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March 2026

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COMPRESSED AIR SYSTEM FEATURES

COOLING SYSTEM FEATURES

LATEST NEWS

EVERY ISSUE

Cover Image: Courtesy of Dishaka.

Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 104, Pittsburgh, PA 15241. Periodicals postage paid at Pittsburgh, PA and additional mailing offices. POSTMASTER: Send address changes to: Compressed Air Best Practices®, 37 McMurray Rd, Suite 104, Pittsburgh, PA 15241.

FROM THE EDITOR

System Engineering for Efficient and High-Quality Food Production

This month, we pay special attention to engineering compressed air, chilled water and nitrogen systems for energy- and water-efficiency while meeting quality standards for food production.

Dishaka of Houston, TX, produces over 1,000 bags of salty snacks per minute. With that kind of volume, it needs infrastructure that keeps pace. Joshua Blair, Sales Engineer, Liberty Systems, explains how his company helped this customer adopt Modified Atmosphere Packaging with onsite nitrogen generation.

Mike Sims, Sales Manager, Bi-State Compressor, is a 30-year veteran of the compressed air industry. His team helped a food manufacturer grow from one plant to many. Each new plant relies on the same model 200 hp, lubricated, variable-speed drive, rotary screw air compressor to keep ordering and maintenance simple.

Compressed air boosters have seen major gains, writes Manoj Purohit, Product Marketing Manager, Atlas Copco Compressors. A new generation of rotary screw booster is engineered to boost air to 435 psig (30 barg), delivering higher flow rates and optimizing energy efficiency.

Eric Thompson, General Manager, Frigel North America, provides a detailed look at adiabatic coolers. He explains the difference between dry mode and adiabatic mode, showing why some plastics processors see 20-40% lower lifecycle costs with modern adiabatic solutions.

Engineers will appreciate our detailed Q&A on optimizing chiller lift with Robert Tanner, Marketing Director, Johnson Controls. Tanner explains the differences between low, medium and high lift, and how rejected heat can be boosted and used in place of fossil fuels.

Finally, three food packaging and processing experts from Kaishan USA – John Schmitt, Marketing Product Manager; Weston Benton, Product Channel Manager, and Rob Grizzle, Midwest Sales Manager – discuss approaches to vacuum and compressed air system design when experiencing direct, indirect or ambient contact with food or food packaging.

Be sure to read the *Blower & Vacuum Best Practices Magazine* bundled inside this issue. We're pleased to present a feature on aeration blowers in the food industry from Bob Kisler, Regional Sales Manager, Hoffman & Lamson, and Doreen Tresca, Marketing Manager, SSI Aeration, as well as a case study of a vacuum system upgrade GlobalVac & Air and Brabazon Pump, Compressor & Vacuum did for the University of Missouri Dalton Cardiovascular Research Center.

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WOMEN IN
COMPRESSED AIR / VACUUM / COOLING

Connecting. Supporting. Advancing Women in the Industry.

The WCVC Networking Group is a community of women working across the compressed air, vacuum and cooling industries. We connect professionals through mentorship, education and meaningful networking – empowering women at every stage of their careers.

- **Quarterly Virtual Meetings**
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Women's Networking Breakfast

Best Practices 2026 EXPO & Conference
Wednesday, October 14, 2026 | Indianapolis, IN

Join fellow women in compressed air, vacuum and cooling for an inspiring morning of connection, conversation and community.

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https://cabpexpo.com/events/

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!

Our sales team hit the road last month for face-to-face meetings with select companies in the Midwest. Pictured here are Ed Perry, Chief Operating Officer, and Bryan Smither, CEO (left to right), of Brehob Corporation at the company's corporate headquarters in Indianapolis, IN. Brehob represents Quincy Compressor, and excels in creating custom compressed air solutions and providing round-the-clock emergency service. Visit https://www.brehob.com.

Our sales team also met with Paul Ryshavy, Sales Manager for Penway in Edinburgh, IN. Here, he stands in front of a portion of the company's ready-to-ship ASME Code pressure vessel inventory. With 40 years of pressure vessel experience and 35,000 feet of manufacturing space, the company can fabricate to any specification. Visit https://www.penway-inc.com.

The annual meeting of the Women In Compressed Air, Vacuum & Cooling (WCVC) Networking Group is always one of the highlights of the Best Practices EXPO & Conference. Katharine LeeHong, Sullair, and Teresa Hackwith, ALPLA North America (left to right), enjoyed a morning of networking and inspiring talks. Visit https://america.sullair.com and https://www.alpla.com/en/north-america.

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.

St. Jude wasn't the only world-class medical facility in attendance at the Best Practices 2025 EXPO & Conference. Jesse Becker, Senior Mechanical Systems Engineer, Mayo Clinic, was happy to learn from the exhibitors. "The most valuable thing for me has been talking with all the refrigerated dryer manufacturers and vendors who could give me information on all the different technologies that are out there," he said. Visit https://www.mayoclinic.org.

One highlight of the Best Practices 2025 EXPO & Conference was the opening session presentation "Central Energy Plant Optimization: Best Practices and Low-Hanging Fruit" by Hemant Tiwari, Energy Engineer, St. Jude Children's Research Hospital. Once he finished sharing his experience on energy efficiency, he found time for some reading. Visit https://www.stjude.org.

NEWS Compressed Air Industry & Technology

Kaeser Compressors Announces Factory-Direct Branches in South Florida

Kaeser Compressors announced the opening of factory-direct branches to serve customers throughout South Florida. A combination of brick and mortar facilities and mobile warehouse service vehicles will provide direct manufacturer support – including KFaCT certified service, parts, equipment sales and expert system engineering – to customers from Key West to Port St. Lucie.

Kaeser Compressors will serve customers from factory-direct branches in the West Palm Beach and Miami areas.

"We are committed to providing our South Florida customers with the seamless support they deserve," said Matt McCorkle, Director of Branch Operations. "We are on the ground and prepared to execute, ensuring our customers' systems achieve peak reliability and maximum energy efficiency without delay."

Kaeser's local team of certified experts is available to assist with immediate needs, from routine maintenance and troubleshooting to complete compressed air system design and installation. The new branches offer a direct line to the manufacturer, ensuring faster response times and technical expertise for industrial, commercial and institutional users.

Kaeser Compressors is a leader in reliable, energy-efficient compressed air equipment and system design. It offers a complete line of superior quality industrial air compressors as well as dryers, filters, SmartPipe™, master controls and other system accessories. Kaeser is an ENERGY STAR Partner. For more information, visit https://us.kaeser.com.

CAGI Introduces Compressed Air Purity Guide

The Compressed Air & Gas Institute announced the release of its newly published Compressed Air Purity Guide, available for free download on the CAGI website.

This essential resource offers a deep dive into the ISO 8573-1 standard, the globally recognized benchmark for compressed air purity. Whether working with plant air, instrument air or process air, this guide helps compressed air system operators understand how to achieve and maintain the right purity level to protect compressed air systems.

Air surrounds everything created and consumed. But when airborne contaminants – manmade or natural – enter a compressed air system, they can cause equipment failure, product contamination and costly downtime. That's why understanding and applying the ISO 8573-1 standard is critical.

This guide covers the composition of atmospheric air and how it impacts compressed air systems, as well as the risks posed by particles, water and oil contamination. It reviews how to apply ISO 8573-1 to classify and achieve desired purity levels and equipment selection strategies to meet purity requirements for different applications. Whether plants are in food production, pharmaceuticals, manufacturing or utilities, this guide is a roadmap to cleaner, safer and more efficient compressed air. For more information, visit https://www.cagi.org.

Sullivan-Palatek Expands SP20+ Rotary Screw Air Compressor Line

Sullivan-Palatek has expanded its SP20+ Series of rotary screw air compressors with the addition of a 200 horsepower (hp) model. Following the successful launch of the 125 hp and 150 hp SP20+ models, this latest addition further strengthens the SP20+ lineup, offering enhanced capacity and performance for demanding industrial applications.

This model has increased airflow with an expanded capacity up to roughly 1,000 acfm, depending on pressure settings. It's available in both fixed-speed and variable-frequency drive models to match varying air demand needs. Its enhanced 20 Series precision-ground rotor design ensures maximum performance and longevity, and the advanced Q1 microprocessor controller offers remote monitoring, web access and multi-compressor sequencing for up to 12 units. The premium WEG TEFC motor ensures optimal energy efficiency and reduced operating temperatures. The 200 hp SP20+ is built with heavy-duty components, corrosion-resistant materials and a NEMA 4 electrical enclosure for industrial reliability.

As with all SP20+ models, the 200 hp air compressor is backed by Sullivan-Palatek's warranty, including one year on the full package, two years on the airend and five-year Platinum and 10-year Platinum Plus extended coverage options. With 24/7 parts and service support and a nationwide distributor network, Sullivan-Palatek ensures dependable performance and peace of mind for its customers. For more information, visit https://www.sullivan-palatek.com.

Sullivan-Palatek's 200 hp SP20+ Series rotary screw air compressor

FOTRIC Unveils TD2 sense Acoustic Imaging Module: Compact, Intelligent Acoustics for Robotics and Monitoring

FOTRIC launched the TD2 sense Acoustic Imaging Module, a palm-sized innovation that redefines how acoustic technology can be integrated into robotics and fixed monitoring systems.

Powered by a 64-microphone array, the TD2 sense captures and interprets complex sound signals with high precision – enabling a range of diagnostic functions including partial discharge detection, compressed air and vacuum leak evaluation and acoustic navigation. It can also be configured to trigger alarms based on specific sound signatures, supporting early intervention in maintenance and safety scenarios.

Measuring 3.6 × 3.4 × 2.0 in (91 × 87 × 50 mm) and weighing 14.8 oz (420 g), the TD2 sense delivers advanced acoustic intelligence in a lightweight, portable form. Designed for robotic platforms, overhead inspections and discreet fixed installations, it enables continuous monitoring without adding unnecessary bulk. By extending inspection capability into hazardous or hard-to-reach environments, the module provides insights that conventional tools often miss.

To simplify adoption, the TD2 sense comes with a developer SDK and demo software, allowing engineers and solution providers to quickly embed its acoustic functions into autonomous platforms and monitoring systems. This flexibility makes deployment efficient, scalable and cost-effective.

The TD2 sense has already attracted interest from well-known robotics companies exploring new ways to enhance acoustic awareness and inspection capabilities in autonomous systems. Whether mounted on mobile robots for factory inspections or installed as a stationary monitor, the module empowers organizations to detect problems earlier, reduce risk and improve operational efficiency.

"Compact and highly adaptable, the TD2 sense represents a step forward in acoustic sensing technology," said a FOTRIC Product Manager. "Its ability to serve as both an integrated component and a standalone solution expands how industries can approach inspection and monitoring tasks."

FOTRIC TD2 sense Acoustic Imaging Module monitoring a manufacturing facility, detecting leaks and operational anomalies.

With its portability and integration flexibility, the TD2 sense supports a wide range of industries – including power utilities, manufacturing, industrial automation and infrastructure inspection. Whether deployed as a standalone monitor or built into autonomous systems, it helps organizations detect problems earlier, reduce risks and enhance operational efficiency.

"Compact and highly adaptable, the TD2 sense represents a step forward in acoustic sensing technology," said a FOTRIC Product Manager. "Its ability to serve as both an integrated component and a standalone solution expands how industries can approach inspection and monitoring tasks." For more information, visit https://www.fotric.com.

NEWS Compressed Air Industry & Technology

Hitachi Industrial Equipment Systems Group Achieves Carbon Neutrality for Scope 1 and 2 Emissions

Hitachi Industrial Equipment Systems (HIES) and its group companies have achieved carbon neutrality (Scope 1 and 2) across its global business operations in fiscal year 2024 (April 1, 2024 – March 31, 2025), six years ahead of its 2030 target.

HIES is part of Hitachi Group's long-term environmental vision, Hitachi Environmental Innovation 2050, which aims for net-zero greenhouse gas emissions across the entire value chain by fiscal 2050. This target is a science-based net-zero target aligned with the 2.7°F (1.5°C) goal set by the Paris Agreement and has been certified by the Science Based Targets initiative (SBTi).

HIES Group has been advancing initiatives to reduce GHG emissions by implementing energy-saving measures, introducing renewable energy power generation facilities, procuring renewable energy from external sources (purchased and certified) and using carbon offsets. By the 2024 fiscal year, the company achieved carbon neutrality at 54 sites, including domestic and overseas business sites, factories, service stations and offices, which account for more than 95% of the group's GHG emissions (Scope 1 and 2).

Solar panels installed at the Shimizu Works (Shizuoka City, Shizuoka Prefecture, Japan)

Additionally, HIES Group aims to reduce the offset ratio (based on 2019 emissions, which account for approximately 20% of its decarbonization target baseline year emissions) in 2024 to 17% or less by 2030, through continuing its efforts to reduce Scope 1, such as efficient operation and electrification of equipment.

"We are proud to achieve carbon neutrality," said John Randall, President and CEO, HIES. "This reflects our commitment to sustainability – not only in our operations but also in helping our customers improve their energy efficiency. We will continue to develop connected and sustainable industrial products and solutions to contribute to a more sustainable society." For more information, visit https://www.hitachi-ies.com.

ABB Unveils Open Drip-Proof Motor Design, Offering Cooling Efficiency and Power Density for Industrial Use

ABB announced the launch of its latest line of open drip-proof (ODP) motors. The new motors are optimized for demanding industrial environments where cooling efficiency and power output are critical.

Designed with IE3 efficiency (equivalent to NEMA Premium Efficient), these motors help reduce energy consumption while maintaining robust performance in applications with moderate exposure to dust and moisture.

With open ventilation allowing direct airflow over the windings, ABB's ODP motors run cooler and offer higher power output from standard frame sizes, resulting in a favorable horsepower-to-dollar ratio. They are ideal for applications such as air compressor rooms, container cranes, hoists, trolley and boom cranes and ammonia compressors in the food and beverage industry. With essential and non-essential marine certifications available, these motors are also well-suited for below-deck marine use.

The motors are available in IEC frame sizes 280-355 and NEMA sizes 5010, 5012 and 588, pre-engineered for rapid delivery across the U.S. Optimized for 460V/60Hz operation and compliant with US IHP and EU EcoDesign efficiency standards, these motors offer a sustainable and reliable solution for a wide range of industries. These motors can also be configured as WPII or IP44 motors (without a bonnet) due to an innovative design with a series of internal right angles and filters providing additional protection in outdoor environments.

Key features of ABB's new ODP motors include high power density without the need for auxiliary cooling, superior energy efficiency for reduced operational costs, reliable performance in challenging industrial conditions and compatibility with existing North American motor installations for easy retrofits and upgrades.

"The launch of our new ODP motors reflects ABB's commitment to innovation and sustainability," said Robert Boyce, U.S. Division Manager for IEC Low-Voltage Motors, ABB. "We're excited to showcase how these motors can help our customers achieve greater efficiency and reliability without compromising on performance." For more information, visit https://global.abb.

ABB's open drip-proof motor

EL-AV Launches BL Series Two-stage, Reciprocating Air Compressors

EL-AV Compressors' BL Series two-stage, reciprocating air compressor

EL-AV Compressors introduced the BL Series of two-stage, reciprocating air compressors. With a cast-iron pump, UL-certified components, integrated after-cooling and ASME-approved tanks, the BL Series is built for industry professionals who demand efficiency, endurance and clean compressed air without compromise.

When it comes to compressed air, reliability is everything. From factory floors to auto shops, every operation depends on air power that works as hard as its people. That's where the new BL Series two-stage, reciprocating air compressors from EL-AV take the spotlight – combining classic heavy-duty design with advanced cooling technology for dependable performance.

At the core of the BL Series is a two-stage solid cast-iron pump. This heavy-duty construction ensures superior strength, minimal vibration and exceptional heat resistance. Unlike lighter single-stage models, the BL Series operates at low RPM, reducing wear and extending component life.

Inside the pump, dual solid-steel connecting rods and industrial-grade removable disc valves make maintenance straightforward while ensuring consistent performance under continuous load. Oversized bearings, precision-balanced crankshafts and stainless-steel valves all contribute to smooth operation and long service intervals.

Every BL Series air compressor is assembled from UL-certified components and mounted on an ASME-certified air receiver. Available in 60-, 80- or 120-gallon configurations, each tank is equipped with vibration-isolation pads that minimize noise and structural stress. The system also features an automatic dual-timer tank drain, removing accumulated water automatically and reducing maintenance needs.

Each unit integrates an advanced aluminum intercooler and after-cooler system, along with an auto-drainer, which together reduce air temperature dramatically before it leaves the compressor. This built-in cooling system improves air quality by reducing moisture content at the source and often eliminates the need for a high-temperature compressed air dryer. In some installations, no compressed air dryer is needed at all.

The BL Series offers flexible configurations, including vertical or horizontal tank layouts for space optimization and duplex systems for redundancy or alternating load sharing. It's compatible with compressed air dryers, filters, drains and smart control modules. For more information, visit https://el-av.com.

Atlas Copco Group Acquires Air Compressor Works

Air Compressor Works has become a part of Atlas Copco Group. Air Compressor Works is located in Florida and provides air compressor equipment and service.

The company's customers mainly operate within general industry in South Florida. The company was founded in 1979 and has 50 employees who join Atlas Copco Group as part of the acquisition.

"This acquisition will allow us to grow the Quincy Compressor brand and will contribute to a stronger presence in South Florida," said Philippe Ernens, Business Area President Compressor Technique.

The purchase price is not disclosed. The acquired assets have become part of the service division within the Compressor Technique Business Area.

Atlas Copco Group enables technology that transforms the future and innovates to develop products, services and solutions that are key to its customers' success. Its four business areas offer compressed air and vacuum solutions, energy solutions, dewatering and industrial pumps, industrial power tools and assembly and machine vision solutions. In 2024, the group had revenues of BSEK 177 and, at year end, about 55,000 employees. For more information, visit https://www.atlascopcogroup.com.

NEWS Compressed Air Industry & Technology

Flir Si2-Series Acoustic Imaging Cameras Now with Integrated GPS for Precise, Location-Based Inspections

Flir, a Teledyne Technologies brand, announced built-in GPS for its Si2-Series acoustic imaging cameras. The upgrade adds precise location data to predictive maintenance inspections, helping service providers and reliability teams streamline workflows across multi-site operations, long-distance inspections and utilities and power-transmission applications.

Flir's Si2-Series acoustic imaging camera with built-in GPS

With integrated GPS, every acoustic image captured by the Si2-Series cameras now includes geospatial metadata that seamlessly connects with Flir Acoustic Viewer and Flir Thermal Studio software. This enables inspection teams to organize, visualize and document findings by exact location, enhancing traceability and compliance across assets and sites. The Si2-Series retains its industry-leading acoustic performance and intuitive design, with no change to camera handling.

"This enhancement improves inspection teams' ability to document and manage their findings," said Darrell Taylor, Global Acoustic Business Development Manager, Flir. "From power lines to complex industrial facilities, geotagged acoustic data makes it easier to track maintenance trends, plan repairs and demonstrate program ROI."

The GPS enhancement applies to all Flir Si2-Series models and is not available as a firmware upgrade for existing cameras. For more information, visit https://www.flir.com.

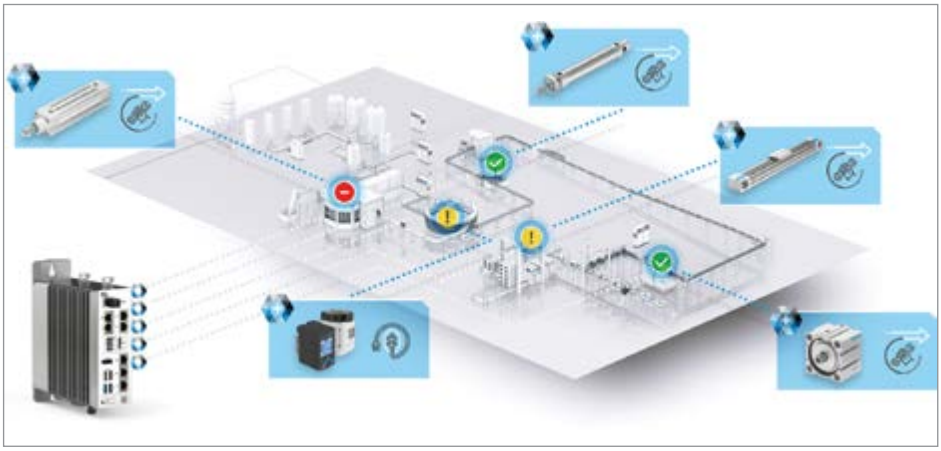
Festo Launches AX Motion Insights Pneumatic, AI Pneumatic Cylinder Monitoring and Predictive Maintenance System

Festo introduced AI-enabled monitoring and predictive maintenance system Festo AX Motion Insights Pneumatic. AX Motion Insights Pneumatic is a cost-effective, easy-to-use solution for preventing costly unscheduled machine downtime through its monitoring of pneumatic cylinders for wear and anomalies. This AI-based industrial app ensures operations are more reliable, efficient and profitable.

The system uses AI to detect anomalies in the behavior of pneumatic drives and cylinders without the need for additional sensors. It provides a health score as a risk of failure indicator for each cylinder. Connectivity is achieved via a PLC function block. The system is compatible with actuators from different manufacturers and has specific connectivity details for Siemens, Rockwell and Beckhoff controllers.

Motion Insights Pneumatic enables maintenance teams to schedule tasks in advance, significantly reducing the risk of unexpected downtime. The platform offers the flexibility of on-premises computing, giving end users full control over their data and deployment. This is an open system and works with both Festo and third-party components. The AX platform features ease-of-use and seamless integration, opening the door for customers to embrace today's AI, data-driven solutions and digital transformation without worry.

Through Festo App World, customers can select a license package based on the number of cylinders they want to monitor. Unlike competitors that might offer a single software tool, Festo AX apps are a seamless part of a complete one-stop-shop automation solution, including its electrical and pneumatic components. For more information, visit https://www.festo.com.



AX Motion Insights Pneumatic is a cost-effective, easy-to-use solution for preventing costly unscheduled machine downtime through its monitoring of pneumatic cylinders and drives.

Sauer Compressors USA Launches Dedicated Navy and Defense Division

Sauer Compressors USA (SUSA) launched a dedicated division to centralize air compressor solution operations for the United States Navy and Department of Defense in a time of quickly evolving global challenges.

Staffed by seasoned professionals focused solely on defense systems, the new division places decision-making in the hands of those who understand the mission from the deck plates up.

SUSA's Navy and Defense Division is fully engaged in developing new technologies in the Sauer Compressors product line. This initiative is supported by experts who are dedicated to designing these critical systems to remain at the leading edge of evolving equipment priorities for the military. In addition, the division maintains a robust fleet of rental equipment to ensure the Navy remains prepared to respond without delay. With the improved company infrastructure, the team at SUSA will be able to meet more accelerated delivery targets, while continuing to safeguard compliance with government standards.

"Our Navy and Defense Division will ensure that every decision is made with mission readiness at the forefront," said Joshua Peter, U.S. Navy Veteran and a leader in the new division. "We are here to provide the systems, technology and support to get ships underway and keep them there. Our role is to back the naval fleet and DoD facilities with reliable air compressors and equipment, responsive service and key rental solutions that keep operations moving when it matters most. We understand that when a ship is tasked to sail, there is no margin for delay. We have geared up to be the leading air compressor solutions partner for the men and women who are tirelessly defending our freedom, day in and day out."

The launch of the Navy and Defense Division at SUSA has strengthened the company's commitment to the United States Department of Defense. This new division is built around one clear priority: ensuring the Navy has dependable mission critical air compressor systems and supporting equipment on time, every time. Whether in port or underway, the SUSA team will remain steadfast in keeping the Naval fleet ready to defend the nation when duty calls. For more information, visit https://www.sauerusa.com.

NEWS Chiller & Cooling Industry & Technology

Daikin Applied Invests $163M in Advanced R&D Test Lab at Minnesota Headquarters to Bolster HVAC Innovation

Daikin Applied announced a $163 million investment to build a state-of-the-art research and development test lab at its Plymouth, MN, headquarters. This strategic investment underscores Daikin Applied's commitment to advancing HVAC innovation across its portfolio, from chillers and air handlers to heat pumps.

The 71,000-square-foot lab has already begun phased commissioning of nine test cells, with full facility completion and opening planned for 2027. Building on Daikin Applied's extensive testing capabilities, the new lab will advance product innovation by replicating the operating extremes of modern hyperscale environments. Four test cells will also focus on next-generation airside technologies to address emerging market trends and evolving customer needs. This expanded capability will further support innovation across Daikin Applied's traditional cooling and heat pump segments.

The investment in the new Plymouth facility expands Daikin Applied's ability to rapidly design, validate and deploy technologies meeting the specialized cooling requirements of high-density environments.

Daikin Applied's expansion in Plymouth and the Greater Minnesota region reinforces its commitment to building the industry's most advanced testing ecosystem. The location offers strategic proximity to a highly-skilled talent base in the Minneapolis–St. Paul metro area. The new lab will support ongoing training and development for engineers, technicians and cross-functional teams developing next-generation cooling technologies.

"Our commitment to HVAC innovation compels us to continually push the boundaries of what's possible. This world-class test lab is a powerful testament to that vision," said Yu Nishiwaki, Chief Operating Officer, Daikin Applied Americas. "Innovation is at the heart of everything we do and, with this new facility, we are well-positioned to equip our customers with the advanced technologies required to meet the dynamic demands of today's environment." For more information, visit https://www.daikinapplied.com.

Rendering of Daikin Applied's research and development test lab in Plymouth, MN

Danfoss Inaugurates Expansion of Factory in Mexico, Investing to Serve the Growing American Market

Danfoss celebrated the opening of its expanded factory in Monterrey, Mexico, a decision driven by increased demand for reliable, energy-efficient HVAC equipment in the North American and Latin American markets. The expansion is also an important part of Danfoss' LEAP 2030 strategy, which aims to reduce delivery times and further strengthen supply chains for customers in all markets.

The multi-million-dollar investment doubles production and adds three new product lines to the current facility. The expanded facility will house the production of sensors, microchannel heat exchangers, large and medium scroll refrigerant compressors and semi-hermetic BOCK compressors by the beginning of 2026. This will allow Danfoss Climate Solutions to better serve North American customers with shorter supply chains.

Danfoss leadership and local officials celebrated the opening of the company's expanded production facility in Monterrey, Mexico, with a ribbon cutting.

The LEED Silver-certified factory includes a newly expanded refrigerant compressor laboratory that has doubled in size from 5,382 square feet to 10,764 square feet. It also houses two new calorimeters to validate performance up to 175 kW (50 tons), ensuring reliable testing even for the most demanding applications. Four advanced Life-Test systems further guarantee long-term refrigerant compressor reliability across a wide range of capacities and a UL-certified Burst Test system underscores its commitment to the highest standards of safety.

The expansion coincides with the 30th anniversary of production for Danfoss Mexico and represents the fourth expansion at the site since its inception. The Monterrey location is a major hub for Danfoss, employing over 1,400 people. The new production area will add about 300 new full-time positions, further strengthening Danfoss's commitment to Mexico as a key manufacturing hub.

"We have experienced strong, double-digit growth in the U.S. market this year and are determined to support our customers' growth. With the investment in increased production in Mexico, we are in an even stronger position to help them achieve their sustainability goals and create even greater value through close collaboration and increased resilience in the supply chain," said Kristian Strand, President, Danfoss Climate Solutions. For more information, visit https://www.danfoss.com.

Carrier Launches i-Vu Pro v10, Transforming Building Automation for Better Performance and Collaboration

Carrier introduced i-Vu® Pro v10, a next-generation building automation system (BAS) designed to help facilities of all sizes enhance operational efficiency, collaboration and resilience. Designed for seamless integration with Carrier HVAC equipment, i-Vu Pro v10 provides facility managers and technicians with powerful tools to support smarter building performance and more connected stakeholder engagement.

Facility teams can share dashboards, trends and reports securely with stakeholders, even if they don't have direct BAS access. This facilitates clearer communication, supporting faster responses to building needs and more informed decision-making across teams.

Advanced visualization tools make it easier to interpret building data, spot trends and take timely action. Teams can identify opportunities to optimize energy use and improve comfort. Automated, real-time system backups support rapid recovery from unexpected events, minimizing downtime and maintaining operational continuity.

i-Vu's AI-powered predictive insights add-on enables proactive building management. By continuously monitoring HVAC and BAS data, facility teams can identify potential issues early, reduce unplanned outages and help optimize energy efficiency.

"With i-Vu Pro v10, facility teams can now collaborate more effectively, respond quickly to building issues and streamline operations," said Dominic Eorio, Director, Carrier Controls. "By turning complex data into clear insights, we help customers manage energy use, enhance comfort and support business continuity – all while simplifying day-to-day building management."

Flexible deployment options are available. Organizations can choose between on-premises or cloud deployment, allowing them to tailor their automation strategy to specific operational needs, with secure connectivity and reliable data protection.

Technicians benefit from streamlined workflows and automated commissioning tools designed

Carrier's i-Vu Pro® v10 is now available for order.

to reduce setup time and minimize errors, while supporting faster project delivery and system reliability. Smarter network discovery tools assist teams in locating and configuring BACnet devices, saving time and boosting productivity during system expansions or upgrades. For more information, visit https://www.carrier.com.

NEWS Industrial Energy & Water Conservation

SKF Achieves Prestigious CDP A Score in the Climate Change Category for Environmental Leadership

For the third consecutive year, SKF, a Swedish bearing and seal manufacturing company, has earned an A score in the category Climate Change from CDP, the leading global non-profit environmental disclosure.

In 2025, nearly 20,000 companies were scored through CDP's platform. Achieving the top score A in climate change places SKF among the global leaders demonstrating comprehensive disclosure, mature environmental governance and meaningful progress towards environmental resilience.

SKF has committed to decarbonizing all operations by 2030 and achieving a net-zero supply chain by 2050. Progress includes a 59% reduction of Scope 1 and 2 emissions in 2024 compared to the 2019 base year, well ahead of the 2030 goal trajectory.

SKF's global headquarters in Gothenburg, Sweden

"We are proud to have received an A rating from CDP. This recognition highlights our continuous progress and reflects the commitment of our employees to drive positive change. This award is proof we keep our leadership level in sustainability, but also a reminder we must continue to drive the transition towards a sustainable society," said Sofie Runius Cederberg, Head of Sustainability, SKF.

The CDP Climate Change score provides a benchmark for corporate disclosure and environmental performance, enabling comparability across industries. By achieving leadership status, SKF is recognized for its commitment to climate action, strategic alignment with frameworks such as the Task Force on Climate-related Financial Disclosures (TCFD) and implementation of best practices in sustainability. For more information, visit https://www.skf.com.

Mars Shares Plans to Invest $1.2 Billion to Boost Manufacturing and Innovation across the European Union

Mars, one of the world's largest manufacturers of confectionery, pet food and other food products, announced plans to invest $1.2 billion in its European Union operations by the end of 2026, strengthening the region's manufacturing capabilities, sustainability and innovation pipeline, and increasing its economic resilience.

This investment builds on more than $1.7 billion Mars has invested in EU manufacturing over the past five years, modernizing facilities, increasing production capacity and accelerating efforts to decarbonize its value chain. These investments support the company's 24 factories across 10 EU countries and the 25,000 people it employs in its direct operations.

Mars is investing significantly in modernizing its manufacturing footprint across the EU, upgrading facilities to boost efficiency, product quality and consumer innovation from new packaging technologies.

Packaging of products at one of Mars's manufacturing plants

The company is also dedicated to decarbonizing the value chain to improve sustainability and production resilience. Globally, Mars has reduced its scope 1, 2 and 3 GHG emissions by more than 16% since 2015, while the business has grown 69%. To continue the decoupling of growth from emissions, Mars is embedding environmental initiatives across key stages of its value chain. In 2022, its ice cream factory in Steinbourg, France, became powered entirely by renewable electricity, the first Mars site globally to become fossil-fuel free.

"For Mars, this is about more than just growth. It's also about building a stronger, more resilient business in Europe, one that delivers more innovation to consumers, delivers value for thousands of our European suppliers and creates lasting, positive impacts in the communities where we operate," said Claus Aagaard, CFO, Mars. For more information, visit https://www.mars.com.

Toyota Releases North American Sustainability Report, Announcing 32% Reduction in Scope 1 and 2 Emissions

Toyota Motor North America announced the publication of its 2025 North American Environmental Sustainability Report, an annual report highlighting company initiatives across the United States, Canada and Mexico.

The report outlines Toyota's environmental strategy, while highlighting the company's advancements in its four priority areas: carbon, circular economy, water and biodiversity. Highlights include a 32% reduction in Scope 1 and 2 (operations-related) greenhouse gas (GHG) emissions vs. FY2019. At the end of FY2025, 114 dealerships participated in the company's dealer engagement program, which helps dealers improve their environmental performance. Through the end of the fiscal year, participating dealers have reduced their use of electricity from non-renewable sources by 20%.

Toyota Motor North America reported a 6.7% decrease in the current year for the number of gallons of water withdrawn per vehicle manufactured when compared to FY2021. Water consumption decreased 15% in FY2025 compared to FY2024, and 40% compared to FY2020.

"In North America, we focus on creating a positive impact on both society and the planet," said Tim Hilgeman, Senior Director of Environmental Sustainability, Toyota Motor North America. "During fiscal year 2025, Toyota celebrated many environmental achievements. We are looking forward to the continued momentum on the targets set for each of the environmental focus areas." For more information, visit https://www.toyota.com/usa.

Toyota Motor North America reports a 6.7% decrease in gallons of water withdrawn per vehicle manufactured.

Steelcase Releases 2025 Impact Report, Sharing Its Path to a Net-Zero Future

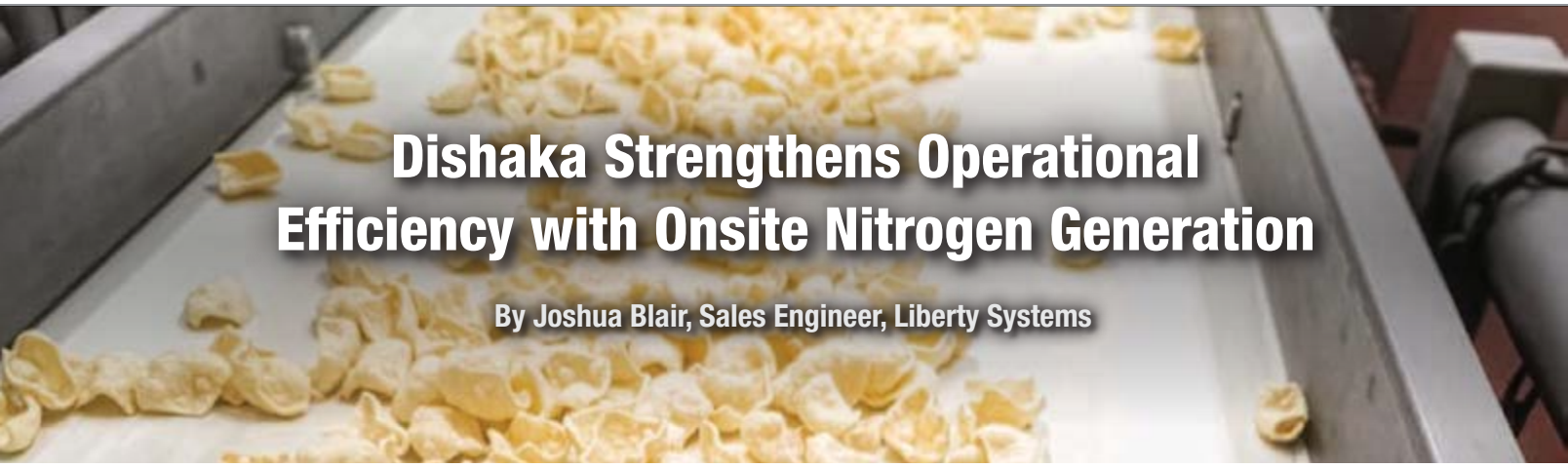
Steelcase, a manufacturer of furniture for offices, hospitals and classrooms, released its 2025 impact report. This document shares the organization's work toward building community, including its growing inclusive design practice. It also highlights progress toward its commitment to achieving net-zero carbon emissions by 2050.

Steelcase is working toward a better future for the planet by cutting carbon emissions across its operations and supply chain, designing products for circularity to reduce waste and choosing materials that are healthier for people and the environment. Through bold goals, innovative tools and collaborative partnerships, the company is transforming how it designs, makes and delivers products to support a net-zero future.

Progress reported this year includes a 31% reduction in Scope 1 and 2 emissions since FY2020, on track toward a goal of 50% by FY2030. The company also achieved a 37% reduction in Scope 3 emissions from fuel, energy, waste and travel since FY2020.

"When we build community and act with intention for both people and the planet, we create spaces where everyone can thrive," said Kim Dabbs, Vice President of Impact, Steelcase. "This impact report is a reflection of our belief that better is always possible – and progress is powered by collective action." For more information, visit https://www.steelcase.com.

Steelcase's Learning and Innovation Center in Grand Rapids, MI



Dishaka Strengthens Operational Efficiency with Onsite Nitrogen Generation

By Joshua Blair, Sales Engineer, Liberty Systems

In the competitive world of snack food manufacturing, operational efficiency isn't just about cutting costs – it's about ensuring product quality, maintaining freshness and staying ahead in an industry where shelf life can make or break a brand. For Dishaka, a family-owned snack manufacturer with roots dating back to 1952, the decision to invest in onsite nitrogen generation has transformed its Houston facility into a model of modern food production efficiency.

"We've always believed in innovation, from our founding in Kuwait City to our state-of-the-art Houston operation," said Rashim Oberoi, President, Dishaka. "But, when we analyzed our nitrogen costs and supply chain dependencies, we knew there was a better way. On-site nitrogen generation wasn't just about savings – it was about control, reliability and positioning Dishaka for the next chapter of growth."

A Legacy of Innovation Meets Modern Technology

Dishaka's North America manufacturing started in 2007 when its U.S. headquarters opened in Houston, Texas, with a singular vision: Offer the most innovative food products created using extrusion technology.

In 2016, the food processor moved to a 200,000-square-foot state-of-the-art facility where it produces an impressive array of extruded salty snacks, as well as popcorn and pretzel products. It specializes in private label, controlled label and house brands for retailers nationwide, offering 360-degree product development custom-tailored to customer needs. Its portfolio includes everything from traditional potato chips and corn snacks to innovative multi-grain options featuring chickpeas, lentils and veggie-based formulations.

Above: Conveying systems move fresh snacks through Dishaka's food processing and bagging operations.

"Growth propelled our move in 2016 to this facility and the addition of popcorn production," Oberoi said. "With production running multiple lines and over 1,000 bags of chips produced per minute during peak operations, we needed infrastructure that could keep pace. Adopting Modified Atmosphere Packaging with nitrogen became essential – not optional."

The Nitrogen Imperative in Modern Food Packaging

For snack food manufacturers, nitrogen plays a critical role in Modified Atmosphere Packaging (MAP), a preservation technique that's become the industry standard for maintaining product freshness and extending shelf life. By replacing oxygen inside sealed packages with nitrogen – an inert, non-reactive gas – manufacturers can significantly slow the oxidation process that causes oils to turn rancid, colors to fade and textures to deteriorate.

At the Dishaka snack factory, a rotary weigher portions snacks for packaging.

The science is straightforward but powerful. Oxygen promotes spoilage through oxidation of fats and supports microbial growth. Nitrogen displaces this oxygen, creating an environment where chips stay crisp, nuts retain their flavor and products maintain their visual appeal throughout their journey from factory to consumer. Additionally, nitrogen acts as a cushioning agent, protecting delicate products during shipping and handling while preventing package collapse.

"When customers open a bag of our chips, they expect a satisfying crunch and fresh taste," Oberoi said. "Nitrogen flushing ensures we deliver on that expectation every single time, whether the product sits on a shelf for two weeks or two months."

The challenge for scaling food manufacturers is sourcing nitrogen efficiently and cost-effectively.

Engineering Solutions Beyond Technology

The partnership with Liberty Systems proved instrumental in Dishaka's transformation. Founded in 2004, the company built its reputation by solving complex industrial gas challenges, beginning with a customer request to inert electrical control cabinets with nitrogen. That initial project – designed to extend the lifespan of electrical components from 12-18 months to 36 months or more by maintaining positive nitrogen pressure while excluding corrosive gases – established the company's philosophy of going beyond technology to deliver genuine solutions.

The company's commitment to quality is backed by ISO 9001:2015 certification, ensuring precision-engineered solutions supported by rigorous quality management processes, risk-management practices and meticulous

documentation. This dedication to excellence results in superior product consistency and drives ongoing enhancements in efficiency and reliability – critical factors for food manufacturers operating under strict food safety regulations.

"Dishaka needed a partner who understood technical requirements and food safety implications," said Joshua Blair, Sales Engineer. "Our systems had to deliver consistent purity, reliable flow rates and seamless integration with its existing compressed air systems. There's no room for error when you're packaging food products at the scale it operates."

First System: Nitrogen Generation System Installation

The food processor's first Liberty Systems installation came in March 2022, with a nitrogen generation system. This initial system was designed to meet the facility's baseline nitrogen requirements for its primary packaging lines, using pressure swing adsorption (PSA) technology.

PSA systems represent the industry standard for on-site nitrogen generation in food manufacturing applications. The technology employs specially treated carbon molecular sieve materials within two alternating adsorber vessels. Compressed air charges both vessels, with one actively adsorbing oxygen, carbon dioxide and moisture while allowing nitrogen to pass through to the storage system. Simultaneously, the second vessel regenerates by reducing pressure and purging captured gases. This continuous cycling ensures uninterrupted nitrogen production at the specified purity level.

"The first system gave us immediate relief from delivery dependencies," said Oberoi. "Within weeks, we realized we were operating more efficiently. No more coordinating delivery schedules or worrying about running low during peak production. The nitrogen was simply there, 24/7, exactly when we needed it."

The system quickly validated the projected ROI. The facility gained the flexibility to scale production without concern for nitrogen supply constraints.

The installation went smoothly due to careful pre-planning. "We conducted a thorough assessment of the customer's compressed air system, production schedules and peak demand periods," Blair said. "This allowed us to size the nitrogen generation system appropriately and integrate it with minimal disruption to the client's operations. Within 72 hours of installation, the system was online and producing specification-grade nitrogen."

Second System Delivers Needed Expansion

Success breeds growth, and for Dishaka, the efficiency gains from its first nitrogen system paved the way for expansion. By early 2025, the facility had increased production capacity, added new packaging lines and identified additional applications for nitrogen throughout the plant. The decision to install a second system reflected both confidence in the technology partner and recognition that operational self-sufficiency extends beyond a single production area.

The second installation (P3OX-V1500), completed in May 2025, brought several strategic advantages. First, the system included a backup air compressor and additional plant air capacity, creating redundancy and ensuring uninterrupted operations even during maintenance or unexpected equipment issues.

For food manufacturers operating on tight production schedules with retailers expecting on-time deliveries, this redundancy isn't a luxury – it's essential business continuity planning.

"The V1500 represented our commitment to operational excellence," said Oberoi. "We weren't just adding nitrogen capacity; we were building a more resilient, more capable facility. The backup air compressor gave us peace of mind, and the additional plant air meant we could support future growth without incurring additional investments."

The expanded system generated high-quality treated compressed air alongside nitrogen generation, supplying the entire facility with clean, dry air for pneumatic controls, actuators and other compressed air applications. This dual functionality created additional efficiencies and cost savings beyond nitrogen generation alone.

Quantifying the Benefits: More than Just Cost Savings

While the financial benefits of on-site nitrogen generation were compelling – with typical payback periods of 12 to 24 months – the client's

Dishaka Strengthens Operational Efficiency with Onsite Nitrogen Generation

experience demonstrated how value extends beyond immediate cost reduction. The client saw financial, operational, environmental and strategic benefits from the installation.

Financial benefits include the elimination of recurring nitrogen delivery costs, the removal of tank rental and surcharge fees, the reduction of approximately 200 annual labor hours previously dedicated to nitrogen supply management, predictable operating costs based on electricity consumption rather than volatile commodity pricing and rapid ROI enabling capital redeployment to other growth initiatives.

Operational improvements included 24/7/365 nitrogen availability eliminating production constraints, the elimination of emergency delivery fees and premium charges, enhanced production scheduling flexibility without supply coordination, a reduced facility footprint thanks to the elimination of bulk storage tanks and improved workplace safety by eliminating high-pressure bulk storage hazards.

Environmental gains included a significant reduction in CO_2 emissions from eliminated delivery vehicles, alignment with corporate sustainability objectives, a reduced overall carbon footprint for manufacturing operations and leading the way in environmental stewardship in the food industry.

A nitrogen generator is fed by this variable frequency drive air compressor

Finally, strategic advantages from the switch included operational independence from external suppliers, scalability to support future growth without infrastructure limitations, enhanced competitive positioning through lower operating costs and improved resilience against supply chain disruptions.

"The cost savings were significant and met our projections, but the operational freedom was transformative," Oberoi said. "It's simply part of our facility infrastructure, like electricity or water. That mental shift allows our team to focus on what we do best – producing snack foods for our customers."

The Nitrogen Generation Self-Sufficiency Model

The customer's experience offers valuable insights for food manufacturers evaluating their nitrogen supply strategies, particularly in an era of supply chain uncertainty and rising operational costs.

Start with a Comprehensive Analysis. Understanding the total cost of ownership for delivered nitrogen extends beyond the per-unit price. Administrative costs, labor for cylinder or tank management, delivery fees, rental charges and opportunity costs from supply delays all factor into the equation. A thorough analysis typically reveals that on-site nitrogen generation becomes cost-effective at much lower consumption volumes than many manufacturers assume.

Partner with Experienced Integrators. The technical aspects of nitrogen generation – purity requirements, flow rates, pressure specifications, integration with existing compressed air systems – demand expertise. Working with ISO-certified partners ensures proper system sizing, installation quality and ongoing support.

Consider Total Infrastructure Impact. Modern nitrogen generation systems can serve dual purposes, providing both specification-grade nitrogen and treated plant air. This integrated approach maximizes ROI and addresses multiple facility needs simultaneously.

Plan for Redundancy. For critical applications like food packaging, backup systems and redundant capacity prevent costly production interruptions. The incremental investment in

The tank system supporting the food processor's modified atmosphere packaging for product freshness

redundancy delivers outsized returns through enhanced uptime and production reliability.

View it as Strategic Infrastructure. On-site nitrogen generation isn't merely a cost-reduction tactic; it's strategic infrastructure enabling growth, improving operational flexibility and enhancing competitive positioning. Companies viewing it through this lens make better long-term decisions.

A Food Processor's Continuing Innovation Journey

As Dishaka continues expanding its product portfolio and production capacity, its nitrogen generation systems provide a foundation for sustainable growth. The food processor's commitment to innovation – evident in its diverse product offerings – is matched by its commitment to operational excellence.

"We're always looking at how to improve our operations, reduce our environmental impact and deliver better value to our retail partners and their customers," Oberoi said. "The partnership with Liberty Systems exemplifies this approach. We invested in technology to improve our bottom line while making us a more sustainable, more reliable supplier."

For Blair, this represents an ideal client partnership: "Working with companies where there's a genuine commitment to operational

excellence and a willingness to invest in the right solutions allows us to demonstrate what's possible. This isn't about selling equipment; it's about enabling the customer's success and building long-term relationships based on performance and trust."

The food manufacturing industry continues evolving, with increasing emphasis on sustainability, operational efficiency and supply chain resilience. The customer's journey from delivered nitrogen to onsite generation offers a roadmap for others in the sector. The combination of proven technology, experienced partners and clear-eyed business analysis creates a winning formula – one delivering returns well beyond the initial investment.

From a small trading post in Kuwait City to a sophisticated U.S. manufacturing operation producing millions of bags of snacks annually, this customer's story is one of continuous evolution and adaptation. The decision to take control of its nitrogen supply through onsite nitrogen generation represents the latest chapter in that story and a model for the future of food manufacturing efficiency. BP

About the Author

Joshua Blair is a Sales Engineer with Liberty Systems, bringing comprehensive knowledge of nitrogen and compressed air systems gained through hands-on experience in both production and client-facing roles. He specializes in listening to customer needs and pain points to design practical solutions for operational challenges. Blair values the connections he's built with professionals worldwide across diverse industries relying on compressed air systems.

About Liberty Systems

Founded in 2004, Liberty Systems is a leading provider of onsite nitrogen generators, filtration and air dehydration solutions for industrial and food manufacturing applications. The company's founding principle, going beyond technology to deliver genuine solutions, drives its customer-focused approach. With ISO 9001:2015 certification, it demonstrates a commitment to quality management and meticulous documentation. The company's NITRO FORCE® nitrogen generation systems use proven PSA technology, delivering consistent purity levels, reliable performance and exceptional energy efficiency for applications including food packaging, Modified Atmosphere Packaging and other industrial nitrogen operations. For more information, visit https://lsn2.com.

To read more ***Nitrogen Generation*** articles, visit https://www.airbestpractices.com/technology/air-treatment.

Visit our Webinar Archives to listen to expert presentations on ***Nitrogen Generation*** at https://www.airbestpractices.com/webinars.

Bi-State Compressor Helps Food Processor Grow

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

Bi-State Compressor is a compressed air dealership established in 1993 and based in Fenton, MO. It serves Missouri and Illinois, and is an authorized distributor for Quincy Compressor. Sales Manager Mike Sims has been in the industrial field for 39 years and has been with Bi-State Compressor for 30 years.

Sims has one cardinal rule for his sales team: "Be honest. Don't try to trick anybody or throw numbers out that don't mean anything. Honesty is the biggest thing. Then, do what you say you're going to do. If you say you're going to look up information for a customer, don't have them call you back. You drive that train. I believe in always contacting the customer. Usually, if the customer's contacting you, it's not good – unless they're calling you to buy an air compressor.

"Get in there and see what's going on. Don't only hang around when times are good. Be honest with the customer, tell them exactly what you're doing and stand by that."

Above: Service Technicians James Tompkins and Joe Temme (left to right) of Bi-State Compressor

When it comes to helping a customer select air compressors, the company doesn't do anything over the phone. Sims instructs his sales team to visit in person and understand the big picture. Even when the customer knows what they want, visiting the plant in person is essential. Does the customer have the sizing correct? Does the customer have filters, oil/water separators and good ventilation? Who's installing the new equipment? Getting the big picture often shows issues the customer wasn't aware of.

Bi-State Compressor is based in Fenton, MO, and began in 1993.

"A good piece of advice is to always be available and return your calls promptly. Don't make customers wait," Sims said. "If you're not available, let somebody know you're not available."

He tells his sales team never to sell a customer an air compressor when a simpler solution will fix the problem. "I've been to plants where I've taught people how to buy air compressors. I tell them, 'You don't need an air compressor right now, let's try these other options.' Man, you talk about winning a customer over. When they think they have to buy a new air compressor, and your audit finds a different solution, they're a customer for life."

"Mike Sims always looks out for his customers," said Mike Mitra, Area Manager, Quincy

Compressor. "He goes above and beyond so they can perform their work without wasting time and energy. He's a solutions-based expert who succeeds by maintaining strong customer relationships and collaborating closely with vendors."

Case Study: Food Processing

One of Bi-State Compressor's biggest clients is a food processor with plants around the country. The distributor began working with the company in 1996, and has been with it as the company grew. The company's preferred air compressor is a 200 horsepower (hp), lubricated, variable-speed drive, rotary screw using food-grade oil. It purchases two to four of this model air compressor per plant, depending on the size of the plant. The company also purchases 10,000 gallons of compressed air storage, compressed air dryers, filters and other essentials for each new plant. It sticks to the same compressed air system configuration, to keep ordering and maintenance simple.

The distributor first worked with the food manufacturer at a plant in Missouri. The plant already had fixed-speed air compressors used with flow controllers, but used variable-speed drives (VSDs) in other plant machinery, such as mixers and conveyors. The plant manager saw the value of VSDs. Looking at audit data from the distributor, he decided to replace his fixed-speed air compressors and flow controllers with VSD air compressors, saying he didn't want to use air compressors with flow controllers any longer.

Mike Sims, Sales Manager, Bi-State Compressor

The plant purchased two lubricated, variable-speed drive, rotary screw air compressors using food-grade oil, as well as storage tanks and refrigerated compressed air dryers. The plant's compressed air system drives all the food processing machinery used to create food and load it into bags. One 200 hp air compressor was all this plant needed; the second air compressor was a backup. The plant has been running VSDs since then, operating between 35% and 75% partial load. Its air compressors are never fully loaded.

Air Compressors in Dusty Settings

The plant is a dusty environment. As Sims says, "You just walk in and you've got food all over you." Dusty environments aren't kind to VSD air compressors, but the plant keeps its compressed air system in a separate room. That room still receives dust, but it has louvres to blow dusty air away.

> *"A good piece of advice is to always be available and return your calls promptly. Don't make customers wait."*
>
> — Mike Sims, Bi-State Compressor

The plant chose a noncycling refrigerated dryer, deciding the savings for a cycling refrigerated dryer wouldn't be great enough. It also has wet and dry compressed air storage tanks offering around 6,000 gallons of storage. The plant handles its own maintenance, but calls Bi-State Compressor when special projects arise.

During Covid, Sims was able to handle a special service request from this company in a creative way that kept his client happy. A newly purchased air compressor ended up with several problems, due to temporary Covid staffing difficulties, and the plant demanded a new replacement air compressor. Instead, he shipped the plant a new motor, cooler and other replacement parts. A former diesel mechanic in the military, Sims, along with a lead service technician, personally fitted the parts into the air compressor. The air compressor manufacturer then extended the warranty by three more years. All this kept the plant satisfied without the expense of shipping a new replacement air

Bi-State Compressor Helps Food Processor Grow

compressor. To this date, the air compressor has performed perfectly with no issues.

The food manufacturer has grown with plants around the country, including the Midwest, South and West Coast. It treats each new plant as a clone of the first, repeating a working model. All plants rely on the same 200 hp, lubricated, VSD, rotary screw air compressors.

"For all food manufacturers, you want to make sure you put food-grade oil in the air compressors, because standard fill in an air compressor is non-food grade. It's easy to miss, because you have to click separate boxes. If you ship an air compressor with non-food-grade oil and they turn it on, that's a major problem," Sims said. "It's never happened to us. We've had new sales guys where we had to remind them, 'You know that plant has food-grade oil, right?' If we'd shipped it and they turned it on, we'd have to clean all the pipes, get the air compressor out, and redo the whole compressed air system. We'd have to change all the oil and filters. That's a major challenge, making sure you select the right oil."

Food-grade oil is rated for 4,000 hours, while regular oil is rated for 8,000 hours or one year. Sims cautions against relying exclusively on manufacturer estimates, since each location has unique challenges.

"Manufacturers are changing their intervals on a lot of things. Oil filters used to be every 1,000 hours; now they're saying 2,000 to 4,000 hours," Sims said. "It's like your car: It depends on what the environment is. How much heat is there? How much dust? There are a lot of factors involved. You can't say, 'I can leave a filter for 1,000 hours' in a dusty environment. It's the same with coolers: You need to make sure the coolers stay clean."

The plant's maintenance team monitors air compressor performance daily. The normal temperature for these 200 hp air compressors is 190°F (88°C). If they measure temperature above 200°F (93°C), it's a red flag that there's a problem, such as being low on oil or having dirty coolers.

Case Study: Industrial Heating Systems

Another major client manufactures heating and heat recovery systems for industrial facilities. It's based in the Midwest and has been a Bi-State Compressor client off and on since 1996. It operates two plants.

This company was small when it first purchased a few 25 hp air compressors from the distributor. The company then worked with a different distributor when it decided to purchase air compressors Bi-State Compressor no longer offered. Plant operators, however, were unhappy with the results. Looking for a new partner, they interviewed multiple distributors. Sims knew so much about the history of the plant, having worked with it before, he got the job soon after his interview.

Food-grade oil is rated for 4,000 hours, while regular oil is rated for 8,000 hours or one year. Sims cautions against relying exclusively on manufacturer estimates, since each location has unique challenges.

The company's business was increasing, so it needed more powerful air compressors to drive its processes. The distributor conducted a seven-day audit using a SCADAR system measuring amps and pressure at one-minute intervals or less. It found the plant needed one 75 hp air-cooled, lubricated rotary screw air compressor to drive its operations. The plant made the purchase and was able to get $5,000 in rebates from the local utility.

The plant wanted backup air compressors, as well. For that, it selected used air compressors, since they wouldn't run as often. It purchased a used air compressor Bi-State Compressor had on hand, paying less than half the price of a new model. The distributor sources its used air compressors from a major retailer, buying them while they're still in excellent condition. Sims has been told the retailer loses a large amount of money every minute its distribution system is down, so it replaces its air compressors with new models when they still have a lot of life expectancy left.

"They're not going to have any equipment in there that's 15 or 20 years old," Sims said. "They just can't afford it. You walk into this distribution center, there are thousands of

The lubricated, VSD, rotary screw air compressor favored by Bi-State Compressor's food manufacturer customer.

TVs in this place. And then you walk in the week after Christmas and they're all gone."

The distributor sold the customer a used air compressor with only 60,000 hours on it. Sims estimates it's good for another 60,000 hours or more. The distributor tests all used air compressors in-house before selling them, and instructs customers to run used air compressors once a day each month, or while performing maintenance on the main air compressor, to keep them in good working order. Since winning this customer back, the distributor has been supplying it with new equipment and performing regular maintenance.

Low Plant Pressure Could Lead to an Upgrade

Five years back, the company built a smaller second plant 20 miles from the first. Process machinery punches holes in sheet metal, cuts it and bends it. The plant isn't high volume, so it runs 25 hp, lubricated, air-cooled, rotary screw air compressors. What's essential for this plant is having a clean production area where it can turn out quality systems.

Sims knows a customer is ready to grow when the plant manager calls and complains the air compressor isn't working the way it used to.

"You visit the plant and ask, 'Have you added anything on?' They say yes and point to new process machinery taking 200 cfm. Well, the air compressor was maxed out before they put that line in," Sims said.

"I had one customer that made silica. Its plant pressure dropped to 50 psi. It had a 150 hp air compressor. I did the audit and saw it needed 200 hp to raise the system air pressure from 50 psi back to 100 psi. We put a new 200 hp air compressor in there, and the plant ran fine. Those are the kind of things you'll see. If your pressure drops, it's usually a malfunction with an air compressor, or typically it's a usage problem. Maybe someone opened a valve somewhere, or the plant has major leaks you don't know about. But typically, they add lines on, and everybody forgets about the air compressor.

"I enjoy helping customers with problems. When people come in with a problem and I show them how to fix it, there's a lot of enjoyment in that. I don't have to search for business anymore; it's been quite a while since I had to go looking. People will call me, and that's always good. Most, if not all, of my business is repeat customers and referrals." BP

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

To read articles on the ***Food and Beverage Industry***, visit https://www.airbestpractices.com/industries/food.

For expert presentations on the ***Food and Beverage Industry***, visit our Webinar Archive Section at https://www.airbestpractices.com/webinars.

Rotary Screw Booster Advances for Blow Molding

By Manoj Purohit, Product Marketing Manager (High Pressure Air/Gases), Atlas Copco Compressors

Compressed air boosters play a vital role in industrial processes where standard compressed air pressure is insufficient. Booster technology has seen significant advancements recently, driven by evolving industry requirements. This article explores the fundamentals of booster technology, new innovations and the benefits of adopting advanced high-pressure systems.

Understanding Booster Technology

Air compressors are designed to take atmospheric air and compress it to a certain pressure. Standard air compressors deliver pressures between 90-150 psig (6.2-10.3 barg) with widely used rotary screw technology. Air boosters, on the other hand, are designed to take low-inlet-pressure compressed air and compress it to a higher pressure (over 150 psig/10.3 barg). Air compressors are a source of compressed air, while boosters are a pressure amplifier for existing compressed air.

Above: An oil-free rotary screw air booster for high-pressure applications.

Why Use Compressed Air Boosters?

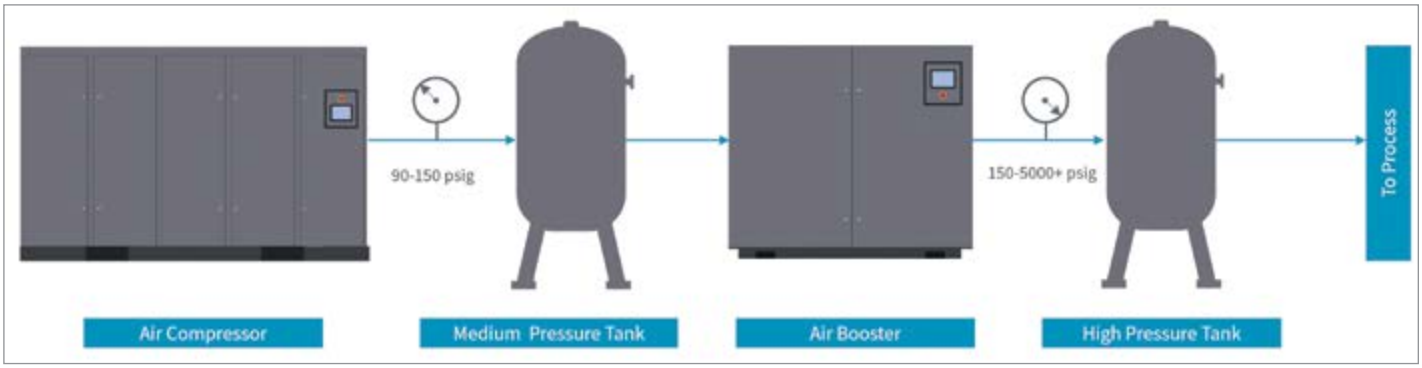
High-pressure compressed air can be supplied either by installing a dedicated high-pressure air compressor system for an entire plant or by using a booster in combination with a medium-pressure compressed air network, depending on specific pressure requirements. Compared to a common or fully dedicated high-pressure compressed air system, a booster offers several distinct advantages:

- **Efficiency:** Oversizing a primary air compressor to achieve high pressure is inefficient and costly. Boosters allow targeted pressure increases only where needed.
- **Flexibility:** Boosters can be integrated into existing compressed air systems without major redesigns.
- **Reliability:** Dedicated boosters reduce strain on the main air compressor, extending equipment life.

Types of Air Boosters

Air boosters are classified by the air compression technology used.

- **Piston Boosters:** This is the most widely used technology in the industry, capable of delivering high pressures – typically ranging from 200-5,000 psig (13.8-344.7 barg).
- **Rotary Screw Boosters:** These are commonly used for medium-pressure applications. Recent innovation has extended this technology to high



The standard setup for an air compressor system with a high-pressure compressed air booster.

pressures, bringing the benefits of rotary screw technology, such as lower maintenance and improved efficiency.

As with air compressors, boosters can be categorized as oil-free or oil-lubricated:

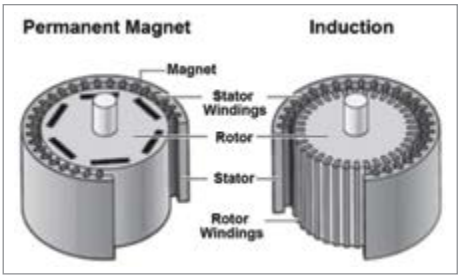
- **Oil-Free:** Delivers high-pressure, oil-free compressed air with a continuous duty cycle. While oil is used for lubricating certain mechanical components, the air compression chamber is isolated from the oil chamber, ensuring no oil contaminates the compressed air.

- **Oil-Lubricated:** Provides a higher pressure range due to oil lubrication. This technology injects oil into the compressed air. This needs to be removed with a filtration system, resulting in regular maintenance.

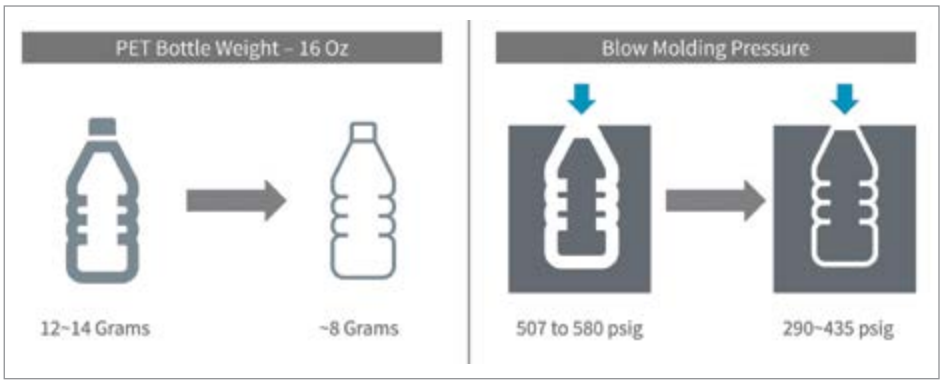
Key Components Oil-Free Rotary Screw Boosters

Due to advancements in bottling and blow molding technology, pressure requirements have been optimized for some industrial applications. Previously, PET blowing applications required approximately 580 psig (40 barg) air pressure, but this has now been reduced to around 290-435 psig (20-30 barg) due to improvements in bottle design, materials and thickness. This optimization results in significant energy savings throughout the bottling process.

Rotary screw technology is commonly used in medium-pressure air requirements in the bottling industry. It provides advantages such as high efficiency, low vibration, better turndown and reduced maintenance. Thanks to recent developments, this technology has been extended to higher-pressure applications (up to 435 psig/30 barg), complementing industry requirements.



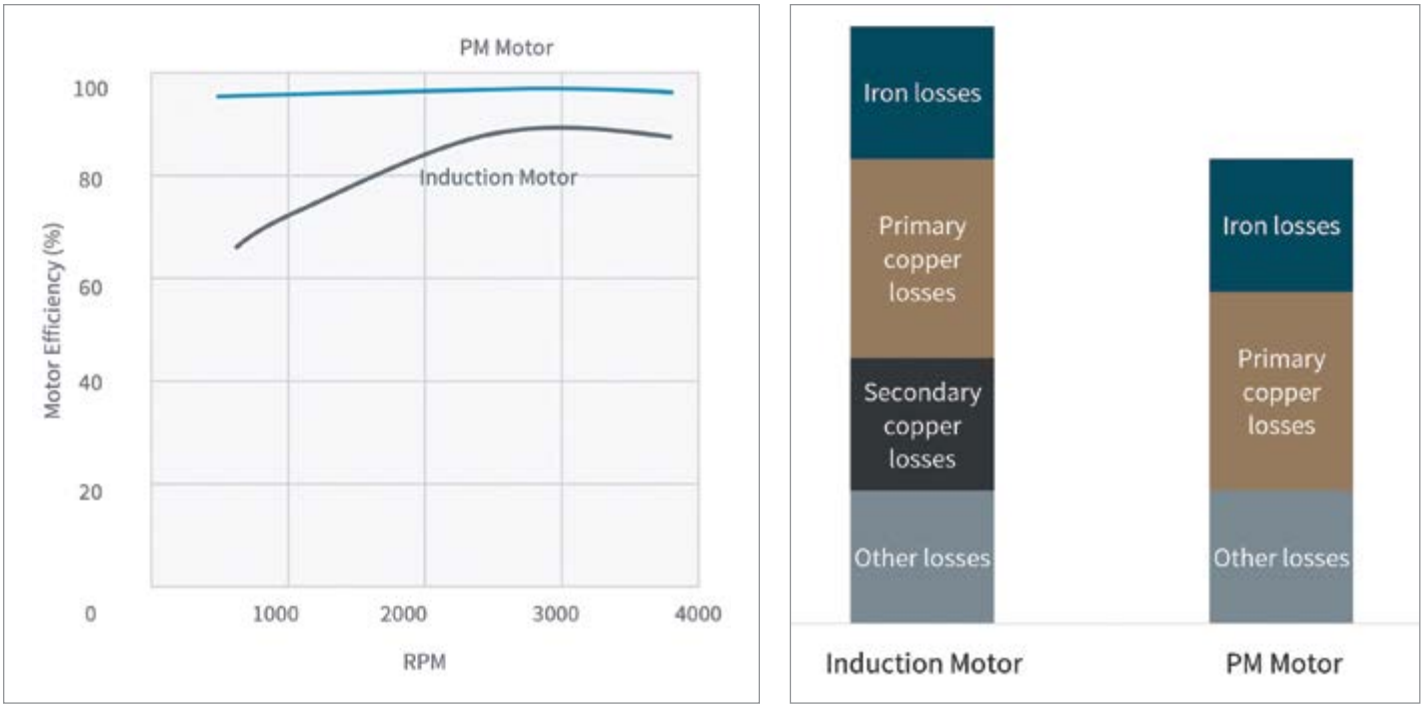
The key structural differences between a permanent magnet motor and an induction motor.



Compressed air pressure requirements for PET bottle blowing have decreased, along with the optimized weight of the bottles.

A new generation of oil-free rotary screw compressed air boosters can increase air pressure to 435 psig (30 barg).

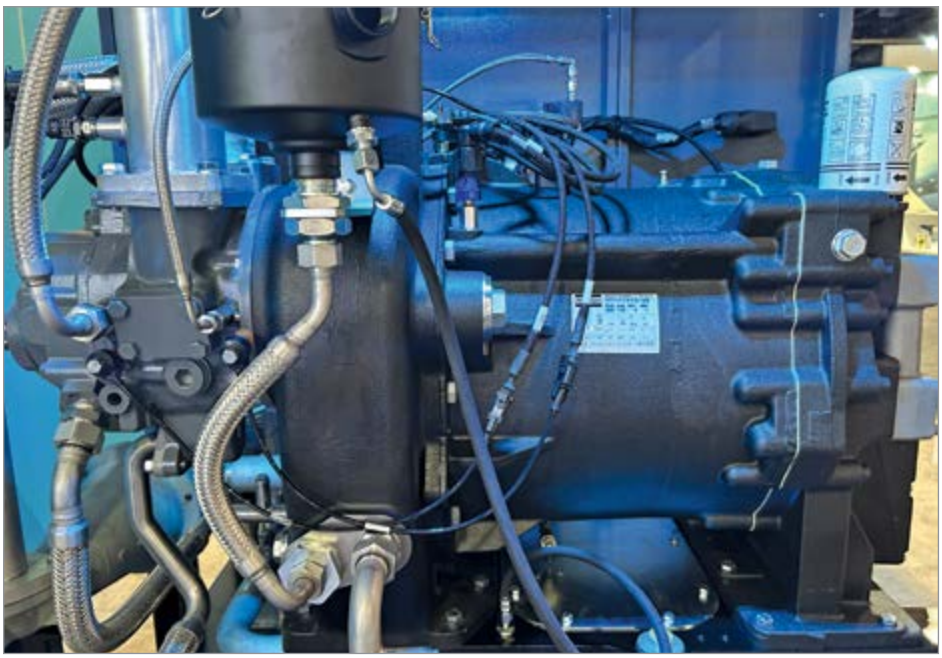
Rotary Screw Booster Advances for Blow Molding



A comparison of efficiencies between a permanent magnet motor and a conventional induction motor.

The new generation rotary screw booster is engineered to boost air to higher pressures, delivering higher flow rates and optimizing energy efficiency. A 100% oil-free, class-0 certified design (as it relates to oil content) ensures compressed air purity, as it doesn't introduce additional oil, dust or water into the air compression chamber. Additionally, this design can handle a wider suction pressure range, making it easy to install in an existing plant setup with a compact footprint.

A specially developed IE5 permanent magnet (PM) motor provides the highest efficiency class. It can save up to 7% energy compared to a conventional induction motor. Permanent magnet motors run synchronously with the applied frequency, allowing the motor to operate at a speed set by the variable frequency drive (VFD), eliminating the intrinsic lag.



This rotary screw compressed air booster includes VSD+ technology for wider turndown and enhanced efficiency.

This motor technology offers high efficiency (up to 97%) with no current losses in the rotor, IP66 protection for challenging conditions, improved speed control as the rotations don't slip or fluctuate with the load and an increased lifetime and low maintenance thanks to oil-lubricated bearings.

A variable speed drive (VSD) saves up to 35% energy compared to a fixed speed system by adjusting the motor speed to match the compressed air demand. Standard VSD air compressors and boosters accomplish this using induction motors coupled to the element.

Newly developed air compressors known as "VSD+" are designed to save additional energy. They have PM motors coupled to rotary screw elements with an advanced transmission system, making them more energy efficient. This drivetrain provides a wider turndown range (20-100%) without compromising the efficiency of the system.

This advanced touch controller optimizes performance and displays system parameters.

An advanced touch controller optimizes performance according to demand, improving energy efficiency with an advanced algorithm. With a remote monitoring system, users can remotely check the machine condition, performance parameters and maintenance schedule. This helps increase the uptime of the booster without impacting production.

Oil-free rotary screw booster technology marks a major advance in compressed air systems. By combining an oil-free design with the benefits of rotary screw technology – such as continuous-duty operation, low vibration and high energy efficiency – they deliver a reliable solution for high-pressure applications without compromising compressed air quality. This innovation expands the capabilities of rotary screw air compressors beyond medium pressure, making them a strong choice for industries seeking clean, efficient and sustainable performance. BP

About the Author

Manoj Purohit is a Product Marketing Manager at Atlas Copco Compressors, responsible for high-pressure air and gas compressor solutions. With hands-on experience in product development, he combines technical expertise with market strategy to support industries in adopting efficient, sustainable compressed air and gas solutions.

About Atlas Copco Group

Atlas Copco is a Swedish multinational company founded in 1873, specializing in sustainable industrial solutions. It provides advanced technologies in compressed air systems, vacuum solutions, industrial tools and power equipment, serving customers in over 180 countries with a strong focus on innovation and energy efficiency. Atlas Copco's compression solutions include a wide range of energy-efficient air and gas compressors, along with air treatment systems and gas generators serving various industries globally. For more information, visit https://www.atlascopco.com.

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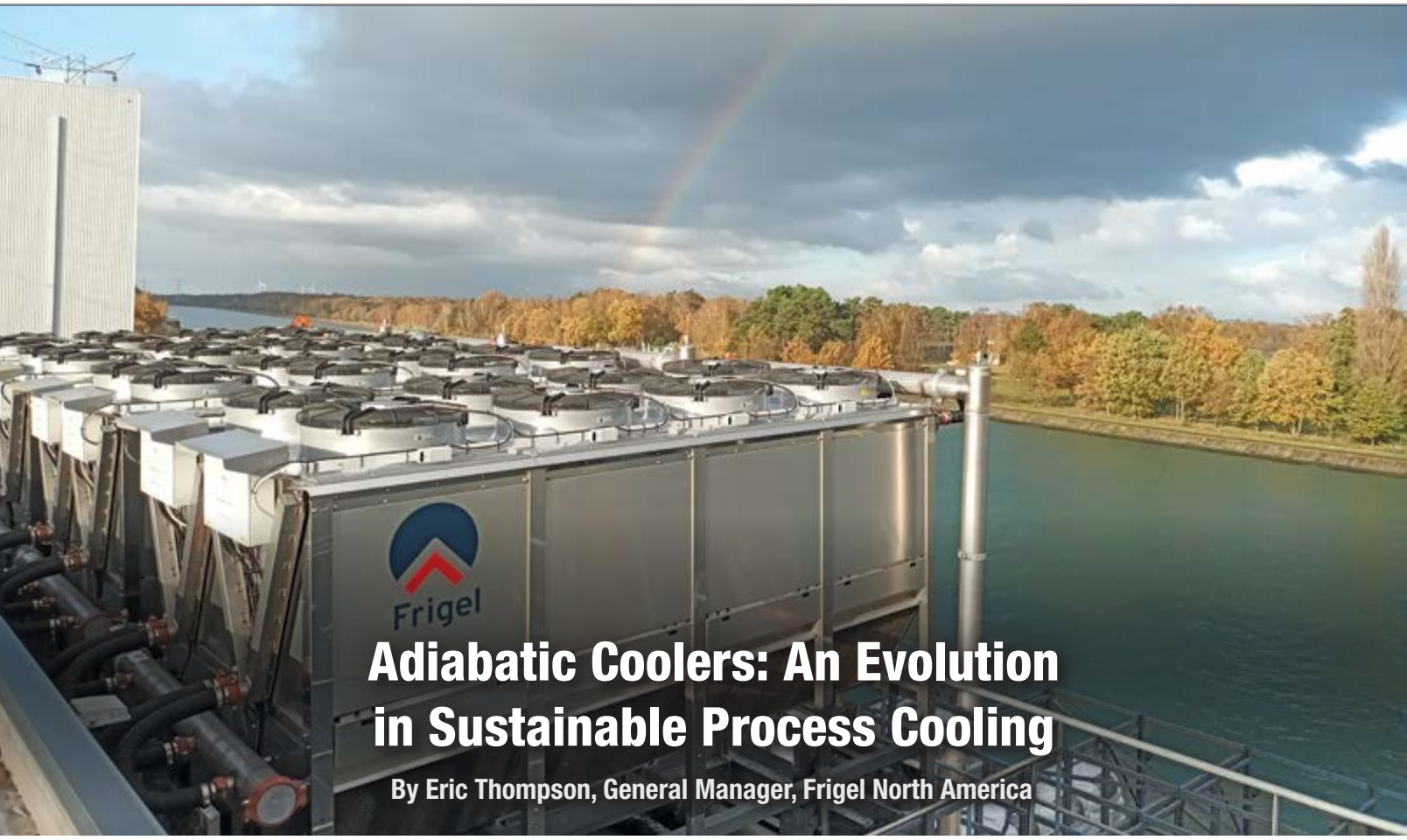


Adiabatic Coolers: An Evolution in Sustainable Process Cooling

By Eric Thompson, General Manager, Frigel North America

Across the plastics industry, cooling is one of the most essential – and costly – elements of production. Injection molding, blow molding, extrusion, thermoforming, compounding and PET processing all rely on precise temperature control to maintain cycle times, protect tooling and ensure consistent part quality. However, traditional cooling options have become increasingly difficult to justify in an era defined by sustainability goals, rising utility costs, increasing environmental regulations and the drive toward smarter, more efficient manufacturing.

As a result, a technology once considered niche has emerged as a defining trend in process cooling: adiabatic coolers.

Typically overshadowed by traditional cooling methods with lower upfront pricing, adiabatic systems have grown in popularity thanks to major advancements in design, controls and performance. Today's adiabatic solutions, especially those engineered specifically for industrial and plastics environments, offer a convincing combination of energy efficiency, water savings, process stability and dramatically lower total cost of ownership.

This article explores how adiabatic cooling works, how it compares to traditional technologies and why the shift toward adiabatic systems is accelerating across North American plastics processing.

How Adiabatic Cooling Works: A Modern Application of a Basic Principle

Adiabatic cooling is based on a simple concept: As water evaporates, it absorbs heat, lowering the surrounding air temperature. But, unlike traditional evaporative cooling towers, where large volumes of water are constantly evaporated in an open system, adiabatic coolers use water only when necessary and in a controlled, closed-loop environment.

Premium technology adiabatic coolers are designed to keep the system process water (or water/glycol mixture) away from open air by employing varying designs of heat exchangers in combination with an adiabatic chamber, allowing the ambient air to be pre-cooled prior to reaching the heat exchanger. Air is pulled through the adiabatic chamber and

Above: This self-draining adiabatic cooling system has eight fans per module. A total of 32 fans provide 480 tons of cooling capacity under normal conditions.

A self-draining adiabatic cooling system

across the heat exchangers using powerful, yet energy-efficient, variable-speed fans. If environmental conditions require additional cooling power, adiabatic coolers can spray non-process water on rugged cooling pads to assist in lowering the air temperature flowing over the heat exchanger. As the air flows over these now wet cooling pads, the water evaporates and the temperature of the air drops significantly, which increases cooling across the coils.

This flexibility in operating modes allows adiabatic coolers to run efficiently for utility savings while providing temperature control.

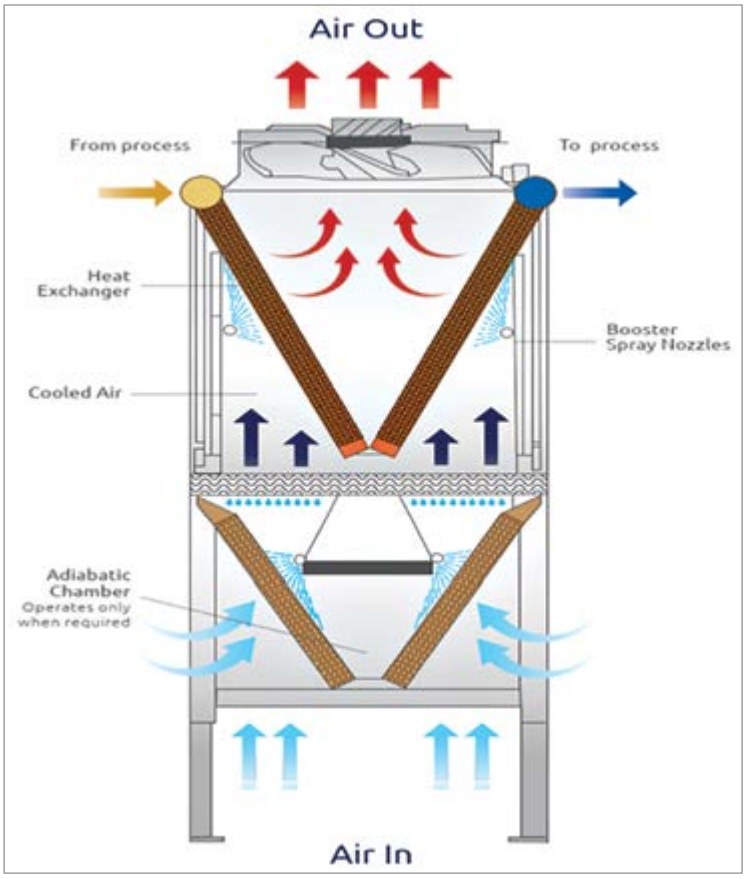
Another key characteristic not to be overlooked is the design of the heat-exchanging coils themselves. Depending on the system requirements, adiabatic coolers can be configured with their coils in a parallel or series design for the process water, which plays an important role in the system's long-term success (refer to this note when choosing the right partner). Choosing the right coil design will depend upon a multitude of factors, including installation position/limitations, system sizing, ambient conditions and the process being cooled.

To prevent freezing in the harshest winter conditions, some top-of-the-line adiabatic coolers offer a self-drainable version integrated into the system, which automatically drains the cooler in the event of a system shutdown or power loss. This type of system can be critical in cold climates where a process cannot accept the use of glycol in the application.

Operating Modes: Performance and Savings

As designed, adiabatic coolers can operate in two basic modes, dry and adiabatic. These two modes are core functions of the adiabatic concept as described above.

Dry Mode. For a large part of the year, especially in northern U.S. and Canadian climates, the ambient temperature is low enough for the cooler to operate dry. Fans draw air across a bank of finned coils (heat exchangers), rejecting heat using only ambient air. This operation provides the best possible combination of low energy consumption, zero water use and minimal maintenance. This mode can be used in almost any climate depending on the load conditions, but frigid climates will provide a greater number of dry mode operational hours.



Airflow within an adiabatic cooler

Adiabatic Mode. When ambient temperatures rise above a pre-determined setpoint, the system activates a fine mist to spray on cooling pads in front of the air stream of the coils. This action, in combination with the high velocity air flow across the cooling pad, allows water to evaporate before hitting the surface of the heat exchanger coil. This evaporative process drops the air temperature several degrees and helps maintain the correct approach temperature even in high-temperature climates or demanding applications. Because water is sprayed only when needed, and at a fine mist, the total consumption remains low and in a controlled state.

As an added benefit, when water is sprayed on cooling pads and not directly on the coils, the water can be totally evaporated, therefore preventing scale and buildup on the coil surface, which would lead to long-term performance degradation of the system.

Some adiabatic coolers can run in additional modes providing an even more effective operation for each system and environment, regardless of the season.

Free Cooling. In certain dry bulb ambient conditions and when used in conjunction with a properly optioned chiller system, the adiabatic cooler can run simply using Mother Nature to cool the process water. This results in the most efficient cooling and greatest savings possible, as the chiller's refrigerant compressors work less. The adiabatic unit isn't spraying water, so water savings increase, as well.

Booster. In the most demanding conditions, some adiabatic coolers can spray additional water directly on the coils to boost cooling power via additional evaporation. While the benefits of not spraying directly on the coils were stated previously, sometimes it's necessary when the cooling load is too great or the ambient operating conditions are too high. Having this booster function permits ultimate flexibility in adiabatic coolers for all operating environments and can be used only when needed to help offset utility consumption. For additional savings, the booster spray water can be collected and recirculated with certain control considerations.

Adiabatic systems have grown in popularity thanks to major advancements in design, controls and performance. Today's adiabatic solutions…offer a convincing combination of energy efficiency, water savings, process stability and dramatically lower total cost of ownership.

Adiabatic Coolers: An Evolution in Sustainable Process Cooling

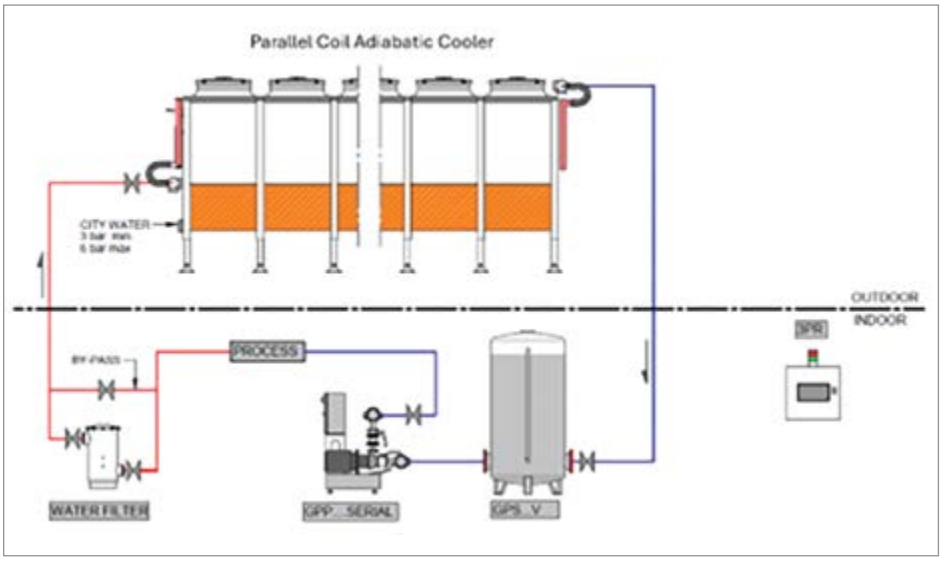
The result is a customizable system providing the best of all worlds: the water and energy savings of free or dry cooling with the performance stability of evaporative or booster systems – without health, maintenance and regulatory burdens.

Adiabatic Cooling and Traditional Cooling Methods: A Practical Comparison

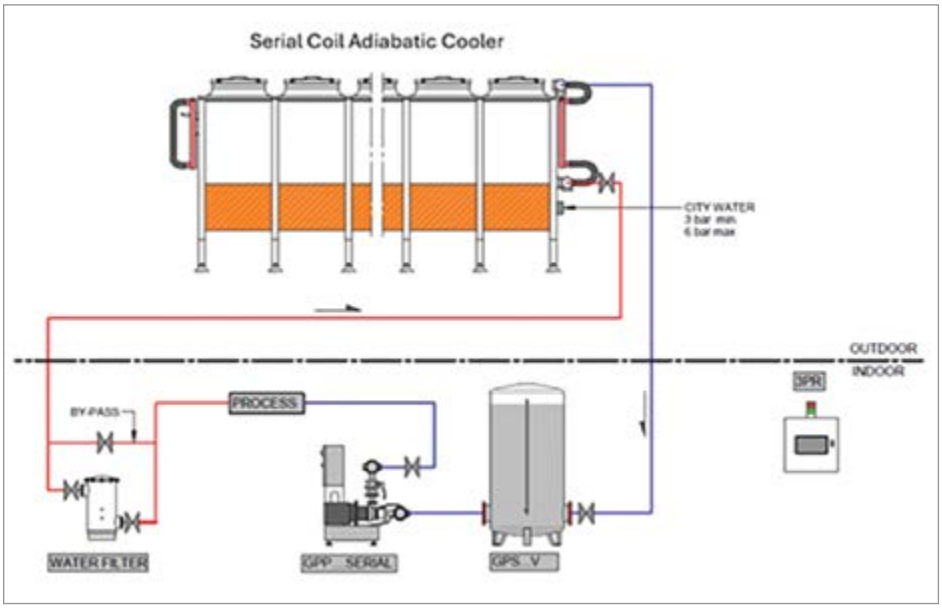
While traditional cooling methods have a lower upfront capex cost, the return on investment (ROI) can be easily calculated using actual process demands for the location. A simple model showing different operating environments and a comparison of usage for a 485 ton system could be:

Water and Energy. As shown, location plays an important role in the operating mode of the unit, determining total water requirements. Despite their varied use, adiabatic coolers can lower water needs by 90% in even the most demanding climates.

Total Cost of Ownership (15-20 years). Traditional cooling methods offer lower upfront costs, but can be costly to operate and maintain. Adiabatic systems come with higher upfront costs, but, if engineered properly, could provide a fast ROI.



An adiabatic cooler with parallel coils



An adiabatic cooler with serial coils

When all factors are included – energy, water, labor, downtime – most plastics processors see 20-40% lower lifecycle costs with modern adiabatic solutions.

Lower Operating Costs. When considering the first pass at budgets, traditional cooling methods typically appear less expensive upfront, but hidden costs can be substantial including water usage and sewer costs, additional chemical treatment, maintenance costs for labor, cleaning, machine repair and downtime for poor machine performance.

Modern adiabatic coolers eliminate most of these costs and cut others dramatically. Many plastics processors see a 90-95% reduction in water use, up to a 30% reduction in energy use and a 50-80% reduction in maintenance labor.

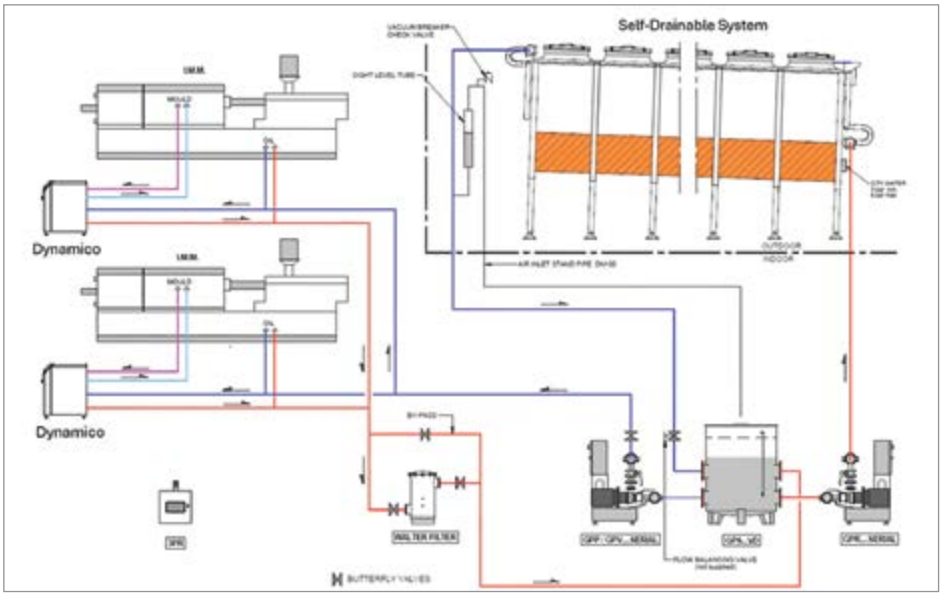
Compliance with Sustainability and ESG Commitments. Water consumption is increasingly scrutinized in industrial facilities, especially where municipal costs are rising or allocation is restricted. A benefit of adiabatic systems is they only use water when necessary and only in small quantities. They produce no contaminated blowdown, require little chemical treatment and improve the energy efficiency of the cooling system through advanced fan control logic. For companies with environmental reporting requirements, adiabatic cooling represents an immediate, quantifiable improvement.

Closed-Loop Cooling. Biological growth, scaling and airborne contaminants all threaten process equipment and heat-transfer efficiency. This affects molds, chillers, TCUs and hydraulic systems. Adiabatic systems solve this problem by keeping the loop sealed. This ensures clean and reliable heat transfer with longer equipment life.

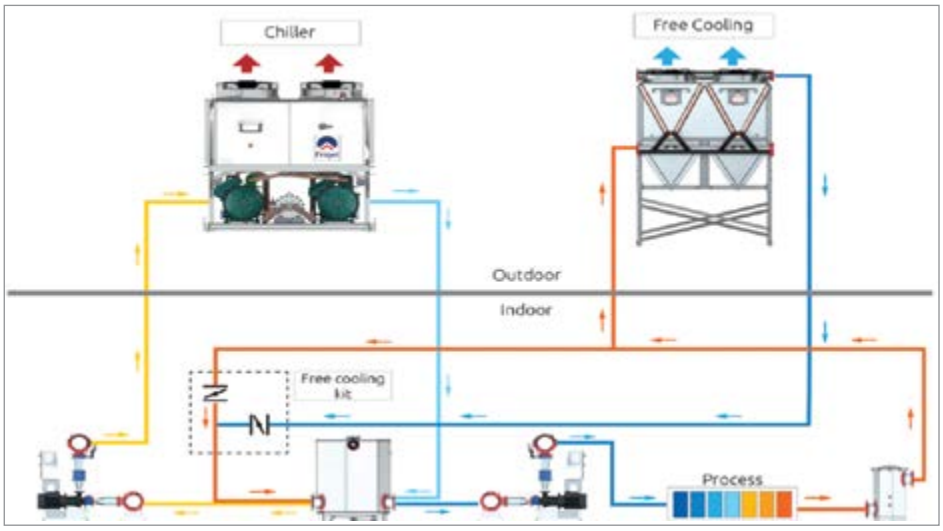
Adiabatic Cooling and Plastics Processing

Plastics processors require consistent cooling to maintain repeatable cycle times. The closed-loop design of adiabatic systems ensures stable temperatures regardless of outdoor environmental conditions by helping control

scale, algae and other airborne debris buildup inside chillers, machine heat exchangers, molds and temperature control units. When buildup collects over time, all these pieces of equipment are more susceptible to failure or improper performance, which directly impacts the process cycle. This stability translates to lower scrap rates, faster cycles and improved uptime.



A self-draining adiabatic cooler



An example of a free cooling system

An adiabatic cooler with a spray booster

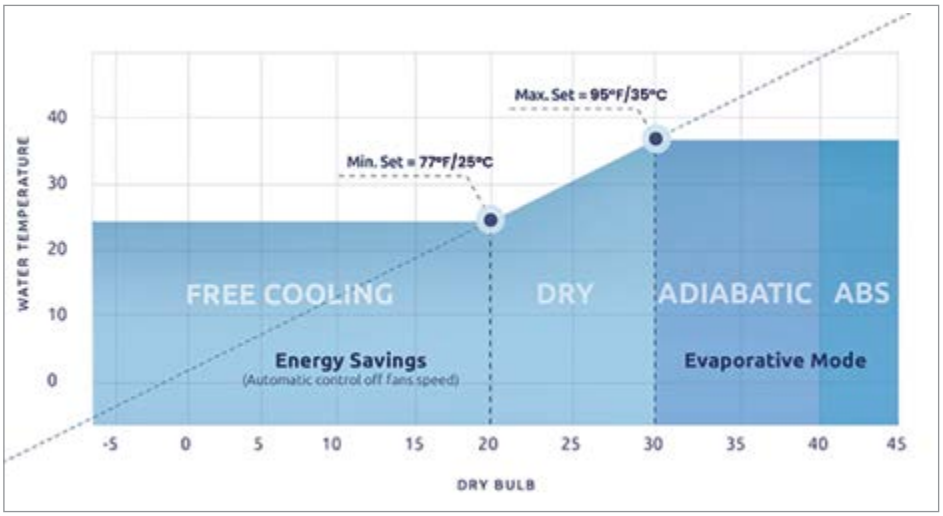
Adiabatic Coolers: An Evolution in Sustainable Process Cooling

Injection Molding. Cycle time reduction is the primary source of profitability. Adiabatic cooling ensures consistent mold temperatures, reducing cycle time creep, scrap rates, chiller loads and downtime due to poor machine performance.

PET Processing. PET preform production is extremely temperature-sensitive, and cooling consistency is often the bottleneck. Adiabatic systems deliver precise, stable water temperatures, reduce cooling tower contamination and improve uptime in hot climates which allows PET preform production to remain in operation steadily.

Blow Molding. Adiabatic cooling improves bottle consistency and reduces variability between molds, particularly in high-speed lines.

Extrusion and Thermoforming. Water quality and consistency are critical. Adiabatic systems prevent contamination and scale, preserving heat-transfer performance throughout production.



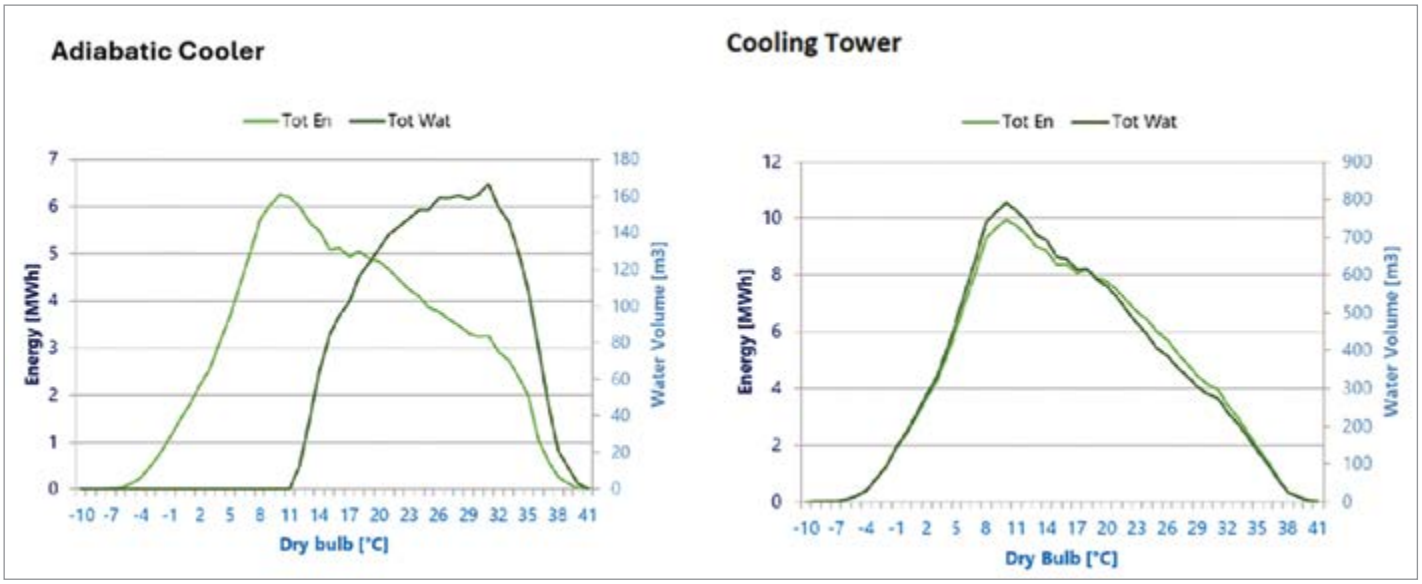
A comparison of working modes in an adiabatic cooler

Choosing the Right Partner for Adiabatic Solutions

While adiabatic cooling technology is not new, the system engineering matters. Systems designed for commercial HVAC often fall short in industrial applications. Choosing a partner whose technology is built specifically for heavy, high-duty process cooling, especially plastics processing, is critical.

Water Consump. Comparison	Paris		Bangkok		Houston	
[m3/Year]	Traditional cooling method	Adiabatic cooler	Traditional cooling method	Adiabatic cooler	Traditional cooling method	Adiabatic cooler
Water consumption	26,768	214	35,230	2,321	31,806	1,282
Savings	26,554		32,909		30,524	
	99%		93%		96%	

Water use comparisons for three cities



This side-by-side comparison shows an estimate for central California with both energy and water savings at almost 40%.

Engineered for Industrial Load Conditions. Units should be designed to handle high fluid temperatures while managing variable yet demanding production loads. Adiabatic systems must integrate seamlessly with centralized chilling systems, operating efficiently year-round and able to tolerate harsh outdoor conditions.

A properly designed and installed adiabatic system is ideal for injection molding, PET processing, thermoforming and extrusion, where each day processing machines can be on or off depending on market conditions.

Smart, Adaptive Control. Control systems determine efficiency and regulate the operating mode based on real-time conditions. The control system should be integrated with the entire cooling system for maximum savings, so it can automatically control adiabatic spray water when needed, modulate fans for energy efficiency and provide continuous monitoring to ensure setpoint accuracy. With a smart and adaptive control system, plants can get cooling capacity on demand without wasting water or energy.

Integration with Complete Systems. Adiabatic coolers can be integrated with an existing cooling system, offering a unique environment for process cooling. Adding adiabatic coolers to an existing cooling system increases operational efficiency using the operating modes previously covered and maximizing the performance of centralized chillers, mold temperature control units, pumping stations, high-performance filtration and smart monitoring. Adiabatic coolers serve as a backbone for a fully integrated, optimized cooling solution tailored to each facility's needs.

Adiabatic Systems and the Future of Process Cooling

The plastics industry is moving toward smarter, cleaner and more efficient cooling solutions supporting modern production demands and sustainability expectations. Adiabatic systems offer high performance in all climates, water savings, cleaner and safer operations, lower total cost of ownership, better process consistency and reduced environmental footprint.

For these reasons, adiabatic cooling is becoming the preferred solution not just for new facilities, but also for retrofits where manufacturers seek to replace aging cooling systems.

Conclusion

Cooling is an often-overlooked system in the plastics processing industry, and the systems chosen today will influence energy consumption, water use, reliability and overall profitability for decades to come. Adiabatic coolers have evolved into a high-performance, sustainable alternative addressing the specific needs of plastics processors better than traditional technologies.

For manufacturers seeking stability, sustainability and long-term cost reduction, adiabatic cooling is no longer just an option. It is rapidly becoming the industry benchmark for the next generation of high-performance plastics manufacturing. BP

About the Author

Eric Thompson is a General Manager at Frigel North America, with over 20 years in the plastics industry working with extrusion and injection molding processes, injection machinery and cooling technology.

About Frigel North America

Frigel is a leading global manufacturer of intelligent process cooling equipment and systems with corporate headquarters in Florence, Italy, and facilities worldwide.

Frigel North America, established in 2006, is located in the Chicago area and is responsible for sales, engineering, service and parts for the entire North American market. For more information, visit https://www.frigel.com.

To read articles about ***Dry Coolers***, visit https://coolingbestpractices.com/technology/dry-coolers.

Visit our Webinar Archives to listen to expert presentations on ***Dry Coolers*** at https://coolingbestpractices.com/magazine/webinars.

Johnson Controls Optimizes Chiller Lift for Energy Efficiency and Heat Recovery

By Bill Smith, Regional Sales Manager, and Troy Dreier, Senior Editor, Compressed Air & Cooling Best Practices Magazine

➤ Working with higher chiller lift can be a cost-effective method of driving heat recovery solutions or a result of the need to evacuate heat at higher temperatures with less water. We spoke Rob Tanner, Marketing Director, Applied Equipment, Johnson Controls, about ways engineers can optimize chiller lift and the technology pushing the area forward.

Understanding Centrifugal Chiller Lift

Best Practices: How would you define chiller lift qualitatively?

Rob Tanner: It's easier for people to think about chiller lift in terms of temperature rather than pressure. They're correlated: Both go up when the temperature goes up, and both go down when the temperature goes down. Chiller lift is the temperature difference between the condenser outlet and the leaving evaporator outlet. Think about lift as water temperature you get on the condenser side – the useful water temperature for heating – and water temperature you get on the evaporator side – the useful cooling temperature – particularly in applications where you're going to use both of those.

Above: A water-to-water compound centrifugal heat pump.

The pressure relation shows as you go to higher condenser temperatures, you need a chiller able to deliver at higher pressures. It comes down to your refrigerant compressor's capability to deliver pressure, with that particular refrigerant, to achieve the condensing temperature. The next question is how do I build a chiller able to handle that pressure? Let's say a comfort cooling chiller's pressures will be 150 psi or less, but I'm going to get into 300 psi-plus pressures when I start using it for high temperatures, like in a heat pump application.

I could specify a refrigerant pressure in the evaporator and a refrigerant pressure in the condenser. The difference between the two is pressure lift. Pressure lift is defined by how much pressure is added by the refrigerant compressor. The purpose of the refrigerant compressor, centrifugal or positive displacement, is to raise the pressure of the refrigerant gas. It's the water temperature that connects most with people, but you can talk about both terms.

Best Practices: Let's get into low, medium and high lift. How can we define each of those?

Rob Tanner: 70°F (21°C) of lift or less is a low lift application, and I can take advantage of the efficiencies available there. The less lift I need to

Rob Tanner, Marketing Director, Applied Equipment, Johnson Controls

accomplish, the less my refrigerant compressor has to work. There are lots of applications where low lift fits the requirement. A lot of comfort cooling applications fit low lift, and it's common in any commercial building where we're going to deliver chilled water temperature somewhere in the mid 40°s F (around 7°C) to be able to provide cooling or heat removal.

> *"It's easier for people to think about chiller lift in terms of temperature rather than pressure. They're correlated: Both go up when the temperature goes up, and both go down when the temperature goes down. Chiller lift is the temperature difference between the condenser outlet and the leaving evaporator outlet."*
>
> — Rob Tanner, Johnson Controls

The middle road says, if you can get high lift, you can do anything you need to do, but is it optimal? Let's say I need around 100°F (56°C) of lift. I could use a product designed to achieve high lift, but at what cost? I'm now not right-sized for what I need. It's much more than I need. There's a middle ground. I have product solutions where I can have something in between and optimize around that lift. Maybe I only need 140°F (60°C) water. I can do a lot of useful work with that.

High lift is usually driven by a need to either reject heat at a much higher temperature because I'm not using a cooling tower or the climate doesn't allow for low entering condenser water temperatures. Say I'm in the Middle East and ambient temperatures are hot. In order to reject heat, I've got to be warmer than that. I'll need a higher lift to overcome heat rejection. I may not deliver any lower temperature, but I need higher lift to be able to reject heat.

Any place you need higher temperature water, higher lift helps you achieve it. You could still be at the same evaporator temperatures. High lift applications can go pretty high depending on the refrigerant compressor technology.

Changes to Achieve Optimal Chiller Lift

Best Practices: If I see my lift is dropping or rising, how can I diagnose the system? What changes can I make to reset it to an optimal state?

Rob Tanner: If I have a scenario where I'm over-lifting, that's going to represent itself pretty clearly in power draw on the refrigerant compressor. We're increasing the pressure gap between the inlet and outlet of the refrigerant compressor and the temperature of the evaporating and condensing process. The gap in the temperature grows. I think you'd look at it and say, "I'm consuming additional power, so I'm going to see pressures and temperatures change."

Then, it's a question of saying, "What's creating that draw?" If it's a cooling-only application, my control point is my chilled water temperature. If I'm able to maintain that, but I have a higher lift, I'd start looking on the heat rejection side and ask, "Is something happening there that's telling the refrigerant compressor it's not able to achieve this without overcoming more heat rejection? Is there something happening in the

When the power draw on a refrigerant compressor is too great, the first step is understanding what's causing that draw.

Johnson Controls Optimizes Chiller Lift for Energy Efficiency and Heat Recovery

heat exchange process?" It could be in the chiller bundle itself or in the cooling tower.

Usually, it goes the other way, where you have less ability to transfer. Heat exchangers degrade because they're fouling or they're not able to transfer heat as well. That could be an indication overdrive is trying to compensate for heat exchange. In that case, we don't have good heat transfer in some part of that heat rejection system.

On the low end, the question is more often, "What's going on with the refrigerant compressor?" If I'm not achieving the lift I expect, where am I losing? Have I lost capability? Has something happened to the impeller? Did the impeller break? Is it spinning as it should? Have I lost coupling and connection to the motor? The tendency is to ask, "Is what's happening in the refrigerant compressor circuit?" It may not be the refrigerant compressor itself, but it would be some subsystem of the refrigerant compressor diminishing its capacity to lift it to the level it needs. We're not seeing the load on the evaporator side, so we're not going to raise it as much. Those are a couple of first indicators to look at.

A Growing Need for Higher Lift Solutions

Best Practices: Why are users demanding higher lift solutions? Heat-intensive processes have long been around.

Rob Tanner: It's the desire to say, "I want to keep the heat from a cooling process. I've got a need for both: I need to cool something and I need to heat something. I've got that demand consistently and predictably, so I could right-size a solution and go higher." One of the things driving the trend for higher lift is a growing demand from industries unable to get enough cooling tower water for heat rejection.

The numbers are so big that no municipality is going to let you have that much water. You've got to have a way to reject heat without the benefit of the evaporative process or with some reduced capability. Now, I've got to overcome higher condensing temperatures. I need more lift to achieve that. I can't just shift that lift and say, "Oh, let's deliver warmer water and try to make that correlate directly." I need to still do what I'm doing on the evaporator side, but my condenser needs to be able to reject at a higher temperature. Increasingly, we see air-cooled and water-cooled products doing it. If I'm rejecting heat without using evaporative water, I've got to

Most modern high-efficiency chillers use variable speed drives to vary the chiller's capacity.

have a higher condensing temperature. That's a big and growing driver for higher lift.

The other factor is heat that might normally be thrown away. It feels like it's relatively low quality, but it might still be 100°F (38°C). I want to turn that into something useful. I might say, "Rather than reject it at 100°F (38°C), could I go through a process where I could get that to 140°F (60°C), 150°F (66°C), maybe all the way up to 180°F (82°C) or above?" Now, I can use it to replace something that might normally burn fossil fuels. It's more cost-effective to use that solution to get the heating I need rather than firing the boiler. It drives people to solutions delivering a higher lift.

Chiller Control Methods for Energy Efficiency

Best Practices: How does modern chiller technology use lift considerations to deploy control methods for energy efficiency? What are some of the methods we're capable of?

Rob Tanner: With a refrigerant compressor and most modern systems today – unless you're base-loading a product because it's going to run full out all the time – you're going to vary the capacity of the chiller with a variable speed drive. You're going to take the efficiencies you gain in slowing down the refrigerant compressor and the correlating function of being able to handle capacity control.

On the condenser, I might have more favorable temperatures. The temperatures outside are a little bit lower. My cooling tower gets to reject heat to a lower temperature and it's an easier heat transfer than at a higher ambient temperature. You've got that compensation going on.

There are ways to dial in that refrigerant compressor variable speed in motors. As you start to turn down the refrigerant compressor, there are additional valve movements you might make. For example, you might use variable geometry diffusers (VGDs) to optimize what happens to the refrigerant as we slow down. You can ensure you have the most efficient compression of gas and volume of that gas in the refrigerant compressor as it's operating at that speed. Those are the typical ways you refine operation as loads change.

In some cases, you can't get there with the chiller. You might be at a bad operating point. What's the strategy when our load has dropped off, and we can't turn down that far? Do I start another chiller at a smaller capacity designed to operate in the range as the load varies, then shut off the first chiller? In multi-chiller plant strategies, there's always the question of which to run and at what speeds. Those are decisions made based on data to optimize lift.

> *"One of the things driving the trend for higher lift is a growing demand from industries unable to get enough cooling tower water for heat rejection. The numbers are so big that no municipality is going to let you have that much water. You've got to have a way to reject heat without the benefit of the evaporative process or with some reduced capability."*
>
> — Rob Tanner, Johnson Controls

Best Practices: What's a variable geometry diffuser?

Rob Tanner: Think of a diffuser in itself. It's an orifice, and I might change the size of that orifice dynamically based on the volume of refrigerant moving through it, because I'm interested in velocity. I don't get velocity in a centrifugal chiller. A centrifugal chiller is all about being able to sling refrigerant out and convert it to pressure as we roll it through the housing. A VGD allows me to adjust the gap where the refrigerant would exit and start to transition from a centrifugal motion to a pressure I'm going to use. The whole purpose of the refrigerant compressor is creating a pressure difference. A VGD allows me to optimize the difference as I slow things down and as the refrigerant's rate of flow slows down.

A VGD can be used either by itself or in combination. More commonly, you think about guide vanes that can turn and rotate to provide a similar function. I say similar because they can be complementary, too, but it's all about managing the efficient flow of the refrigerant to achieve the needed lift under variable load conditions.

Johnson Controls Optimizes Chiller Lift for Energy Efficiency and Heat Recovery

Managing the Bell Curve as it Relates to Chiller Efficiency

Rob Tanner: As you unload a VSD chiller, the available lift is less. Therefore, you have a higher lift percentage reading at that point. When you start with a full load capacity machine – and I always use the bell curve of percentage capacity load vs. percentage power consumption – you start at the right side of the bell, and as you unload, you go through the middle, and that looks good. Then, as you go to your left, you eventually bump into the wall of the bell. As you start getting closer and closer to the left side of the bell, you actually have to increase your speed. Even though your lift is decreasing, the available lift production is decreasing faster than the lift on the chiller.

The lift reading can be interpreted as, "I'm at 90% of lift, and I'm only at 20% load capacity, and my cooling tower water is less." And yet you're at 90% of your available lift reading. With the VGD, we're actually listening for what we call rotating stall, which is a pulsation. When you pinch the diffuser gap at lower lift, you can increase your available lift possibility.

The VGD gives you a higher lift. It's still less lift than design, but you move the left side of the bell up in an odd-looking hunchback form, as opposed to a bell form. That's the new technology that helps us. You get into the technology of three-dimensional impellers instead of two-dimensional impellers.

We're doing everything we can to try to reduce the lift of the chiller. We've gone to an improved heat transfer surface design. On the tubes, we have an improved evaporator shell design. We call it hybrid falling film/flooded; that design is inside the evaporator shell. On the condenser, over the years we've added sub-coolers and different enhanced tube-type shapes to get better heat transfer.

The VGD doesn't help much at design. Picture two flat turntables, and think of the distance between the two of them. Think of that space as ¼-inch, or 3/16-inch, or 5/32-inch spacings or whatever you want. That is where you size it for your design lift. Then, you find out what happens at less capacity. You get a rotating stall, so the variable geometry diffuser pinched that gap, not the whole plate.

The whole turntable didn't get closer together, but there's a moving portion that pinches down. We're now down to only 1/8- or 3/16-inch gap. The tighter the gap, the higher the velocity. To get the same mass flow rate through the gap, it has to speed up. When it speeds up, that pushes into the left side of the bell curve.

> *"We're doing everything we can to try to reduce the lift of the chiller. We've gone to an improved heat transfer surface design. On the tubes, we have an improved evaporator shell design. We call it hybrid falling film/flooded."*
>
> — Rob Tanner, Johnson Controls

Best Practices: How does this help with heat pump performance?

Rob Tanner: Mother Nature doesn't provide design wet-bulb conditions every hour of the day. The below-design wet bulb temperatures are great for cooling-only with 95°F (35°C) or less condensing temperatures. When you switch to heat recovery system designs, the 95°F (35°C) goes up to as much as 185°F (85°C) condensing conditions to meet the heat requirement temperatures.

Whatever people are asking for today, except at reduced load, you don't get cooler condenser temperatures. You asked for 180°F (82°C). At 50% load, normally on a cooling-only chiller, I would see 85°F (29°C) in and 90°F (32°C) out, as opposed to 85°F (29°C) in and 95°F (35°C) out. In a heat recovery chiller, instead of 160°F (71°C) in and 180°F (82°C) out, I'm going to see 170°F (77°C) in and 180°F (82°C) out. So my 180°F (82°C) condenser out and my 44°F (7°C) evaporator out are constant, and we call that constant lift. My bell curve is now a flat line at the top of the bell. My lift never gets reduced in a heat recovery application. You can't get as much turndown because your bell curve isn't as wide at the top.

With improved technology, we're trying to help that, but there's an unfortunate limitation to the shape of the bell curve. It's also a different use of lift: The lift never varies in a heat pump application, but in cooling-only, the

lift is less than design 99.6% of the time. In a heat pump application, lift is never reduced, unless you take a heat pump chiller, and then, if it's too much heating, you can convert to cooling-only applications. We see that as a lower lift application.

When you reduce design lift on a chiller, you have different compressors and impellers giving you different performance improvements with the reduction in lift. The other thing we've done with technology is creating the variable orifice. When we added the subcooler, we needed to maintain a liquid seal on the refrigerant metering device, which used to be a hole in a plate. If you lose your liquid seal, gas goes from the condenser right into the evaporator. If it doesn't condense, it can't boil in the evaporator because it's already a gas. So, internal high gas bypass is an inefficient product design. If you put in a variable orifice, you can modulate the diameter of the opening so you always maintain your liquid seal, and then you always maintain your subcooler efficiency improvement as an effective part of your chiller efficiency. Again, you're modulating things with extra control algorithms.

We've now moved to high-speed induction motors – a new technology – and high-speed permanent magnet rotor motors. With the use of a variable speed drive, we can convert 60 Hz AC power all the way up to 340 Hz. You're thinking, "How do I get 340 Hz? The United States is a 60 Hz country." Well, that's what the AC inverter variable speed drive does. Technologies allowed us to miniaturize the size of the variable speed drive. We liquid-cooled the variable speed drive close to 30 years ago. That technology allows us to shrink it and put it on a chiller, so I can give my motor a 187.5 Hz output.

Variable speed drives allow us to go to different motor designs, which allow us to get rid of gears. We're adding this crazy concept of a high-speed permanent magnet rotor at a high, odd-sounding 340 Hz out of an inverter. There are still plenty of inverters that take 60 Hz in and give 60 Hz out. They also take 60 Hz in and give 49 Hz out. We're redesigning the shape of the bell curve every time we change the speed of the motor. We're making the bell curve flatter or taller. When you go to high-speed induction motors and high-speed permanent magnet motors, you're running a whole other speed. From a motor horsepower standpoint, the higher the speed, the higher horsepower you can get out of it from a smaller shape. BP

About Johnson Controls

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Compressed Air and Vacuum System Purity for Food Packaging

By John Schmitt, Marketing Product Manager; Weston Benton, Product Channel Manager – Vacuum & Low Pressure, and Rob Grizzle, Midwest Sales Manager, Kaishan USA

Compressed air can contain various contaminants, including water vapor and aerosols, oil vapor and aerosols, microorganisms, and solid particulates coming from atmospheric air and pipe scale.

Many food packaging and processing plants use the ISO 8573.1 standard as a way to classify and specify the desired purity of their compressed air systems. Depending upon the application, more than one purity specification may be established.

Using ISO 8573.1 to Establish a Specification

The ISO 8573.1 establishes compressed air quality classes, ranging from 0 to 9, with class 0 being the cleanest. It applies these quality classes to varying levels of concentrations of particulates, water and oil.

Class 0 does not imply there are no contaminants, only that it is cleaner than the limits established in class 1. For more on the ISO 8573.1 standard, see the story, "ISO 8573.1 – Contaminants and Purity Classes."

It is important to note that ISO 8573.1 compressed air quality classifications do not apply to vacuum systems. The compressed air quality classes are established at normal plant working pressures of 100 psig (7 barg). Unlike compressed-air systems, vacuum systems ingest air from the process environment. As a result, the quality of air entering a vacuum system is determined primarily by the process atmosphere itself, rather than by downstream air-treatment equipment.

Three Different Purity Zones for Compressed and Ambient Air

Some advanced food processing plants establish three distinctly different purity zones for compressed and ambient air. This allows the plants to take a different approach, capitalizing on the initial costs, maintenance and operational benefits a more nuanced view provides, depending upon the purity the applications require. To take full advantage of this approach, let's review each of these areas and their application of compressed air.

- Direct contact
- Indirect contact
- Ambient contact

Direct Contact. Although it's the most demanding with regard to quality, direct contact is the simplest to understand and interpret. If compressed air reaches or touches the food or beverage, plants require oil-free compressed air. Period. This includes all processing equipment, such as mixers and ovens, as well as some initial packaging equipment.

"No oil" is normally defined as less than or equal to 0.01 mg/m^3 of total oil (aerosol, liquid or vapor). To establish this specification, plants specify ISO 8573.1 quality class 0 or 1 in the third digit of the specification, for example 1:2:0 or 1:2:1.

The second digit represents the plant's pressure dew point specification. With direct contact application, many plants specify Class 2, representing a -40°F (-40°C) pressure dew point specification.

The first digit establishes the quality class of compressed air purity as it relates to solid particulates (microorganisms, ingested ambient solids and pipe scale).

To ensure the air is virtually free of oil, moisture and microbes, ISO 8573-1 requires Class 1:2:1 or Class 0 for these applications. There are several ways to deliver compressed air meeting these standards, as discussed below.

Indirect Contact. There are other areas of the plant with indirect contact with food or beverage products. These stages occur when the product is initially packaged and prepared for distribution, sale and storage.

In indirect-contact applications, a barrier, such as a packaging material, separates the food from the compressed air. These include form-fill-seal machines, where compressed air does not contact the food directly, yet is in contact with a packaging material which will then come into contact with food and beverage products.

Above: Processing equipment making direct contact with food requires oil-free compressed air.

Some food manufacturers choose oil-flooded rotary screw air compressors paired with food-grade lubricants for applications that don't involve direct food contact.

Larger manufacturing facilities sometimes use both oil-free and oil-flooded air compressors. However, they need to be separate systems, with different headers, storage and air treatment. Once oil is in the compressed air system, it will stay there.

Ambient Contact. Ambient contact refers to the air inside the factory. Since they introduce air into the factory environment, compressed air and vacuum systems can be sources of ambient air contamination.

The ambient air entering an air compressor can contain millions of organic and inorganic particles and hydrocarbons, as well as water vapor. Atmospheric pollutants, such as diesel fumes from the loading dock, can be concentrated during compression and contaminate food products. In this situation, one can see oil present even when an oil-free air compressor is used. This is why compressed air treatment requirements do not necessarily change based on the air compressor type selected.

While it's almost impossible for vacuum systems to introduce contaminants during vacuum operation, many food facilities rely on small vane pumps that emit oil mist from their exhaust. That's one reason some plants centralize vacuum systems to take vacuum pumps away from production areas.

Dew Point and Piping Considerations for Food Processors and Packagers

To deliver compressed air meeting the desired ISO 8573.1 quality class specifications, food processing plants must address several issues, including reducing moisture, eliminating particulates and preventing microbial growth. The solutions they choose determine pressure dew points, filtration and pipe materials.

Pressure Dew Point. One challenge in providing clean, high-quality air in a food processing facility is reducing the moisture content of compressed air. The ambient air drawn into an air compressor contains water vapor, and the more it's compressed, the greater the moisture content. That changes the pressure dew point, the temperature at which water condenses out of the air at pressure.

This two-stage, oil-free, rotary screw air compressor is machined to micron precision.

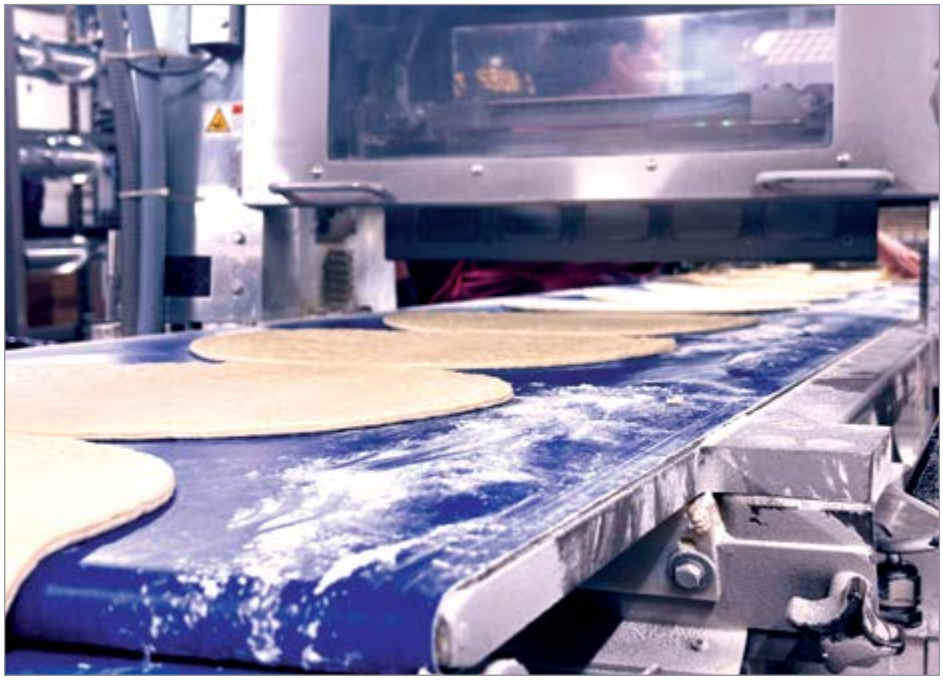
Measuring pressure dew point can be tricky. It doesn't stay constant: If the pressure in a line drops, so does the pressure dew point. And a line can have slugs of water or oil, causing inaccurate readings.

Food processing facilities need to carefully monitor the pressure dew point. Condensation from compressed air can damage pipes and other equipment, allowing microbial growth in stagnant water. It's especially a problem in food processing facilities, where large areas such as packaging zones expose compressed air piping to refrigerated areas.

Consider this scenario: Your compressed air flows through pipes in room temperature areas of the plant, then enters a refrigerated space with temperatures around -22°F to -40°F (-30°C to -40°C). Water quickly condenses. Airflow is restricted, perhaps even blocked if ice forms inside the pipes. Water pools and stagnates, leading to contamination. It may even freeze. Metal components can rust. Overall, it's a recipe for disaster.

As a result, compressed air operators must ensure the pressure dew point of the compressed air is lower than the temperature of the refrigerated areas it passes through. If it isn't, water may condense out of the air. Also, make sure the air piping system doesn't have drip legs. Stagnant water in drip legs should be avoided. Use a combination of compressed air dryers and filters to remove excess moisture.

Piping Materials. Aluminum and stainless steel piping prevents oxidation caused by moisture in



Because compressed air doesn't come into direct contact with food, the Fire Roasted Crust Co. in Wexford, PA, saved money by purchasing an oil-lubricated direct-drive rotary screw air compressor to drive an oven conveyor belt. The company also used a food-grade lubricant in the air compressor to prevent issues in the event of a failure.

Compressed Air and Vacuum System Purity for Food Packaging

the line. Any rough spots in the pipe can cause pressure drops, potentially allowing moisture to accumulate and promote microbial growth.

Aluminum pipe can oxidize if there's a great deal of moisture in the line. Here's why: A small oxidation layer in an aluminum pipe is not a bad thing, providing a thin protective layer that prevents further oxidation. Think of it like anodizing aluminum: A thin protective layer protects the rest of the material.

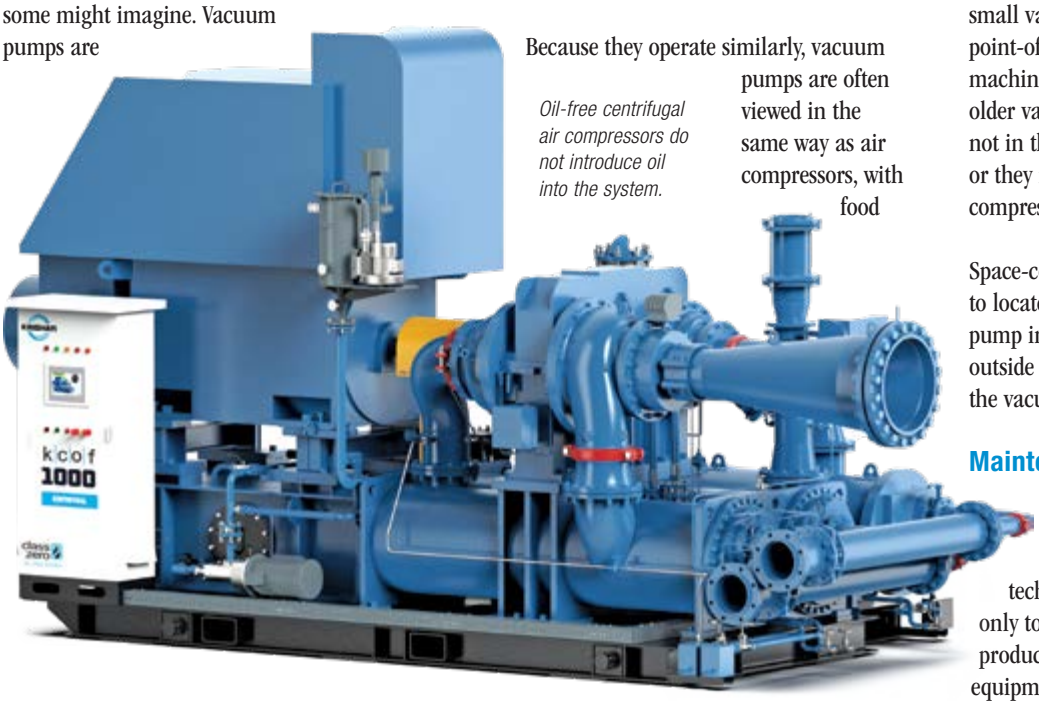
Moving clean water does not directly oxidize the aluminum pipe; it is typically contaminants ingested from the environment (acids, alkalis and process chemicals) mixing with the water, thereby altering the pH, which can accelerate oxidation. The water then becomes a carrier for the contamination.

Standing water also continuously introduces oxygen to the pipe surface, leading to thickening of the oxidized layer on the aluminum pipe. In addition, if the air velocity is too high, high-velocity water can continuously erode the protective oxide layer, exposing fresh aluminum and making it susceptible to further oxidation.

To keep oil carryover below the manufacturer's three parts per million, follow a preventive maintenance program: Check the air-oil separator annually and replace inline filters every six months.

Vacuum Capabilities and Food Processing

Vacuum technology is also part of the food packaging discussion, but not for the reasons some might imagine. Vacuum pumps are essential in food processing. They handle and package delicate fruits and vegetables. They assist in moving food products between stations. They're used in case packing to reduce physical demands on operators and speed up processes. Vacuums help form flat-film containers and create vacuum seals, preserving freshness and extending shelf life. They handle cups used in ready-to-eat meals and work with a wide range of materials from pods to pallets.



Oil-free centrifugal air compressors do not introduce oil into the system.

Because they operate similarly, vacuum pumps are often viewed in the same way as air compressors, with food processing companies seeking oil-free units to avoid any risk of contamination. Since they draw in air, however, there's almost no chance the vacuum process will contaminate a food processing and packaging operation.

Vacuum system exhaust is another matter. Many older vacuum pumps are oil-lubricated and expel oil mist into the ambient air, impacting plant air quality. Many plants use dozens of small vacuum pumps, each serving a single point-of-use application like a form-fill-and-seal machine, releasing oil into the air. Plants with older vacuum pumps should make sure they're not in the same room as an air compressor, or they may send aerosolized oil into the air compressor's air stream.

Space-constrained plants with no choice but to locate both the air compressor and vacuum pump in the same room will want to bring in outside air for the air compressor and exhaust the vacuum outside.

Maintenance Tips for Food Processing Plants

Maintenance is essential for both compressed air and vacuum pump technology in food processing, not only to maintain productivity and prevent product contamination, but also to ensure equipment life.

Air Quality Testing. Consider conducting tests to ensure compressed air systems provide the high-quality air a food-processing plant requires. The least expensive option uses small absorbent discs inserted into the airflow, then sent for testing. A more comprehensive approach is conducting separate tests for hydrocarbons, particulates and pressure dew point.

Moisture. As mentioned previously, moisture can have a range of negative effects on food processing operations, creating a breeding ground for mold and microbial growth. Make sure drains and moisture traps are clean and functioning properly.

Compressed air drains are one of the obvious ways of extracting water from a compressed air system. Not surprisingly, clogged, backed-up or malfunctioning drains are the leading failure point for air-stream moisture. Depending on their design, they can become clogged with debris, rust or sludge. As a result, we recommend plants test compressed air drains daily in all key system equipment or install drain alarms.

Moisture drains and traps are critical components located at intercoolers, aftercoolers and receiver tanks to prevent liquid water from reaching the packaging line. Dryers, filters and receiver tanks also include them, and they're found at the bottom of receiver tanks, filters and compressed air dryers.

Filters. Check and replace compressed air system filters regularly. While many filters last up to a year, consider replacing them every six months. Filters, after all, are a small investment compared to downtime or potential lawsuits.

Filters are critical for both air compressors and vacuum pumps: They make compressed air usable. With vacuums, they offer essential protection. Consider all the organic and inorganic materials vacuums ingest to realize the importance of filters in vacuum technology.

Maintain the plant's air-oil separator, replacing it annually. Varnish can drop out of the oil and coat the separator, creating a significant pressure differential, damaging the separator and sending oil downstream.

Finally, be sure to use the lubricants and filter media specified by the air compressor manufacturer. Original equipment manufacturers devote time and effort to developing filter media designed to work with the air velocity and specific gravity of their recommended lubricants. Using OEM-recommended filters and oil pays off in the long run.

Oil Sampling. As crucial as oil sampling is in standard applications, it is even more critical when using food-grade lubricants. Food-grade lubricants use a base stock similar to standard air compressor oils. The major difference is traditional lubricants contain proprietary antioxidants and additives extending their service life. Without those additives, food-grade lubricants can't withstand heat as effectively. They'll age faster and break down sooner.

Key takeaways for food packaging and processing companies:

- To ensure food safety, use the ISO 8573-1 quality classes to establish specifications for zones where compressed air comes into direct and/or indirect contact with food and beverage production.
- The most advanced food processing companies are reducing maintenance and initial costs by organizing their plants according to the level of compressed air contact with food.
- One hidden challenge in providing clean, high-quality compressed air in a food processing facility with refrigerated areas is reducing the moisture content of compressed air.
- Consider replacing individual point-of-use vacuum pumps with centralized vacuum systems to reduce aerosolized oil released by the smaller pumps.
- Most companies will benefit from expert help with selecting, operating and maintaining compressed air and vacuum systems. BP

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John Schmitt serves as a Product Marketing Manager at Kaishan USA, bringing nearly 30 years of experience in the air compressor and manufacturing industries. He applies his background in product engineering, operations leadership and product management to bring a deep, end-to-end perspective on how industrial products are designed, built and brought to market.

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Rob Grizzle serves as a Midwest Sales Manager at Kaishan USA and brings more than 30 years of experience in industrial sales, distribution and operations. He works closely with air compressor distributors across the region, applying a relationship-driven, hands-on approach to grow market share, strengthen partnerships and solve real-world compressed air challenges.

About Kaishan USA

Kaishan USA partners with a nationwide network of independent distributors to ensure customers receive on-site help and consultation. Whether a plant is using all oil-free compressed air or combining oil-free and oil-flooded air compressors with advanced filtering and food-grade oil, it will benefit from expert help in selecting, operating and maintaining its compressed air system. Kaishan USA's partners are independent, local distributors that have factory-trained technicians with a deep understanding of food-industry applications, helping maximize efficiency and minimize downtime. They can help refine compressed air and vacuum systems to meet ISO 8573-1 Class 0 requirements while also reducing costs, cutting maintenance burdens and conserving energy. For more information, visit https://kaishanusa.com.

FACILITY MAINTENANCE

Saving Energy Is a Compressed Air Best Practice

By John Bilsky, Facilities Specialist, Gentex Corporation

Companies want to save money wherever they can. One of the biggest places to save money – and boost reliability at the same time – is the compressed air system.

It's important to measure what's happening in the compressed air system. In 2003, my company had no measurement tools. By 2004, I was measuring air pressure and flow rates for all main compressed air headers. Measurement gave me a clear picture of what was happening in the compressed air system.

Eventually, we had to add more air compressors to keep up with demand. Back then, companies bought only fixed-speed air compressors. Adding more fixed-speed air compressors meant I needed a larger pressure band to operate them all correctly. I wasn't a fan of this large pressure band. I wanted to smooth out the pressure, not create a larger pressure swing.

In 2006, I bought my company's first variable-speed drive (VSD) air compressor. With it, I matched what the production floor needed and reduced the pressure swing. The best part of the VSD air compressor was that we saved money. We now have 15 VSDs in operation across multiple plants.

Variable speed drive air compressors

Another energy-saving tactic is using flow controllers instead of regulators. One of our production lines only requires 80 psig (5.5 barg). The plant runs at 105 psig (7.2 barg). Using a flow controller, we reduce the pressure for one line to 80 psi (5.5 barg) instead of lowering the pressure for each point of use. Flow controllers react faster than regulators and use less energy, so we don't sacrifice cfm. We use 27 flow controllers in our compressed air systems across multiple plants.

Saving money and making the compressed air system more reliable didn't stop there. Employing a central air compressor controller enabled me to trim my pressure band to 2-3 psi (0.1-0.2 barg). In 2011, four compressed air systems operated from a central controller. Remember, every 2 psi (0.1 barg) drop in pressure is a 1% reduction in energy costs. Now, we have nine central air compressor controllers running across multiple plants.

Improving the compressed air distribution piping saves money. Eliminate excessive pressure drops by reducing the number of elbows, add additional dry storage, increase pipe size where needed and confirm pre- and post-filters are sized correctly for your flow rate.

Finding and fixing compressed air leaks annually not only saves money, but also puts capacity back into your compressor air output.

Many power companies offer rebates for installing VSD air compressors instead of fixed-speed air compressors. They also offer rebates for central compressor controllers, flow controllers, compressed air storage tanks and annual compressed air leak audits and repairs. When energy becomes a hot topic in your company, follow these steps to make your compressed air system more reliable and ask for an energy rebate from your power company. BP

A flow controller on a compressed air system

About the Author

John Bilsky is the Facilities Specialist for compressed air, nitrogen and purified water at Gentex Corporation. He's experienced in engineering design, engineering improvements and maintenance for compressed air, nitrogen and water purification systems supporting production, R&D and lab services. For more information, visit https://www.linkedin.com/in/john-bilsky-24715b10/.

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SALES ENGINEERING SKILLS

How Compressed Air Sales Engineers Can Use AI

By Mark Allen Roberts, CEO, OTB Solutions

Organizations equipping sales teams with AI tools see bigger growth and higher quota attainment. It's time to ask how compressed air sales engineers should leverage AI.

Key AI sales data:

- Sales teams using AI are more likely to grow revenue: 83% of sales teams using AI reported revenue growth in the past year, compared to 66% of teams without AI, according to Salesforce.
- Sellers effectively partnering with AI are 3.7 times more likely to meet quota compared with those who don't, according to a Gartner survey of B2B sellers.
- Dealers moving fast to scale AI report substantially higher revenue per employee and significant productivity gains, according to Business Insider.

How Top Sales Performers Use AI

Top performers use AI as an integrated part of their go-to-market stack, especially for research, personalization at scale, forecasting and operational automation. They deploy AI across a set of repeatable use cases rather than one-off experiments. AI is ideal for administrative tasks, data gathering, sorting and what we refer to as "grunt work."

Once you've identified your ideal customer profile, AI can search for contacts matching your criteria. The goal isn't gaining thousands of possible leads, but a small group showing a high degree of need.

Some teams use AI to shape their outreach messaging. Ask ChatGPT, "What are the common challenges maintenance managers in the plastic injection molding industry face regarding air compressors and chillers in 2026?" Ask the AI to create questions demonstrating you are an industry-trusted advisor, not just another rep trying to hit quota.

Mark Allen Roberts will conduct a Sales Engineering Workshop at the Best Practices 2026 EXPO & Conference in Indianapolis, IN.

This is an example of AI results:

1. Rising Energy Costs and Poor System Efficiency Challenges

Air compressors and chillers are among the largest energy consumers in injection molding plants. Aging equipment, oversized systems, leaks, poor controls and lack of VFDs drive unnecessary kWh usage – often without visibility.

Discovery Questions

1. What percentage of your plant's total energy spend do air compressors and chillers represent today, and how confident are you in that number?
2. When was the last time you measured actual compressed air system efficiency versus nameplate efficiency under real production loads?

AI can help sales engineers deal with routing, scoring and forecasting, as well as creating custom proposals and ROI analysis. Top teams attach metrics to each use case (such as time saved, conversion lift and cycle time reduction) and iterate quickly.

What Sales Engineers Should Never Do With AI

What information don't you want in the cloud for your competitors to find and use against you? This includes proprietary information and financial data. Never enter customer information into AI tools.

By 2028, selling will be reorganized around human and AI workflows. Companies nailing governance and human oversight while scaling the right use cases will be the market leaders. Think of AI as a sales amplifier for sales engineers. BP

About the Author

Mark Allen Roberts is the CEO of OTB Solutions, which provides professional training and coaching. Visit https://www.nosmokeandmirrors.com.

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Real-World Installations & Maintenance

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

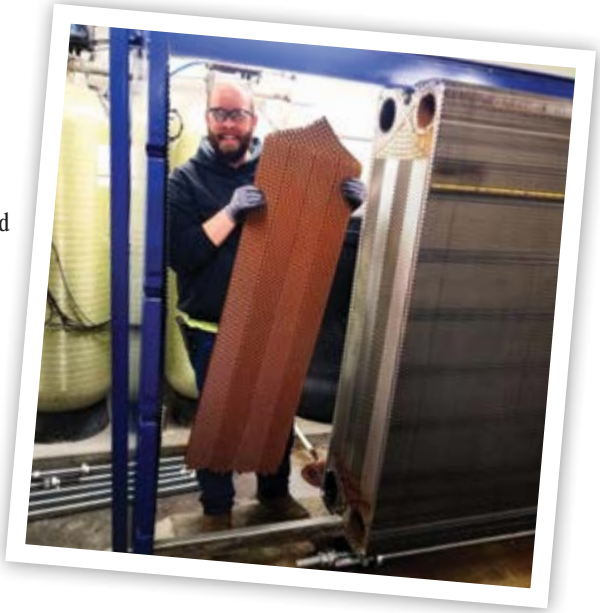
There's much we can learn from real-world compressed air, blower, vacuum, chiller and cooling tower installations. This column asks readers to share lessons learned from system installations and maintenance practices they encounter in the real world.

Pritchard Industrial's Installation for Pork Producer

Pritchard Industrial is the exclusive Kaeser Compressors distributor in Manitoba, Canada. Since 2002, the company has specialized in the custom design and installation of complete compressed air systems. It's a division of Pritchard Engineering, in business since 1923, which also provides expertise in hydraulics, machining, metal fabrication, diesel engines and power systems. Visit https://www.pritchard.ca.

General Manager Ken Loeppky told us about this compressed air system the company recently completed for a pork production facility in Manitoba. The compressed air system includes four air compressors – three fixed-speed 250 horsepower (hp) rotary screw air compressors and one variable-speed 350 hp rotary screw – all of which use food-grade oil. It also includes a 4,300 cfm heated blower purge desiccant compressed air dryer and a SAM 4.0 master controller. "By optimizing air compressor control, air treatment and demand matching, this compressed air system delivers reduced energy consumption, stable pressure and long-term operational reliability – critical requirements in food production," Loeppky said.

This compressed air system provides 1,100 hp total installed air compressor capacity.



Scale Buildup Reduces Heat Exchanger Effectiveness

Rasmussen Mechanical Services offers a variety of industrial solutions, including installation, maintenance are repair for burners, boilers, HVAC systems and compressed air systems. It provides round-the-clock service in Nebraska, Iowa, South Dakota, Colorado and the surrounding areas. Visit https://www.rasmech.com.

The scale buildup on this plate-and-frame heat exchanger was so significant, HVAC Service Technician Jeremy Hansen needed a picture. This heat exchanger is part of a heat pump loop at a Nebraska school. The scale formed because the school has hard water and doesn't use chemical treatment. The company visits this client twice a year to remove scale.

Having a good water treatment program is key, Rasmussen Mechanical Services advises, or this could be the result.

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.

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Peter Vinck
Senior Engineering Consultant, Inflow Corporation

March 5th, 2026

Leveraging Utility Incentives and Demand-Side Credits for Compressed Air

Presenter Peter Vinck, Senior Engineering Consultant, Inflow Corporation – *Sponsored by FS-Elliott*

> *"This was very practical and beneficial. Our plant can implement some of these simple solutions to see immediate improvement.*
>
> – I/E Reliability Engineer, Qemetica US Silica

Ron Marshall
Chief Auditor, Marshall Compressed Air Consulting

March 12th, 2026

Detecting and Measuring Compressed Air Leaks Rapidly

Presenter Ron Marshall, Chief Auditor, Marshall Compressed Air Consulting – *Sponsored by VPInstruments and Teledyne FLIR*

Andy Smiltneek
President, Growth Solutions Consultants

March 19th, 2026

Conserving Water with Dry Vacuum Pumps and Knock-Out Pots

Presenter Andy Smiltneek, President, Growth Solutions Consultants – *Sponsored by FS-Curtis*

> *"Your information is very important to me and the maintenance of my equipment."*
>
> – Civil Works Supervisor, Magna

April 23rd, 2026

Optimizing Cooling Tower & Chiller Systems for Part Load Efficiency

Presenter Philip Johnston, PE, CEM, Principal, E4E Solutions, LLC – *Sponsored by ABB*

Philip Johnston, PE, CEM
Principal, E4E Solutions, LLC

May 7th, 2026

Compressor Controls from Load/Unload to VFD Operation

Presenter Andrew Smith, P.E., Co-Founder, SMARTCAir – *Sponsored by VPInstruments and Rogers Machinery*

Andrew Smith, P.E.
Co-Founder, SMARTCAir

May 14th, 2026

Inside the Blowers: Comparing Centrifugal and Positive Displacement

Presenter Tom Jenkins P.E., President, JenTech Inc.

> *"Thank you, I learn from every one of these seminars. Staying in touch with the industry as I design."*
>
> – Engineer, ISG Engineers

Tom Jenkins, P.E.
President, JenTech Inc.

Jun 4th, 2026

Dryer Sizing: Load, Dew Point and Ambient Conditions

Presenter Don Van Ormer, Auditor, APEnergy – *Sponsored by Trace Analytics*

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