recent years, he has focused on energy conservation and plant optimization using the MAG Turbo aeration blower.

Hayato Sakamoto leads the Kawasaki MAG Turbo aeration blower project. With over two decades of experience in the development and applications of blowers, compressors for air and other gases, and natural refrigerant chillers, he specializes in the aerodynamic technology of rotating machinery. He designed the highly efficient impellers and diffusers forming the core technology of the MAG Turbo.

About Kawasaki Heavy Industries

With about 100 group companies in Japan and overseas, Kawasaki Heavy Industries is a technology corporate group. Through the development of unique and broad businesses, it solves issues facing customers and society. For more information, visit https://global.kawasaki.com.

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previously used with a smaller air compressor. This scenario yielded a storage ratio of .65 gallons per full load cfm (80 gallons/122 cfm).

Figure 2 shows the resulting data logging graph with six minutes of data. During the recording, the machine loaded and unloaded 21 times, the unloaded amp draw only reached 22 amps and calculated average power consumption was 21.6 kW. The air compressor did not stay unloaded long enough to reach full sump blowdown and the associated power reduction.

Scenario 2: 400 Gallons of Storage

Next, the 80-gallon tank was removed and replaced with a 400-gallon tank. This yielded a storage ratio of 3.3 gallons per full load cfm (400 gallons/122 cfm).

Figure 3 shows the data logging graph with six minutes of data. During the six-minute time frame, the air compressor loaded and unloaded only four times, the unloaded amp draw reached 16 amps and calculated average power consumption was 19.3 kW. The additional storage had a positive impact on the air compressor's operation, including an 11% reduction in calculated power.

Scenario 3: 800 Gallons of Storage

For the final test, we added an additional 400-gallon tank for a total of 800 gallons. This yielded a storage ratio of 6.6 gallons per full load cfm (800 gallons/122 cfm).

Figure 4 shows the data logging graph with six minutes of data. Doubling the storage capacity resulted in a 50% reduction in duty cycle as the air compressor loaded and unloaded only twice. Additionally, the unloaded amp draw reached as low as 15 amps and calculated average power consumption was 18 kW. That offered an additional 7% power reduction for an overall 17% reduction from the first scenario.

Our exercise wasn't intended to prove or disprove the values from the graph; thus, we didn't use kW meters or orifice plates. The takeaway was

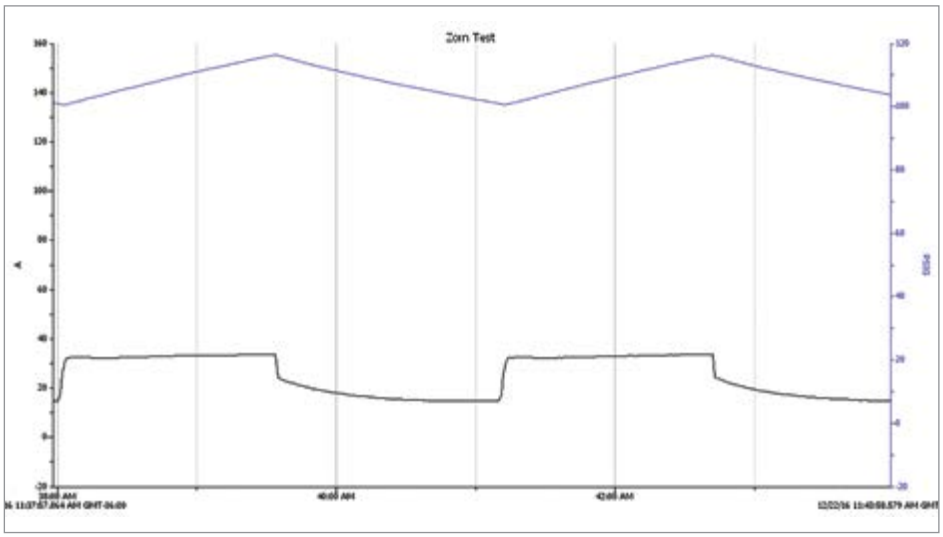

Figure 4, testing with two 400-gallon tanks

The Effect of Increased Storage Capacity on Load/No Load Air Compressors

proving the value of storage capacity for load/no load controlled lubricated air compressors.

The Opportunity for Substantial Energy Savings

The power savings of a single 15- or 30-hp air compressor might seem trivial compared to work being done in large compressed air systems at major corporations. However, if we take time to examine the size of the small lubricated rotary air compressor market, the savings potential is impressive.

Some researchers examining small manufacturing have estimated there are roughly 250,000 manufacturers with employees in the U.S., and approximately 75% of them have fewer than 20 employees.

A significant percent of small manufacturing plants operate 15 to 30-hp lubricated rotary screw air compressors, and it's generally accepted as an important market segment accounting for thousands of rotary air compressor annual unit sales. For this important installed base, if we imagine half of small manufacturers operate on average a 20-hp fixed speed, load/no load air compressor for a conservative average of 1,200 annual operating hours, that's a tremendous use of energy.

Now, imagine additional storage reducing that energy use by 5% or 10%. The power reductions and savings are impactful both for the individual company and the industry as a whole.

An Action Plan for Manufacturing Plants, Compressed Air Providers and Energy Providers

As an industry, we need to emphasize the value of storage for load/no load lubricated rotary air compressors. Some energy providers offer incentives for adding additional storage to existing load/no load air compressor installations.

Manufacturing Plants: Make room for an extra storage tank and consider it an investment, not an expenditure.

Compressed Air Providers: Have the courage and knowledge to propose an extra storage tank, presenting it as an investment rather than an expenditure. Manufacturing plants often

tell us an air compressor vendor said their unit doesn't need an extra storage tank. Unless the provider can communicate the benefits of additional storage, it may not even be offered in a competitive situation. Perhaps the data in this article can help.

Energy Providers: Consider offering financial incentives to manufacturing plants increasing storage capacity on existing fixed speed, load/no load air compressor installations.

This is an opportunity for the compressed air industry to assist a vital segment of the U.S. industrial base, the small to mid-size manufacturer. Additional storage for new fixed-speed applications or existing installations can have a beneficial impact on their business. BP

About Frank Melch

Frank Melch is a compressed air industry veteran, having started in the industry in 1981. He worked for a variety of distributors and manufacturers over the years before joining Zorn Compressor & Equipment in 1999. He retired after spending 14 years as Vice President of Sales & Marketing. Melch is a 1981 graduate of Lake Forest College (Illinois) with a BA in Economics. In addition, he's a Department of Energy (DOE) Compressed Air Systems AIRMaster+ Qualified Specialist.

About Zorn Compressor & Equipment

Zorn Compressor & Equipment is a family-owned company based in Pewaukee, WI, with multiple branches in Wisconsin and Illinois. With over 55 years of experience in the industry, Zorn distributes a wide variety of compressed air equipment, parts and services. It provides maintenance and repair, emergency service and rentals, installation and plant piping and air, energy and system audits. For more information, visit https://www.zornair.com.

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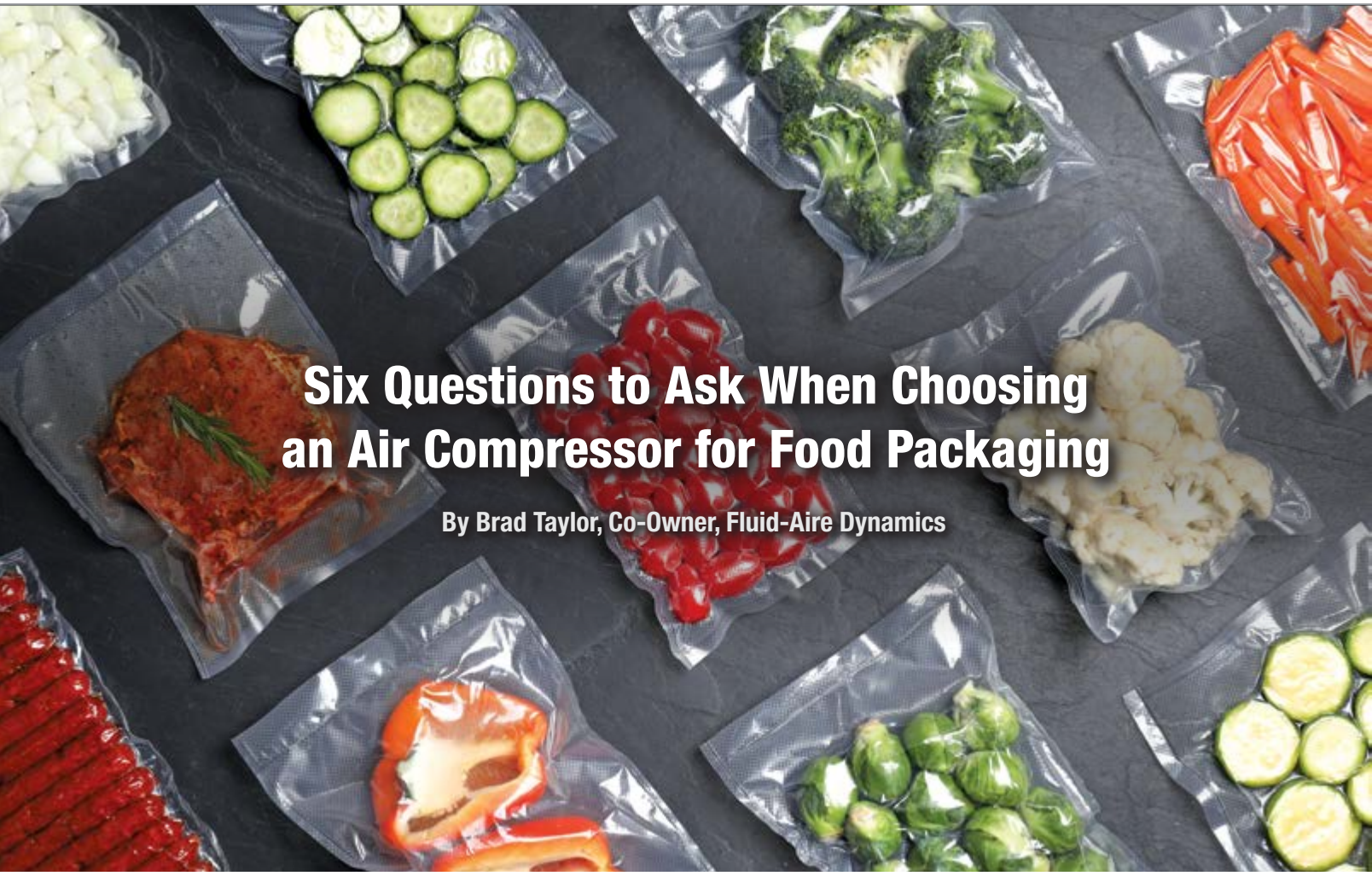

Six Questions to Ask When Choosing an Air Compressor for Food Packaging

By Brad Taylor, Co-Owner, Fluid-Aire Dynamics

Compressed air is critical in food packaging, powering sealing machines, nitrogen generation systems and much more. Choosing the wrong air compressor can lead to contamination, compliance issues and wasted costs. To make the right choice, you need to ask the right questions. These six questions will help you design a compressed air system that meets food safety standards, ensures efficiency and keeps your operations running smoothly.

1. What Applications Will Use Compressed Air?

The first step in choosing an air compressor is understanding how compressed air will be used in your food packaging operations. Compressed air can serve a variety of roles, each with unique requirements for air quality and system design. Broadly, these applications fall into two categories:

- **Direct Contact Applications:** In direct contact applications, compressed air comes into direct contact with food products or packaging materials. Examples include air knives, product handling, blow-off and package inflation or cushioning. Because the air interacts with the product, maintaining the highest level of purity is essential to avoid contamination.

- **Indirect Contact Applications:** In indirect contact applications, compressed air powers machinery or supports processes without coming into direct contact with food. Examples include powering equipment (filling, sealing or labeling machines), running nitrogen generation systems for modified atmosphere packaging and blow-off or cleaning for outer containers and cartons. Air purity requirements for these applications can vary. Most nitrogen systems require a high degree of air purity. While other applications may be less sensitive, clean, dry compressed air is still important to prevent damage to equipment and maintain product safety.

Above: Food packaging applications require ultra-clean compressed air.

2. What Are the Relevant Air Purity Standards for the Application?

Compressed air used in food packaging must meet stringent air purity standards to prevent product contamination and

ensure compliance with Food and Drug Administration (FDA) regulations. Food manufacturers are required under Good Manufacturing Practices 21 CFR Part 110 to ensure compressed air does not contaminate food products. Compliance with compressed air standards is also an essential component of Safe Quality Food certification.

ISO 8573-1 is an international standard that specifies purity classes for compressed air based on three key contaminants: particulates [A], water [B], and oil [C], given in an [A]:[B]:[C] format. The standard defines ten classes for each contaminant, ranging from the strictest (Class 0, nearly contaminant-free) to Class 9. While the FDA does not mandate specific air purity classes for food packaging, there are common industry guidelines. For example:

- Direct contact applications: Purity class of 2:2:1 or better.
- Indirect contact applications: Purity class of 2:4:2 or better.

3. Do You Need an Oil-Free Air Compressor?

Most food packaging applications rely on rotary screw air compressors, which are ideal for high-volume, continuous applications. These air compressors come in both oil-flooded and oil-free versions. Choosing between oil-free and oil-flooded air compressors is a balancing act between cost and compliance.

- **Oil-free air compressors** are designed to deliver air free from oil contamination, making them a strong choice for applications requiring strict air purity. They are well-suited for direct contact applications where any trace of oil contamination could result in food safety issues or regulatory violations. These systems are more expensive than lubricated air compressors and have higher maintenance costs.

Direct-contact applications, where compressed air comes into contact with food products, may require a higher level of compressed air purity than indirect-contact applications such as running packaging machinery and conveyor systems.

Six Questions to Ask When Choosing an Air Compressor for Food Packaging

- **Oil-flooded air compressors** use oil to lubricate moving parts in the airend. Oil-flooded air compressors are usually less expensive than oil-free versions. These air compressors are a great choice for indirect contact and less sensitive applications. Oil-flooded air compressors can still meet food-grade air standards when paired with the right filtration and air treatment options.

While oil-flooded air compressors paired with advanced air treatment can offer cost savings upfront, filtration costs can add up over time. The best solution depends on the specific needs of your operation, including the type of applications, purity standards and production volume.

4. What Kind of Air Treatment Is Required?

Proper air treatment involving filtration and compressed air dryers ensures compressed air is clean, dry and free of contaminants. The compressed air treatment strategy used depends on the compressed air purity standard required and the type of air compressor.

- **Air dryers:** Excess moisture in compressed air can lead to equipment corrosion, microbial growth and contamination risks, especially in food packaging. Compressed air dryers remove this moisture and lower the dew point (a measure of moisture

Most food applications require a desiccant compressed air dryer to remove all traces of moisture. These compressed air dryers can achieve dew points as low as -40°F (-40°C) or even -100°F (-73°C).

content) of the air. Refrigerated compressed air dryers do this by cooling the air to let moisture fall out naturally. They can achieve dew points down to 38°F (3°C). This is typically suitable for general manufacturing and indirect contact applications. However, in direct contact applications that require Class 1 or 2 purity levels for moisture, a desiccant compressed air dryer is usually required. These use adsorptive material to remove water from the compressed air, achieving dew points as low as -40°F to -100°F (-40 to -73°C).

- **Filtration:** Inline filtration is essential to remove contaminants from compressed air, including particulates, oil aerosols and vapors. Filter options include particulate filters (for solid particles), coalescing filters (for oils, aerosols and fine particulates) and activated carbon filters (for oil vapors and odors) which may be used in combination. Filters should be strategically installed to target contaminants at various stages of the compressed air system, with multiple layers of filtration for maximum effectiveness. For oil-flooded air compressors, an additional layer of treatment is necessary to remove residual oil content. High-efficiency coalescing filters and activated carbon stages are crucial for achieving ISO 8573-1 Class 1 or Class 0 oil purity.

5. How Will You Monitor and Maintain Air Quality?

Even with a well-designed compressed air system, maintaining consistent compressed air quality requires regular monitoring and proactive maintenance. Without these measures, contaminants can accumulate, jeopardizing food safety and compressed air system performance. Maintenance and monitoring includes:

- Regular compressed air testing to ensure air meets purity class requirements. Testing should align with ISO 8573-1 standards and include periodic audits to confirm compliance with food safety protocols.
- Replacing filters at regular intervals recommended by the manufacturer.
- Proactive maintenance of the air compressor and compressed air dryers.

A coalescing inline filter removes both oil residue and fine particulates. With the right filtration, it is possible to meet food quality standards for compressed air with a lubricated air compressor.

Six Questions to Ask When Choosing an Air Compressor for Food Packaging

- For oil-flooded air compressors, maintenance and inspection of the oil/water separator (including filter changes, cleaning and water testing) to prevent contamination or failure.

6. What Is the Total Cost of Ownership?

Choosing the right compressed air system for food packaging isn't only about upfront costs – it's about understanding long-term expenses and benefits. A compressed air system that seems cost-effective initially may turn out to be more expensive over time due to energy inefficiency, maintenance or non-compliance penalties. Evaluating the total cost of ownership helps you make a smarter investment in your compressed air system. Factors to consider include:

- **Capital expenses:** While oil-flooded air compressors paired with advanced air treatment can offer cost savings upfront, oil-free air compressors might be more economical in the long run for applications requiring strict air purity. Consider both the air compressor itself and the cost of air treatment systems such as compressed air dryers and filtration.
- **Maintenance and consumables:** Ongoing costs include filter replacements, oil changes (for oil-flooded systems) and servicing of compressed air dryers, separators and other air treatment components. Oil-free air compressors eliminate the need for oil-related maintenance but still require regular servicing of filters, compressed air dryers and other components. Weigh the recurring costs of consumables and servicing for each system type.
- **Energy efficiency:** Air compressors are energy-intensive, often accounting for a significant portion of operational costs. Look for compressed air systems with features like variable-speed drives to optimize energy use based on demand.
- **Compliance costs:** Meeting air purity standards ensures regulatory compliance and avoids costly penalties or recalls. Factor in air quality testing and monitoring to maintain consistent performance.
- **Downtime and productivity:** Unplanned downtime disrupts operations and results in revenue losses. Investing in equipment with monitoring capabilities helps minimize risks.
- **Longevity:** Investing in a high-quality compressed air system with durable components can extend the lifecycle of your equipment, reducing the frequency and cost of replacements.

Choosing the Right Air Compressor for Food Packaging

In the food packaging sector, choosing an air compressor is a critical decision impacting your operations, product safety and bottom line. By asking these six questions, you can ensure your compressed air system meets the unique demands of your applications and operates efficiently. Working with a qualified compressed air system designer is essential to ensure your compressed air system is tailored to your specific application and compliance requirements. An experienced professional can help analyze your needs, select the right equipment and design a compressed air system that is both efficient and compliant with food safety standards. BP

About the Author

Brad Taylor is a Compressed Air Systems Engineer and co-owner of Fluid-Aire Dynamics, a specialist in the design, installation, maintenance and repair of industrial compressed air systems.

About Fluid-Aire Dynamics

Fluid-Aire Dynamics is a leading provider of industrial compressed air system sales and service in Chicago, Milwaukee, Minneapolis, Detroit, Philadelphia and San Antonio. Specializing in rotary screw air compressors, it offers compressed air system design and engineering, equipment sales, preventative maintenance, emergency repair and air compressor rentals. Based in Schaumburg, Illinois, Fluid-Aire Dynamics services all major makes and models of industrial air compressors and associated air accessories. For more information, visit https://fluidairedynamics.com.

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PREMIUM OEM COMPONENTS

New ABB Super Premium Motors Bring Energy Efficiency Gains

By Troy Dreier, Senior Editor, Compressed Air Best Practices® Magazine

Headquartered in Zurich, Switzerland, ABB is a Fortune 500 electrical equipment manufacturer and one of the world's biggest suppliers of industrial motors. The company acquired U.S. manufacturer Baldor Electric in 2011. Baldor had acquired Reliance Electrical Company in 2007.

The company is in the middle of a multi-phase rollout of its SP4™ Super Premium motor technology, which promises energy efficiency gains and cooler operation. These motors are sold under the Baldor-Reliance® brand.

Driven by National Electrical Manufacturers Association (NEMA) and Department of Energy (DOE) motor efficiency regulations taking effect in 2027, ABB began developing SP4 technology in 2021. While the regulations apply only to 100-horsepower (hp) and higher motors, the company is creating a full range of these motors.

Technical Innovations for Improved Motor Efficiency

Manufacturing motors with NEMA Super Premium efficiency (the equivalent to an IEC IE4 rating) required technical innovations. The SP4's electrical grade steel is created with a new process. The motor's stator core was redesigned with a longer iron stack, incorporating more iron to improve efficiency. Additional copper and increased active material in the rotor core further optimize energy conversion. These advances let SP4 motors convert electrical energy into mechanical energy while minimizing energy loss as heat. This results in up to 20% more efficient motors than previous models, reducing energy waste by the same margin.

The reduction of heat losses allows SP4 motors to run at lower operating temperatures, which extends their lifespans. The improved steel allows ABB to better control magnetic flux lines and limit losses, furthering efficiency gains. These motors are rated for an operating temperature of 104°F (40°C), the industry standard.

Thanks to the SP4's lower operating temperature, ABB has improved the most common failure point of electric motors – the durability of their bearings. As a result, customers benefit from the motor's extended overall lifespan. Reflecting this, ABB is offering these motors with a four-year warranty rather than the standard three-year warranty offered with other motor types.

"The 20% reduction in losses is a huge benefit for our customers. SP4 motors comply with upcoming regulations, which is another benefit. Also, they offer cooler operation for extended life. That's going to play into the added value our products give to our customers," said Brandon Canclini, NEMA Motors Division Global Product Manager. "We increased our warranty period, going from a three-year warranty to a four-year warranty. So, I think it makes for an attractive package."

Original equipment manufacturers (OEMs) will appreciate that these motors offer drop-in

An ABB Baldor-Reliance SP4 rolled steel motor

Above: ABB is releasing a full suite of Baldor-Reliance SP4 motors.

replacement with the same sizing and connection ports as previous models.

"For already-existing applications, if a motor goes down, we want to be able to give the market an opportunity to replace that product with a higher efficiency product. Customers can easily find a product within our offerings that will fit inside their existing application," said Canclini.

Energy Savings for OEM Equipment

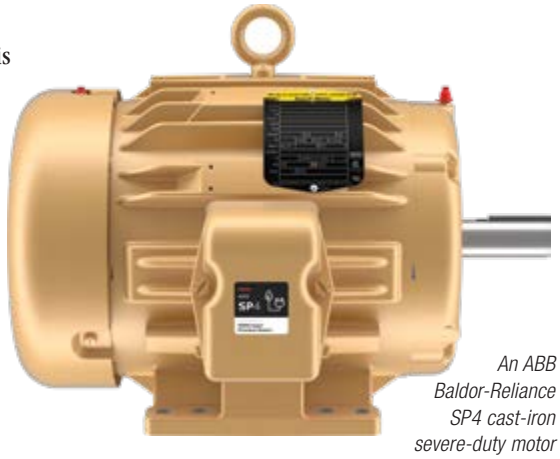
ABB is releasing these motors in a multi-phase launch. The first phase began in early 2024 with ¼ to 20-hp rolled steel in 2, 4 and 6-pole configurations. Customers can choose from totally enclosed non-ventilated (TENV) or totally enclosed fan cooled (TEFC) models. In June 2024, the company released these motors with severe duty enclosures, which include 25 to 300-hp models. These TEFC models are meant for hazardous environments. Insulation is Class F, with Class H as an option. Future rollouts will bring this technology to additional products.

SP4 motors can be paired with variable-speed drives for even greater efficiency and cost savings. Affinity laws show that during peak operation, power used to drive fans and pumps increases exponentially, not linearly. Reducing speed during low-use times greatly reduces the power consumed. An energy savings calculator on the company site (https://nema-energysave.us.abb.com) lets prospective buyers know what kind of savings to expect.

Asked about the benefits to air compressors, Canclini said, "SP4 motors provide the high efficiency and reliability required for air compressors which operate under demanding and variable-load conditions. The reduced energy losses and cooler operating temperatures mean a lower total cost of ownership for manufacturers. Additionally, the NEMA Super Premium efficiency level ensures compliance with stringent energy regulations, making this a future-proof investment. Since this line only launched earlier this year, we haven't yet compiled field results or document savings/case studies."

For use in cooling towers and cooling water pumps, Canclini said, "For cooling tower and pump applications, SP4 motors offer unmatched reliability in handling variable load conditions and harsh environments. The motors' cooler operation reduces the risk of overheating, which is crucial in temperature-sensitive cooling systems. Additionally, pairing these motors with ABB variable speed drives allows manufacturers to optimize energy use based on demand, achieving substantial energy and cost savings. Their durability and extended warranty give manufacturers confidence in their long-term performance."

Brandon Canclini, NEMA Motors Division Global Product Manager



An ABB Baldor-Reliance SP4 cast-iron severe-duty motor

Finally, for aeration blowers, industrial blowers and vacuum pumps, Canclini said, "SP4 motors are designed to handle continuous, high-demand applications like those in blowers and vacuum pumps. Their ability to operate efficiently over extended periods reduces maintenance intervals and operational downtime. This is particularly valuable in aeration and industrial blower applications, where reliability and low operational costs are critical. The 20% reduction in motor loss directly translates to energy savings, while the improved cooling reduces heat-related wear, extending motor life." BP

About ABB

ABB is a technology leader in electrification and automation, enabling a more sustainable and resource-efficient future. The company's solutions connect engineering know-how and software to optimize how things are manufactured, moved, powered and operated. Building on more than 140 years of excellence, the company's more than 105,000 employees are committed to driving innovations that accelerate industrial transformation. For more information, visit https://global.abb.

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Leak Detection Leads to Energy Savings for Cabinet Manufacturing Plant

By Juan Londono, Applications Engineer, Air Unlimited

Above: The Air Unlimited headquarters in Winnipeg, Manitoba

A multinational cabinet manufacturing company with a production plant in Manitoba, Canada, recognized as one of the largest energy consumers in the province by the local utility, looked for ways to improve its compressed air system efficiency, reduce energy consumption and lower greenhouse gas emissions to align with its sustainability goals. Understanding the social, economic and environmental impact of its operations, the company committed to embracing a more sustainable approach to its production processes.

The plant's compressed air system consisted of multiple air compressors from different manufacturers, with capacities ranging from 100 to 250-horsepower (hp), for a total system capacity of around 1,100-hp. The plant's average compressed air demand was 2,300 cfm, with peaks reaching 3,500 cfm. System pressure fluctuated between 105 and 110 psi (7.2-7.6 bar).

The system included three refrigerated compressed air dryers, a variety of filtration units including mist eliminators, particulate filters and coalescing filters, plus various

Air Unlimited used a UE Systems UVLP acoustic camera to conduct its inspection.

styles of condensate drains. These components removed moisture and contaminants from the system, maintaining the required air quality of 1:4:2 as per ISO 8573-1 for the plant's diverse application processes.

The compressed air system included three compressed air dry tanks, offering a total compressed air storage capacity of 2,000 gallons, along with a pressure/flow controller to ensure reliable and stable operation throughout the compressed air system.

A Detailed Compressed Air System Assessment

In August 2023, the plant worked with Air Unlimited, the local manufacturer's representative, when one of its largest air compressors failed. Upon arriving at the site, the service manager discovered the failure was caused by an electrical power supply fault rather than a mechanical or internal electrical failure in the air compressor itself. Working with the company's maintenance team, the service manager restored the air compressor to full operation.

Following this successful service, the company's maintenance supervisor reached out to Air Unlimited again. He wanted to explore opportunities for improving the compressed air system's efficiency, reducing air compressor use where possible and lowering energy consumption.

Air Unlimited conducted a system assessment in November 2023, to identify the primary sources of energy consumption. The assessment showed targeting compressed air leaks would be an ideal starting point due to the number of leaks observed during the walkthrough. This aligned with the cabinet manufacturer's sustainability goals by enhancing system performance, lowering costs and setting the stage for further energy-saving measures.

During the leak detection service, conducted over multiple days in September and October 2024, Air Unlimited collected data using a UE Systems UVLP industrial acoustic imaging

Before working with Air Unlimited, the cabinet maker wrapped this compressed air leak in clear tape.

Leak Detection Leads to Energy Savings for Cabinet Manufacturing Plant

This compressed air leak on the cabinet maker's production line was identified and tagged.

camera. The process was supported by a maintenance team member who was familiar with the plant layout and would be responsible for repairing the identified leaks. The scanning process began in the air compressor room and continued throughout the facility, following all compressed air lines across the various departments.

358 Leaks Discovered

The greatest number of leaks were identified in the painting, finishing and polishing areas, as well as the assembly lines where most of the pneumatic tools were located. These areas included numerous compressed air hoses and connection points. Leaks were found at couplings, old and poorly maintained hoses with small holes, fittings, quick disconnects and the flexible tubing connecting pipe drops to point-of-use applications, a common problem area.

In production areas with automated machines (rather than pneumatic tools), most leaks were at pipe and hose joints, as well as FRLs (filters, regulators and lubricators).

In the air compressor room, leaks were observed in condensate traps, flanges and thread sealants. It is uncommon to find significant leaks in the air compressor room, as these typically involve substantial airflow and are noticed immediately.

Several factors contributed to the great number of compressed air leaks found in the plant:

employees not reporting compressed air leaks to the maintenance department, compressed air leaks in loud areas where they were difficult to hear and compressed air leaks in isolated areas with minimal staff traffic or supervision. Additionally, the maintenance department did not prioritize compressed air leak repair so known compressed air leaks went unaddressed. Air Unlimited documented and tagged each compressed air leak, ensuring precise reporting and an organized repair process.

To assess the financial impact of the leaks and create a comprehensive evaluation of energy savings, Air Unlimited requested the plant's electrical rates. It analyzed collected data to assess the impact of compressed air leaks on both energy consumption and emissions.

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Manitoba, Canada

Compressed air leakage report

Leaks Found	358
Total Leak Size	750.8 ft³/ min
Total Cost	$58,525 CAD/year
Minimum level	21.4 dB
Average Leak Size	2.1 ft³/min
Min Leak Size	0.37 ft³/min
Max Leak Size	9.4 ft³/min
Average Cost	$163 CAD

Air Unlimited provided the cabinet manufacturer with a report detailing its findings.

The results were striking: It identified a total of 358 leaks for a loss of 750.8 cfm. This compressed air loss represented approximately $40,520 in annual energy savings in U.S. dollars. To put this into perspective, the volume of air lost matched the output of a 150-hp air compressor. Manitoba benefits from one of the lowest electricity rates in North America, with an average cost of $0.03 per kWh in U.S. dollars. This favorable rate influences energy savings calculations for industrial facilities.

Persuaded by the quick and substantial return on investment associated with repairs, the cabinet manufacturer committed to addressing its compressed air leaks quickly. Repairing compressed air leaks has a low upfront cost with immediate benefits in compressed air flow, energy reduction and system efficiency.

Compressed Air Leaks Were Only the Beginning

During the compressed air leak detection, Air Unlimited identified additional compressed air system inefficiencies. These included:

- Pressure set points on some air compressors were identical. Therefore, more than one air compressor loaded and unloaded at the same time leading to a fight for control and short cycling.
- Air compressors were set for higher pressure than was needed to compensate for compressed air system losses. Reducing the output pressure on air compressors leads to a reduction in overall power consumption. For every two psi decrease in discharge pressure, energy consumption decreases by 1%.

Leak Detection Leads to Energy Savings for Cabinet Manufacturing Plant

- The plant's compressed air system piping didn't include a full loop, which would optimize air flow and improve pressure stability. The compressed air system piping included several sharp angles and elbows, slowing air flow and reducing pressure. The compressed air piping system also lacked drip legs for reducing moisture content.

- Inappropriate compressed air uses included open blowing, cabinet cooling, personnel cooling and vacuum venturis.

These issues lead to a rise in energy costs and a lowering of operational efficiency. They will be evaluated in an upcoming comprehensive compressed air audit in spring 2025. This audit will provide deeper insights into each area, guiding targeted improvements to enhance system performance and lowering long-term costs.

Best Practices for Compressed Air System Efficiency

Air Unlimited provided the client with the following compressed air best practices to ensure lasting efficiency and sustainability:

- Inspect workstations and encourage operators to report any compressed air leaks or fluctuations in system pressure. This helps detect new compressed air leaks early, preventing them from going unnoticed.

- Follow manufacturers' maintenance schedules. Routine checks and maintenance will help ensure compressed air equipment operates at peak levels, minimizing unplanned downtime and improving system efficiency.

- Provide comprehensive training to the maintenance team on best practices for compressed air systems, ensuring they have the skills to operate, maintain and troubleshoot the compressed air system. Gaps in training included knowledge of air compressor controls and coordination strategies, evaluating compressed air use throughout the facility to identify and address inefficient or inappropriate uses and adhering to manufacturer maintenance guidelines for all compressed air system components. Establish a detailed maintenance plan that involves all team members to enhance compressed air system reliability and efficiency.

- Track and report key performance indicators. Many components and operating parameters within the compressed air system were unmonitored. Implementing continuous compressed air system monitoring with alarms and detailed reporting allows staff to track essential metrics such as equipment running hours, compressed air system pressure, power consumption, airflow, air and equipment temperature, relative humidity, dew point and system efficiency. Consistent tracking and reporting help plants verify energy savings and emissions reductions, helping assess improvements and marking progress toward sustainability goals.

Taking proactive measures will help the plant maintain operational efficiency, reduce energy consumption and continue progress in its sustainability objectives. BP

About the Author

Juan Londono is an Applications Engineer at Air Unlimited, with over seven years of experience in engineering, project management, compressed air systems and nitrogen generation. His areas of expertise include designing compressed air systems and nitrogen generation solutions and conducting comprehensive compressed air audits. His proficiency in both engineering and project management allows him to oversee projects from conception to execution.

About Air Unlimited

Air Unlimited has been a leader in the compressed air systems and building power solutions industry for over 50 years, providing sales and services to clients in Manitoba, Saskatchewan and Northwestern Ontario. It offers 24/7 certified technicians, installation capabilities, compressed air audits and energy conservation studies, preventative maintenance programs and electric and diesel rental options. For more information, visit https://www.airunlimited.ca.

To read more ***Compressed Air Leak System Assessment*** articles, visit https://www.airbestpractices.com/system-assessments/leaks.

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Fluid Equipment Solutions Saves Energy and Water with Dry, Hybrid and Adiabatic Cooling

By Troy Dreier, Senior Editor, Chiller & Cooling Best Practices Magazine

Fluid Equipment Solutions of New England (FES) is a manufacturer's representative firm based in Amesbury, MA, covering Maine, New Hampshire, Massachusetts and Rhode Island. It represents EVAPCO cooling towers, Danfoss SONDEX heat exchangers, LAKOS centrifugal separators and sand filters and controls from various manufacturers, as well as pumps and hydronics.

Before FES began, the EVAPCO rep firm for New England was a one-man operation run by Bud Jensen. Jensen had been the area rep since the late 1970s. Ben McLaughlin, Senior Sales Engineer, left another company to join Jensen in 2007. The two executed an asset purchase in 2012, where McLaughlin created his own legal entity and bought Jensen's assets. That was the beginning of the company. Jensen retired after passing along his customers, manufacturer relationships and 29 file boxes.

Ben McLaughlin, Senior Sales Engineer, at Fluid Equipment Solutions of New England's Amesbury, MA, headquarters.

"He was a mentor to me and taught me a lot about the industry, including product history, details around working with and applying the products and replacements, industrial applications, HVAC applications and all the ways to maintain good relationships with our buyer customers," McLaughlin said. Jensen is retired on Cape Cod, and still keeps up with company news.

Above: A project in southeast Massachusetts supplied an electric vehicle battery technology developer with two V-configuration dry coolers, each with ultra-high efficiency permanent magnet motors.

Fluid Equipment Solutions Saves Energy and Water with Dry, Hybrid and Adiabatic Cooling

A New England-based automotive plastic interior parts manufacturer needed five 34-ton adiabatic fluid coolers, each sized for 81.3 gpm, with an entering temperature of 95°F (35°C) and a leaving temperature of 85°F (29°C).

Since 2012, business has continued to grow. Thanks to Boston's many college campuses and medical facilities, the company has grown even in economically lean years.

Focused Product Offerings, High Degree of Expertise

FES is involved in the full lifecycle of its projects. Its sister company under the same ownership, Good Tower Services of New England, handles all startup, warranty and field service work. A sale to a mechanical contractor typically involves a startup in the field. McLaughlin likes to tell the lead service technician doing most of the startups that he's an important part of the organization because he puts a bow on the project.

"As a rep firm, we are a unique presence in our industry. We're involved in the lifecycle of our cooling towers and fluid coolers before they exist all the way to the end of life. We're even involved in service and maintenance in partnership with our contractor customers," McLaughlin said. "That's unique. We work with a consulting engineer on the design, we bid the product and, hopefully, work with the mechanical contractor and sell it to them. Then, Good Tower Services, our parts and services arm, works hand-in-hand with the installing contractor on startup and commissioning.

"We're often called upon by our mechanical contractor customers, as well as owners, asking, 'How can we extend the life of this product?' We're careful to work with our contractor and owner customers to find solutions," McLaughlin said.

Another thing distinguishing FES is the limited size of its product offerings. Because the company keeps its product offerings small, it's able to have a high degree of expertise. McLaughlin noted the company is consistently one of the top-performing EVAPCO reps in the country.

"We maintain high product and application knowledge, and that allows us to give a high level of personal service," McLaughlin said.

New England Market Moves to Dry, Hybrid and Adiabatic Cooling

The New England climate presents unique opportunities for FES. Because most of the firm's geography freezes in the winter, customers can run their coolers dry in the winter to save energy and water. The company sees a trend away from evaporative cooling and towards dry cooling.

About a decade ago, McLaughlin noted, EVAPCO began selling wet-dry hybrid fluid coolers that can run dry in the wintertime and wet in the summertime. While McLaughlin isn't sure which came first – the desire to conserve water or cooling towers making it possible – it's clear customers are moving in that direction. Hybrid cooling towers are popular both for new projects and customers looking to replace existing equipment. Upfront costs for hybrid cooling systems are higher, but customers can see a return on investment sooner. For industrial customers operating year-round, the return is fairly quick, McLaughlin said.

FES's top offering for water savings is a hybrid fluid cooler. The ability to take advantage of lower ambient temperatures in the wintertime and run dry provides big savings. The company also offers dry and adiabatic fluid coolers. Around eight years ago, EVAPCO came out with a full line of dry coolers. Adiabatic coolers are a type of dry cooler with a wetted pad in the air stream.

Water Treatment Products Offer High Cycles of Concentration

Water use is typically not a concern in New England, and customers don't face the same

Wireless Provider Saves Water and Energy with a Hybrid Fluid Cooler

In 2024 and early 2025, FES worked with a wireless provider near Cape Cod to replace an older forced draft centrifugal fan fluid cooling tower with a modern hybrid fluid cooler to take advantage of water and energy savings. The cooler would serve the building's chillers. The company worked with Boston-based engineering firm CannonDesign.

The selection criteria for the hybrid fluid cooler considered year-round temperatures. Summer duty had an entering water temperature of 95°F (35°C) and a leaving water temperature of 85°F (29°C). In winter, the wireless provider could use the fluid cooler for direct free cooling, meaning it could send water directly through the fluid cooler, bypassing the chiller. Entering water temperature was 55°F (13°C) and leaving water temperature was 44°F (7°C). The company leveraged the surface area of the hybrid fluid cooler for two different sets of cooling criteria.

When working on a replacement project in an existing building, the replacement product should be of an equal or smaller operating weight than the original equipment. The existing structure was built to support a certain operating weight. To mitigate or eliminate structural redesign, the replacement needs to be of equal or less operating weight. That presented a special challenge for this installation, as moving to a hybrid fluid cooler requires more surface area.

A wireless provider needed a hybrid fluid cooler matching the footprint and weight of its previous cooling tower.

"We had to find the balance, so the finned coil hybrid fluid cooler would handle the design criteria, yet not increase the overall operating weight of equipment on the existing roof," McLaughlin said.

The company was able to provide a product similar in footprint and operating weight to the original cooling tower, yet capable of meeting different sets of cooling criteria to achieve energy and water savings. As of this writing, the project is in the building phase.

Fluid Equipment Solutions Saves Energy and Water with Dry, Hybrid and Adiabatic Cooling

This eco-ATWB hybrid fluid cooler includes a Smart Shield water treatment system, and serves a Massachusetts-based company that does laser powder bed fusion on an industrial scale.

constraints as industry in the Southwest or West Coast. However, costs for both energy and water are higher in New England than the national average.

The company sells water treatment options, which have a strong impact on water use. Non-chemical water treatment products allow customers to run at higher cycles of concentration and save water. Similarly, EVAPCO offers a product called Water Saver, a pre-treatment product applied to incoming water to lower the level of dissolved solids and enable high cycles of concentration.

Corrosion from salt water is a common problem in New England. While the water supply in Greater Boston and many surrounding communities works well with cooling towers and fluid coolers, some communities have water high in chlorides. When chlorides enter a recirculating evaporative system, their corrosivity is multiplied. Another area the company serves has soft water devoid of mineral content. This also presents challenges in a recirculated system as chemistry entering from ambient air becomes magnified when cycled up.

Greater Cooler Surface Area Leads to Greater Energy Savings

When customers need to save energy, the company recommends custom solutions that let them run their fans less. Options include using more water or providing more surface area to reject heat to atmosphere. When customers are open to increased water use, the recommendation depends on the customer's particular location and temperature profile.

"The other way of providing energy savings is in the form of surface area, and wet-dry fluid coolers and dry and adiabatic fluid coolers have a tremendous amount of surface area to do so," McLaughlin said. "The more surface area you can provide, the more heat transfer you get without water or fan energy. For any given product selection, if you're going to oversize it in that application, you're going to use less water and energy. The strategy is looking at products with more surface area, as well as potentially using sizing for the temperature profile that's unique to that customer's requirements."

Cooling Tower Strategies for the Coldest Months

For customers running open cooling towers year-round, McLaughlin has strategies to mitigate icing. First is raising the water temperature, since warmer water is less prone to icing. Second is reversing the cooling tower fan during certain hours, so the cooling tower blows air down instead of pulling air up. This draws air over the warm water and expels it through the inlet louvers, which are prone to icing.

Filtration Benefits for Cooling Towers

FES represents LAKOS filtration products. As McLaughlin likes to say, cooling towers are fantastic air cleaners: They pick everything out of the air – dust, dirt, pollen – and bring it

In this installation, a LAKOS basin sweeping system removes debris from a cooling tower basin.

into the cooling tower. Those pollutants have the potential to hinder heat transfer, such as on the film media in a cooling tower. Adding filtration to a cooling system preserves its heat transfer ability.

Nearly one-half of commercial HVAC systems have filtration on them, McLaughlin estimated. LAKOS works with the company to calculate the return on investment for adding filtration.

Besides preserving heat transfer, filtration helps operators avoid downtime. Dust and dirt from the air ends up in the basin of a cooling tower, especially one operating year-round. Operators are left with one to four inches of mud that needs to be cleaned out every year. Cooling systems with filtration and sweeper systems (nozzle systems in the basins of cooling towers that clear the water and the cooling tower at the same time) have much less downtime.

"There's a tremendous benefit to these systems, and a lot of the discerning owner-operators, consulting engineers and builders see it. We do sell a fair amount of those solutions," McLaughlin said.

A Community of Trusted Contractors and Engineers

Several contractors and industrial engineers help FES satisfy its demanding customers. McLaughlin highlighted three contractors representing three market segments. E.M. Duggan is a large mechanical contractor in New England with a strong business built on relationships. LC Anderson is a service contractor for the greater Boston area providing support with aftermarket and replacement market installations in commercial heating, cooling and refrigeration. And IMEC is primarily an industrial process customer handling process cooling applications.

Consulting engineer partners of note include CannonDesign, a multidisciplinary consulting engineering firm in Boston. It assisted with the installation detailed in the sidebar. Arup is a global full-service engineering firm with a long presence in Boston, and Clarke Energy is a data center power solutions provider.

"They say, do what you love and you won't work another day in your life. I think I see myself somewhere in there. I love what I do and I appreciate the challenge of solving problems, providing solutions and, ultimately, making heroes of our customers," McLaughlin said. "Our consulting engineers, our mechanical contractors, most of our equipment – the pathway of sales goes through those courses to the end-user. Making our customers a hero to their customer is my primary job." BP

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Real-World Installations & Maintenance

Edited by Troy Dreier, Senior Editor, Compressed Air Best Practices® Magazine

There's much we can learn from real-world compressed air, blower, vacuum, chiller and cooling tower installations. This column asks readers to share lessons learned from system installations and maintenance practices they encounter in the real world.

Upgrading to Zero Air Loss Condensate Drains

Andrew Smith-Carrier is a Mechanical Engineer who has worked in industrial energy efficiency with a focus on compressed air for over 15 years, currently through SMARTCAir, which he founded. Visit https://smartcair.com.

Smith discovered this timed electric solenoid drain valve while conducting a leak audit for an automotive parts manufacturer. Located under a compressed air storage tank, it opens and closes on a set schedule whether needed or not. Replacing it with a zero air loss drain would be a better choice, Smith noted, as that would keep compressed air from escaping. Also, repositioning the drain to a more accessible area would make routine maintenance easier.

Located under a compressed air storage tank, this timed electric solenoid drain valve presents a challenge for routine plant maintenance.

Leaky Bypass Saturates Single-Tower Desiccant Dryer

Robert McKay is a Senior Strategic Account Manager at Altec AIR. Based in Broomfield, CO, Altec AIR manufactures refrigerated and desiccant compressed air dryers, as well as other air treatment equipment. Visit https://www.altecair.com.

Altec AIR installed its HBS-1000 single tower, heat regenerative desiccant compressed air dryer at a Michigan power plant that needed clean, dry air for periodic testing. The power plant installed it on the main compressed air system with a separate bypass valve so it could be used as needed. McKay tested the system before providing training to plant personnel, and discovered the bypass valve had been leaking for the past year. The desiccant dryer was filled with water!

The HBS-1000's single tank design is well suited for periodic testing, as the power plant can run tests for four to five hours, then let the desiccant dryer regenerate. Once this unit's desiccant and filter elements are replaced – and the bypass valve is fixed – the power plant can finally begin its testing.

A power plant got a surprise when testing this desiccant compressed air dryer, thanks to a leaky bypass valve.

Submission Guidelines

We invite subscribers to share stories and photos of remarkable system installations they've come across. Email Troy Dreier at troy@airbestpractices.com. Please send a high-resolution image as a JPG or GIF file and a note describing the installation. If we publish your submission, we'll thank you with a $25 Amazon gift card.

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