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December 2025

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Cover Image: Courtesy of Egger

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FROM THE EDITOR

Monitor and Analyze for Optimal Results

This month, we're looking at how monitoring industrial processes and analyzing the results leads to better performance with lower costs. Our lead story comes from Eastern France, where Egger, a global giant in wood-based manufacturing, has a plant in Rambervillers. This plant already had a control system for its compressed air system – which includes 11 air compressors spread over three zones – but found it didn't provide the level of insight and automation the plant now requires. Upgrading to a new CMC control system reduced annual energy use by 1,438,567 kWh for a savings of $166,500.

AMSOIL provides a deep dive into lubricant analysis for air compressors, showing how a structured lubricant analysis program improves operating efficiency and reliability while reducing downtime. Facilities using predictive maintenance strategies report up to 20% longer air compressor life and 10% lower maintenance costs.

Expect to see big gains in waste heat recovery in the coming years. Today's heat pump chillers are able to harvest wasted thermal energy from buildings' chilled water loops or exhaust air streams. Johnson Controls shows how one project led to an 18% reduction in energy costs and a 25% reduction in water use.

Did you know an EPA ruling on industrial process cooling systems is due to take effect on January 1, 2026? Under the ruling, new cooling systems must use refrigerants with a global warming potential (GWP) of 700 or less. A must-read article from Thermal Care helps plants navigate the change.

The Best Practices 2025 EXPO & Conference took place in Kansas City in October. This year's event had more learning than ever, with two conference tracks, five EXPO pavilions and five hands-on conference workshops. It included speakers from 3M, ALPLA, CAGI, CTI, Trane, Johnson Controls and St. Jude Children's Research Hospital. It included 89 presentations, 84 exhibitors and nearly 1,000 registered attendees. With so much going on this year, we split our coverage into three articles to better show compressed air, cooling/HVAC, industrial blower and vacuum system professionals everything the event had to offer.

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Subscribers From Around the World

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

Our Publisher, Roderick Smith, was pleased to attend WEFTEC 2025, a leading event for industrial and wastewater treatment plant technologies, which took place September 29 to October 1 in Chicago. Two of the many familiar faces he ran into were Tom Jenkins, President, JenTech (and frequent Blower & Vacuum Best Practices contributor), and Kevin Murtha, Marketing Events Manager, REXA (left to right). Visit https://www.jentechinc.com and https://www.rexa.com.

Soon after at WEFTEC, Smith paid a visit to Matt Mosier, Regional Sales Manager, and Kevin Grant, North American Sales Manager, NexTurbo (left to right). NexTurbo displayed its GTB-T10XZ turbo blower available in a compact enclosure. Mosier and Grant explained their units have ball bearing gearboxes and dual point controls with guide vanes and VFDs. Visit https://www.next-turbo.com.

Preparing for our Best Practices 2025 EXPO & Conference, Smith next made a trip to Kansas City. While preparing for the show, he met with Jonathan McPherson, Director of the Advanced Manufacturing and Bulk Solids Technology Center, Kansas State University Olathe. McPherson led the conference's Pneumatic Conveying Workshop, covering the fundamentals of pneumatic conveying and reviewing basic calculations and sizing. Visit https://olathe.k-state.edu.

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.

Sherman Engineering is an employee-owned company with over 100 years of experience engineering industrial vacuum and compressed gas systems. With sales staff serving Pennsylvania, New Jersey, New York City, Maryland, Delaware, Washington, D.C. and Connecticut, it provides on-site evaluation and sales support. Customers include medical facilities, power plants, paper mills, petrochemical refineries and pharmaceutical laboratories. It represents BeaconMedaes and Gardner Denver. Visit https://www.shermanengineering.com.

Owned by Fidelity Building Services Group, ESC is an energy-focused building system integration company based in Connecticut. It focuses on solar power, EV stations, VFD upgrades, building management systems and compressed air projects. In 2024, it purchased CES (Compressor Energy Services) of New Hampshire, to move more into the industrial compressed air market. Pictured here are George Lyons, Vice President, Sales, Jessica Protz, Marketing Manager and Ben Denalsky, Vice President, Operations (left to right). Look for a case study from ESC in an upcoming issue. Visit https://esccontrols.com.

NEWS Compressed Air Industry & Technology

Atlas Copco Group Acquires Compressed Air and Gas Measurement Technology Company SUTO iTEC

SUTO iTEC, a compressed air and gas measurement company, has become part of Atlas Copco Group.

SUTO specializes in providing measurement and monitoring solutions for compressed air and gases. The company is headquartered in Hong Kong and has operations in China and Germany, as well as a global sales network. SUTO has 136 employees who will join Atlas Copco Group as part of the acquisition.

The company's solutions include flow, power and dew point meters, as well as leak detectors and compressed air purity analyzers. These products are used across various industries, including manufacturing, food and beverage, automotive, pharmaceuticals and electronics.

"We are happy to welcome SUTO to the Group. With the company's expertise, we will be able to provide our customers with optimized air quality and improved energy efficiencies in their compressed air installations," said Philippe Ernens, Business Area President Compressor Technique.

The purchase price was not disclosed. During 2024, the company had revenues amounting to approximately 130 MHKD (176 MSEK*).

The business becomes part of the service division within the Compressor Technique Business Area. For more information, visit https://www.atlascopcogroup.com.

*Average exchange rate for 2024.

Atlas Copco's U.S. headquarters in South Carolina

JORC Launches Updated SEPREMIUM i Range of Oil Water Separators

JORC unveiled its updated SEPREMIUM i range of oil water separators for compressed air condensate management, engineered to drive down residual oil content to below 5 ppm and keep facilities on the right side of environmental regulations. The lineup combines multi-stage adsorption with activated-carbon polishing, delivering high separation efficiency in a compact, installer-friendly package.

Built for real-world plants, the new SEPREMIUM portfolio spans 2 to 60 m³/min air compressor capacities to cover everything from small repair shops to multi-shift production lines. Models include the SEPREMIUM 2i, 4.5i, 10i, 20i, 30i and 60i*, each tuned for its duty class while maintaining the same sub-5 ppm discharge target.

SEPREMIUM brings built-in flashing overflow indicators and optional sensor connectivity for integration with plant monitoring systems. Select models add a visual element-life indicator to help teams plan filter changes instead of reacting to them. A test valve and sample bottle are included for on-site ppm checks – so compliance isn't a guessing game.

"Sub-5 ppm is the new baseline. The real win is doing it predictably – with alarms, sample ports and service valves that make compliance and uptime boringly reliable," said a JORC spokesperson. "SEPREMIUM is built for technicians who need straightforward installs today and zero-surprise audits tomorrow."
For more information, visit https://www.jorc.com.

*Model names may vary depending on the region.

JORC's SEPREMIUM i range of oil water separators

PneuTech Introduces PF Series of Industrial Reciprocating Air Compressors

PneuTech announced the release of its PF Series of reciprocating air compressors. Engineered for durability, efficiency and superior value, the PF series delivers outstanding performance with one of the most robust pump designs in the market today.

Competitively priced and assembled in the USA, PF Series air compressors are stocked for quick shipment to distributors and end-users nationwide. The line includes eight models ranging from 5 to 10 horsepower, with integrated ASME-certified vertical or horizontal air tanks (80 or 120 gallons) to suit a variety of shop configurations. Larger models feature a V-twin pump design to improve heat dissipation and promote cooler operating temperatures, even under heavy demand.

Built to last, each unit features a 100% cast iron pump and a ductile iron crankshaft for superior strength and long-term wear. A high-performance air filter and oversized oil breather help extend the life of both the pump and the motor, while the low-RPM design reduces noise and contributes to a longer service life. An optional dual control system allows the air compressor to operate in either start/stop mode or constant-run mode with load/unload control, providing flexibility for varying demand conditions.

Fully packaged (FP) models include premium features like an air-cooled aftercooler, automatic tank drain and automated low-oil shutdown to protect the unit and simplify maintenance. All PF Series air compressors come backed by a one-year warranty on the full unit and a two-year limited warranty on the pump.

PF Series air compressors are ideal for workshops, auto service centers and light industrial operations, and an attractive option for PneuTech distributors and resellers. For more information, visit https://pneutech.com.

Kaishan Compressor USA Celebrates $11 Million Expansion of Its Headquarters in Loxley, Alabama

Kaishan Compressor USA announced the completion of its $11 million expansion in Loxley, AL.

This major investment doubles the size of Kaishan's Loxley operations and represents a significant milestone in the company's long-term commitment to enhancing production, training, research and development and job creation in the United States. The expansion is part of the company's strategic plan, originally launched in 2018, to build value and manufacturing capability domestically. With this project, Kaishan USA reinforces its role as a leading force in American industrial innovation.

"This expansion is more than just square footage – it's a commitment to our customers, our employees and the Loxley community," said Keith Schumacher, CEO, Kaishan USA. "We're excited to showcase our growth and share the next chapter of Kaishan USA with our partners and friends."

The newly expanded facility includes Phase II production and testing of Kaishan's oil-free product line, continuing the company's commitment to this important global market segment. The upgrade will also enhance the ability to manufacture oil-injected airends to support premium series products for customers in the Americas. The expanded warehouse portion will boost aftermarket support and streamline product shipments.

The investment introduces more dedicated space for hands-on and classroom distributor service training, an additional office, a breakroom space and significantly upgraded research and development and quality control zones for continuous product development and improvement.

In addition to operational improvements, Kaishan USA is making a long-term commitment to the Loxley community by creating more than 50 high-paying jobs over the next five years. "Kaishan's expansion is a great example of the kind of growth we want to see in Loxley," said City of Loxley Mayor Richard Teal. "They're bringing high-quality jobs, innovation and long-term investment to our community, and we're glad to see their success contributing to our region's strong manufacturing industry." For more information, visit https://kaishanusa.com.

Kaishan Compressor USA's headquarters in Loxley, AL

CAGI Releases Compressed Air Treatment: Sizing Refrigerated Air Dryers Video

The Compressed Air & Gas Institute (CAGI) announced a new educational video: Compressed Air Treatment: Sizing Refrigerated Air Dryers. This video walks viewers through the key considerations for properly sizing a refrigerated compressed air dryer, a critical step in optimizing the performance and efficiency of compressed air systems.

Moisture in compressed air can lead to corrosion, equipment damage and system performance issues. Proper compressed air dryer sizing ensures compressed air systems deliver dry, reliable compressed air that protects business investments and keeps operations running smoothly.

The video teaches how to match compressed air dryer capacity to system demand, factors that influence compressed air dryer performance and how to ensure clean, dry compressed air by preventing moisture and contaminants from entering the compressed air system.

The Compressed Air and Gas Institute has been the leading source on all matters related to compressed air. For more information, visit https://www.cagi.org.

NEWS Compressed Air Industry & Technology

ELGi Expands EG SP 'Super Premium' Series Air Compressors to Unlock Energy Savings in Industrial Applications

ELGi Compressors USA expands its EG SP "Super Premium" Series of oil-injected rotary screw air compressors, now offering models ranging from 100-200 hp. The air compressors deliver up to 15% energy savings when compared to the ELGi EG Series and competitors, and are now more suitable for a wider set of industrial applications, including automotive, packaging, mining, agriculture, textile and manufacturing.

"Compressed air is one of the most critical utilities in industrial operations and also one of the most overlooked when it comes to energy efficiency. By optimizing compressed air systems, companies can unlock substantial energy savings," said Aneek Roy, RPMO Director, ELGi. "By delivering both lower and higher horsepower air compressors in this range, companies can find the right-sized solution for their specific needs, helping them improve operational efficiency and reduce overall energy costs."

The ELGi EG SP improves energy efficiency through its two-stage airends with the proven η-V profile. This configuration distributes operational load evenly across each stage, increasing component lifespan and reducing energy demand by 15% when compared to previous models.

ELGi's EG SP "Super Premium" Series of oil-injected rotary screw air compressors

EG SP air compressors feature NEMA Premium Efficiency motors with a large core and substantial windings. Built for severe-duty applications, these motors feature a TEFC (totally enclosed fan-cooled) design, direct coupling with the airend to minimize transmission losses and a high ambient temperature rating for hot environments. The series is available with optional built-in variable frequency drives that automatically adjust motor speed to match real-time air demand. By aligning air compressor output with actual requirements, the EG SP Series can provide additional energy savings of up to 25% when they are not under full load. For more information, visit https://www.elgi.com/us

OTC Industrial Technologies Announces Acquisition of Fleetwood Industrial Products and P-M Industrial

OTC Industrial Technologies announced the acquisition of Fleetwood Industrial Products and P-M Industrial, both recognized names in the rotating equipment space across the Northeast.

This strategic acquisition is a major step in OTC's ongoing investment in service and repair capabilities, adding critical resources and expertise that will support the company's growing customer base throughout the region.

Founded in 1986, Fleetwood Industrial Products has built a strong reputation as a trusted Flowserve distributor and a certified Flowserve Diamond Level Service Center, a prestigious designation that highlights its commitment to excellence in repair, engineering and customer support.

"Fleetwood's Diamond Level status is a direct reflection of its technical depth, quality standards and ability to solve complex challenges for customers in oil and gas, chemical, power, manufacturing and more," said Brett Stanton, President of OTC's Rotating Equipment Group. "This acquisition strengthens our strategic footprint in the Northeast and aligns perfectly with OTC's goal of expanding our world-class service and repair network."

The Fleetwood team at its headquarters in Boothwyn, PA

Fleetwood's capabilities include the distribution of mechanical seals, couplings, gaskets, non-metallic bearings and packings, as well as engineering and fabrication of lube oil skids and seal support systems. In 2018, the company partnered with P-M Industrial, an established provider of fluid sealing solutions since 1964. Together, they've expanded assembly and repair services and deepened their product portfolio to better serve critical industries, including pharmaceutical, refining, municipal and marine.

With this acquisition, OTC continues to accelerate its geographic service and repair expansion strategy, bringing best-in-class capabilities closer to customers and reinforcing its position as a national leader in rotating equipment solutions. For more information, visit https://otcindustrial.com.

SKF and Sieb & Meyer Announce Strategic Partnership for Magnetic Bearings

SKF announced a strategic partnership with Sieb & Meyer. The collaboration marks a significant milestone in delivering integrated, high-efficiency inverter solutions tailored for demanding applications such as air compressors, turbo blowers and HVAC systems.

Under the partnership, SKF will manufacture variable frequency drives (VFDs) at its facilities, leveraging Sieb & Meyer's advanced design expertise and decades of experience in high-speed drive technology. Customers will benefit from a seamless plug-and-play solution that simplifies integration, reduces engineering time and increases confidence in system performance, while also offering long-term scalability into new applications.

The collaboration enhances SKF's offering by delivering an optimized package, combining SKF's high-speed electric motors on magnetic bearings with VFDs that are precisely tuned for performance, reliability and energy efficiency.

"By combining our magnetic mechatronics capabilities with Sieb & Meyer's VFD technology, we're creating a new standard for high-speed motor systems. This partnership allows us to offer a more complete and efficient solution to our customers," said Frederic Ponson, Director of Magnetic Mechatronics, SKF. For more information, visit https://www.skf.com and https://www.sieb-meyer.com.

SKF's magnetic bearing system

CMC NV's Metacentre CORE Drives Compressed Air Efficiency Gains Across U.S. Industrial Plants

Metacentre CORE, developed by CMC NV, has gained traction across industrial plants seeking to optimize compressed air systems. With verified energy savings of up to 30%, the platform addresses persistent inefficiencies through real-time system visibility and remote control capabilities.

Designed for compatibility with fixed-speed (via LINK+) and variable-speed (via DRIVE+) air compressors, Metacentre CORE brings together a suite of high-performance features. It offers dynamic analytics, identifying energy waste and system inefficiencies in real time using embedded intelligence, and its protocol-agnostic integration supports MODBUS RTU and TCP, easing system integration. Setup is fast with guided installation via a 12-inch touchscreen that ensures minimal disruption. There's an option for a CLOUD+ upgrade, which enables secure remote diagnostics, monitoring and asset control. The Metacentre CORE offers scalable asset support and can control up to six air compressors per CORE unit. ESG reporting tools provide trackable metrics for sustainability and compliance frameworks.

CMC NV's Metacentre CORE

"The early adopters span sectors including manufacturing, logistics and food processing," said Nicolas De Deken, International Business Development, Metacentre. "Metacentre CORE is helping them identify loss points and improve air compressor efficiency with minimal infrastructure changes."

Initial site feedback highlights reduced air compressor cycling, lower maintenance overheads and improved performance metrics. For more information, visit https://cmcnv.com.

NEWS Chiller & Cooling Industry & Technology

Danfoss Adds Rotary Screw Refrigerant Compressors to Portfolio Through Palladio Compressors Acquisition

The acquisition of Palladio Compressors marks a significant expansion of Danfoss's broad refrigerant compressor portfolio, covering applications from light commercial comfort to large-scale process cooling, heating and refrigeration. Over the past two years, Danfoss and Palladio have evaluated technological synergies, particularly in high-lift heat pumps. Integrating Palladio's rotary screw refrigerant compressors with Danfoss's existing technologies promises competitive and advanced high-temperature solutions.

Fabio Klein, President, Danfoss Commercial Compressors, and David Candio, CEO, Palladio Compressors (left to right)

The Palladio range introduces state-of-the-art rotary screw technology, addressing the limited offerings of advanced, non-captive rotary screw refrigerant compressors. The company is well-positioned to support customers entering new markets with refrigerant compressors using natural and low-GWP refrigerants. The rotary screw technology is particularly relevant for middle-range energy intensity applications. When deciding on a suitable refrigerant compressor for their systems, customers consider factors such as size, energy intensity and payback period requirements. The company's rotary screw offering allows it to address this uncovered middle market segment.

The newly branded Danfoss Screw range will benefit from increased investment in R&D, production and sales capacities, ensuring robust capabilities and market presence. By integrating rotary screw technology into its suite of refrigerant compressors, valves, controls, heat exchangers and sensors, Danfoss reinforces its commitment to delivering greener and more efficient solutions worldwide.

"We are thrilled to welcome Palladio Compressors and its talented team into the Danfoss family," said Fabio Klein, Divisional President, Danfoss Commercial Compressors. "This acquisition broadens our technological capabilities and reinforces our commitment to decarbonization across industries. Palladio's advanced technology complements our portfolio, enhancing our refrigerant compressor solutions for industrial heat pumps and large commercial and industrial refrigeration."

This acquisition aligns with Danfoss's strategic focus to expand and grow market presence. The company is committed to hiring additional personnel, including R&D specialists, engineers and technicians, to support facility growth and innovation. For more information, visit https://www.danfoss.com.

G&D Chillers Announces ForgeLine™ HT Series

G&D Chillers, a U.S. leader in industrial-grade process chilling systems for more than 30 years, has announced its newest innovation, the ForgeLine™ HT Series.

Purpose-built for high-temp, high-demand applications, the ForgeLine HT Series delivers micro footprint and macro performance. Combining rugged components, intuitive controls and G&D's proven engineering, ForgeLine units provide reliable process cooling for fermentation, food processing, light manufacturing and general industrial operations.

The ForgeLine™ HT Series features durable rotary scroll refrigerant compressors for consistent performance under load. Its stainless steel plate evaporator provides efficient, long-lasting cooling. The series has an outdoor-rated, corrosion-resistant chassis with easy-access panels. Its advanced microprocessor controls offer precise temperature management. ForgeLine™ HT has capacities from 0.7 to 6.1 tons and uses R-513A.

G&D Chillers' ForgeLine™ HT Series

"With ForgeLine, we've taken industrial-grade cooling and packed it into a smaller, smarter, tougher unit," said Justin Thomas, President, G&D Chillers. "It's innovation forged into every detail – ready to meet high-temp demands head-on." For more information, visit https://gdchillers.com.

CTI Updates Sound Certification Program for Heat Rejection Equipment

The Cooling Technology Institute provided an update on the progress of the Sound Certification Program. The new Sound Certification program will be conducted in accordance with CTI Standard 204. In conjunction with Sound Certification, the Sound Measurement Test Code, CTI ATC 128, has been updated with a release in February 2025, whose Section 8 for Small Towers will provide the measurement methodology for this program.

To be eligible for Sound Certification, the equipment must first be Thermal Performance Certified based on CTI Standard 201.

The Thermal Certification Program includes 108 manufacturers and 30 private brand affiliates from around the globe. The program participants currently offer more than 290 certified open and closed-circuit cooling towers as well as dry cooler product lines encompassing a total of over 85,000 individual models available to the market. All participating manufacturers who are interested in certifying their heat rejection equipment for sound are invited to do so by filling out the certification inquiry form and indicating their interest in Sound Certification.

The Sound Certification Program and the Thermal Certification Program are both continuously open to applications for new manufacturers and/or new product lines. The CTI also encourages those manufacturers with lines that are not thermally certified to apply for thermal certification under the CTI STD 201 program by contacting the Thermal Certification Administrator. For more information, visit https://www.cti.org.

Trane Expands Portfolio of Sustainable HVAC Solutions

Trane® – by Trane Technologies announced a new portfolio of commercial HVAC solutions designed to meet the evolving demands of the built environment, including new electrification of heat technologies and redesigned solutions that help enhance overall building performance and serviceability, reinforcing Trane's commitment to industry-leading innovation.

Trane continues to expand its portfolio of sustainable solutions that support the electrification of heat. The Ascend™ Air-to-Water Heat Pump (ACX) is built upon the proven Ascend platform, with expanded capacities ranging from 80-230 tons. The ACX offers a cost-effective, all-electric heating solution for smaller commercial buildings, capable of operating efficiently in temperatures as low as -15°F (-26°C) and delivering hot water temperatures up to 145°F (63°C).

The Ascend™ Air-Cooled Chiller (ACS) now features a factory-installed partial heat recovery option, which captures and repurposes waste heat to help reduce energy consumption and support sustainability goals.

Designed to help enhance building performance and drive future readiness, Trane is introducing ARIA, an AI-building agent. This generative AI solution analyzes equipment and building data to provide actionable insights and recommendations, empowering facility teams with continuously updated intelligence to help streamline operations, support faster decisions and help improve performance.

Trane is also adding Nuvolo IWMS to its smart building lineup. Nuvolo is a comprehensive integrated workplace management system that brings together maintenance and asset management to support customers across the full building lifecycle. These new solutions provide a unified platform for managing diverse building and workplace needs and ensuring long-term operational excellence.

"Trane is dedicated to pioneering solutions that not only meet today's challenges but also anticipate the needs of tomorrow," said Oakley Roberts, Vice President of Product Management, Commercial HVAC Americas, Trane Technologies. For more information, visit https://www.trane.com and https://www.tranetechnologies.com.

Carrier Launches the TechVantage Ignite Program

Carrier Commercial Service and Automated Logic Field, part of Carrier Global Corporation, have launched the first cohorts of TechVantage Ignite, a program to develop the next generation of commercial HVAC technicians and controls engineers.

TechVantage Ignite combines classroom training and self-paced online learning with mentorship and on-the-job training. The program begins with a two-week introduction at Carrier University's Charlotte, NC, and Kennesaw, GA, training centers. Participants in the inaugural classes represent field offices across the United States, including Arizona, California, Georgia, Kentucky, New Jersey, Texas, Utah, Washington and West Virginia.

TechVantage Ignite participants receiving training.

TechVantage Ignite is designed to increase the speed of learning and proficiency of new technicians and field engineers. The training plan is divided into a year-long program, with learning objectives supported by service and field managers.

"We are thrilled to have the next generation of our business receive this early-career boost through the TechVantage Ignite program," said Andy Bierer, Managing Director, Automated Logic Field. "These hands-on experiences, coupled with our ongoing partnerships with trade schools and other organizations, are building a bright future for our industry."

TechVantage Ignite is part of Carrier's larger TechVantage Initiative, launched in January. The initiative calls for hiring 1,000 service technicians in the U.S. and providing additional training to over 100,000 Carrier and partner HVAC technicians over five years. For more information, visit https://www.carrier.com/commercial.

NEWS Industrial Energy & Water Conservation

Sony Group Corporation Establishes 'Green Management 2030' Medium-Term Environmental Targets

Sony Group Corporation, a multinational conglomerate company that is involved in a wide range of businesses including electronics, entertainment and financial services, has set its "Green Management 2030" (GM2030) medium-term environmental targets that will take effect from FY2026 through 2030. Sony's "Road to Zero" long-term environmental plan is to achieve a zero environmental footprint by FY2050 throughout all stages of its product lifecycles and business activities from four perspectives: climate change, resources, chemical substances and biodiversity. To achieve this, it sets medium-term environmental targets every five years to serve as milestones.

As of the end of FY2024, Sony expects to achieve most of the targets set forth in its previous plan, "Green Management 2025" (GM2025), which covers the five-year period up to and including FY2025. For GM2030, Sony has included new indexes as the key performance indicators based on issues identified in the course of GM2025, while also taking into account the current environmental situation. The new GM2030 indexes include targets for reducing total amount of greenhouse gas emissions from Scope 1 to 3 by more than 25% over five years and accelerating activities that bring about resource circulation.

Sony's MDR-M1 monitor headphones

Sony aims to achieve net zero throughout the value chain, including Scopes 1 to 3, by FY2040 – 10 years earlier than the other three perspectives. To achieve this goal, the company will implement the following measures to reduce total amount of greenhouse gas emissions by more than 25% over 5 years by FY2030: Reduce group-wide Scope 1 and 2 emissions by 60% compared to FY2025 and remove the amount of carbon equal to the residual emissions, reduce group-wide Scope 3 emissions by 25% compared to FY2025, achieve 100% renewable electricity used in the company's own operations and encourage major raw material and component suppliers to use 100% renewable electricity when manufacturing products for the Sony Group. For more information, visit https://www.sony.com.

Hyundai Mobis Receives Science Based Targets Initiative Approval for Accelerated 2030 GHG Reduction Targets

Hyundai Mobis, a global automotive supplier, has newly set greenhouse gas reduction targets for 2030 and obtained approval for them from Science Based Targets initiative (SBTi). This is the result of the company presenting achievable reduction targets and implementation methods for the next five years and comprehensively demonstrating them.

Hyundai Mobis received approval for its GHG reduction targets through 2030, an intermediate step toward achieving carbon neutrality by 2045. The company's reduction plans for both domestic and international business sites, as well as the supply chain, simultaneously passed the review. Consequently, Hyundai Mobis's GHG reduction over the next five years is projected to be 46% lower than the 2019 baseline, nearly halving emissions.

Through this verification, Hyundai Mobis secured approval for its near-term goal to reduce absolute Scope 1 and 2 GHG emissions from its operations by 46% by 2030. For Scope 3 emissions from purchased goods and services, the company aims to achieve a 55% reduction per million KRW of value added within the same timeframe.

The company has established a concrete carbon neutrality strategy, setting a target to increase the proportion of renewable energy used at its domestic and international facilities to 65% by 2030 and 100% by 2040. To achieve this, the company is implementing RE100 by establishing separate timelines for each country and facility.

Hyundai Mobis is increasing its renewable energy share through various methods, including signing renewable energy purchase agreements and purchasing certificates. The company's facilities in Slovakia, Brazil and Turkey have already completed their transition to 100% renewable energy. For more information, visit http://www.mobis.com.

Hyundai Mobis's headquarters in Seoul, South Korea

Amplifon to Reduce Direct GHG Emissions by 42% and Indirect GHG Emissions by 25% by 2030

Amplifon, a global leader in hearing solutions and services, is launching its climate strategy validated by the Science Based Targets initiative (SBTi) to reduce greenhouse gas emissions and contribute to achieving the goals of the 2015 Paris Agreement to counteract climate change.

The strategy, "Listening to our Planet," specifically calls for a 42% reduction in the company's direct greenhouse gas emissions (Scope 1 and 2) by 2030 compared to 2023. Over the same period, the company has committed to reducing indirect Scope 3 emissions by 25%, deriving from purchased goods and services, capital goods, fuel and energy related activities, upstream transportation and distribution, employee commuting, upstream leased assets and use of sold products and franchises. The plan also stipulates that, by 2030, 44% of its suppliers in terms of emissions related to purchased goods and services will have greenhouse gas emission reduction targets based on climate science.

Amplifon's headquarters in Milan, Italy

"The launch of a scientifically validated climate strategy represents a further step forward in the process of fully integrating ESG factors into our business. Making concrete commitments to reduce our direct and indirect emissions in the medium term is in line with the sustainability plan we launched last year with 20 concrete and measurable targets for 2026, 2028 and 2030 in the areas of products and services, ethics and environmental responsibility, people and communities. We want to continue to grow in an increasingly responsible and sustainable manner," said Enrico Vita, CEO, Amplifon. For more information, visit https://www.amplifonusa.com.

Ardagh Group Publishes 2024 Sustainability Report, Achieving 10% Reduction in Scope 1 and 2

Ardagh Group, a global leader in sustainable aluminum and glass packaging, announced the publication of its 2024 sustainability report. The report includes information on Ardagh Group's two operating businesses – Ardagh Metal Packaging (AMP) and Ardagh Glass Packaging (AGP).

AMP increased global renewable electricity coverage to 30%, with strong regional progress (Europe: 46%, South America: 43%).

AMP achieved 10% emissions reduction for Scope 1 and 2 versus 2023; 18% emissions intensity reduction versus the 2020 baseline, while AGP achieved a 12% reduction versus 2023, 16% lower than 2020 levels. For Scope 3, AMP achieved a 25% reduction versus the 2020 baseline, surpassing the 2030 target, while AGP achieved 10% reduction versus the 2020 baseline.

"We continued to make meaningful progress toward our sustainability goals guided by our core values," said Herman Troskie, Chair, Ardagh Group. For more information, visit https://www.ardaghgroup.com.

Egger Modernizes Its Compressed Air System for the ESG Era

By Graham Coats, Director of Strategic Product and Business Development, CMC

In today's manufacturing landscape, efficiency is no longer a silent virtue. It must be demonstrable, defensible and aligned with environmental responsibility. As environmental, social and governance (ESG) frameworks tighten and ISO 50001 standards become the norm, energy-intensive industries across the globe are under increasing scrutiny. Stakeholders, from regulators to investors, now demand proof that every kilowatt-hour is justified, every ton of CO_2 is actively reduced and every operational process is traceable through data.

For Egger, a global leader in wood-based materials, this challenge converges on one of its most critical yet historically overlooked utilities. Compressed air may be the most critical utility you don't see – essential to production, yet often under-monitored. As the de facto fourth utility in manufacturing, it drives everything from actuation to packaging. But unlike electricity or water, its consumption is rarely tracked with precision. Without dedicated instrumentation – including flow meters, pressure sensors and dew point probes – compressed air systems remain vulnerable to inefficiencies, hidden losses and missed savings opportunities.

Visibility isn't a luxury anymore; it's a baseline requirement for performance, compliance and control.

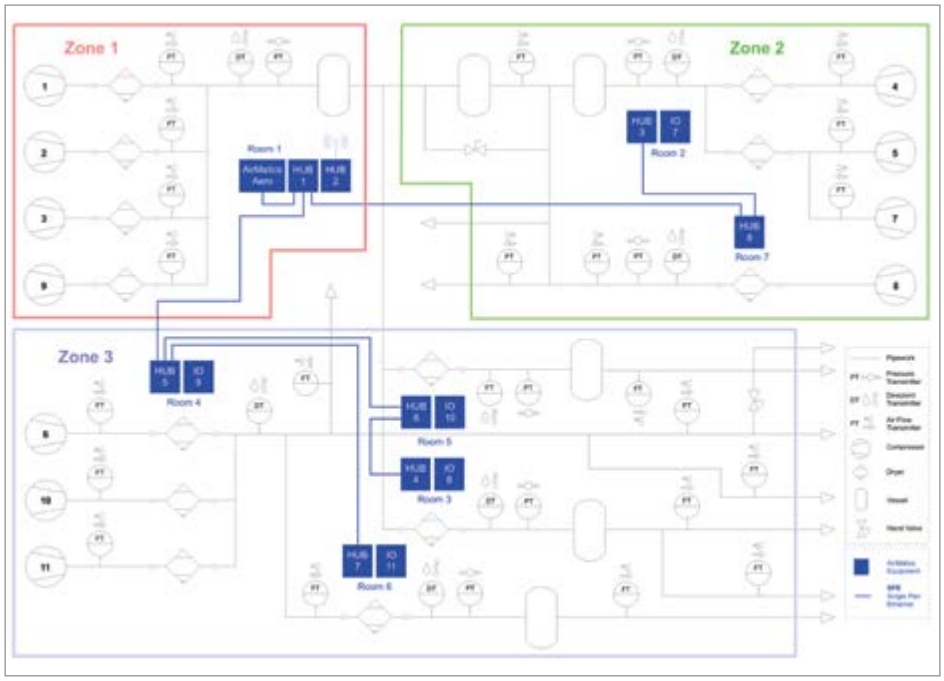
At Egger's Rambervillers site in France, compressed air is not a peripheral service; it's a production enabler. It drives high-precision cutting tools, supports finishing lines, powers pneumatic recycling systems and maintains packaging integrity across multiple zones. The compressed air system operates continuously, with 11 air compressors distributed across three zones and over seven dedicated rooms, each tailored to the plant's evolving layout and air pressure demands.

Above: Egger's factory in Rambervillers, France

Yet despite its centrality, compressed air had long remained in a black box – reliable but invisible. Legacy control systems provide automation, but not insight. Energy use was estimated, not measured. Performance was inferred, not verified. As Egger's sustainability goals matured, this lack of visibility became a strategic liability. The company needed more than operational uptime. It needed an auditable infrastructure that could deliver real-time data, cross-departmental transparency and ESG-ready reporting.

That realization marked a turning point. Compressed air was no longer just a utility; it became a measurable asset, a source of competitive advantage and a cornerstone of Egger's environmental accountability.

Eleven air compressors form the backbone of this compressed air system, all ranging in age, brand and control logic, but unified in purpose: delivering stable, high-quality compressed air to



Egger's Rambervillers plant includes 11 air compressors distributed across three zones and seven dedicated rooms.

every corner of the Rambervillers facility. These machines aren't just mechanical assets; they're embedded in the rhythm of daily operations, powering cutting lines, finishing stations, recycling processes and packaging zones around the clock.

Each air compressor plays a distinct role in maintaining pressure stability across the plant's multi-zone architecture. Whether responding to peak demand, stabilizing pressure across the network or distributing load cycles efficiently, each air compressor's performance directly impacts energy consumption, product quality and overall system reliability. In a facility where compressed air is as vital as electricity or water, these 11 units represent more than infrastructure; they're strategic instruments of efficiency, reliability and environmental accountability.

In 2024, Egger's engineering team recognized that its current Metacentre XC control system, installed by CMC NV in 2010, no longer met modern expectations for transparency or ESG reporting. "We needed more than control," said a member of Egger's maintenance team. "We needed intelligence; a system that could tell us in real time how each air compressor performed and what that meant for our energy and ESG goals."

Information Reporting Needs for an Expanding Compressed Air System

The original Metacentre XC system delivered reliable automation, centralized sequencing, reduced idling and balanced load sharing across multiple air compressors. For years, it ensured a stable air supply at minimal energy cost. However, technology and expectations have advanced dramatically.

The system relied on localized data and manual reporting. Information existed but was difficult to share or analyze across departments. Maintenance teams exported readings manually, while energy teams reconciled data offline for monthly summaries. As Egger expanded and environmental accountability became a corporate imperative, limitations in visibility became a bottleneck.

"As our group pushed harder on sustainability and energy transparency, we realized our compressed air system needed to become more than an invisible utility; it had to become auditable infrastructure," explained Pascal Labourdique, Energy Manager at Egger Aubervilliers.

By 2024, Egger's production growth in France created a multi-zone compressed air system spanning three distinct areas – CONTI, FINITION, and MONO – each with its own air compressors, compressed air dryers and storage tanks. The compressed air system's complexity had outgrown its legacy control platform. The hardware remained reliable, but the network lacked visibility, automation and integration.

CMC NV, Egger's long-time service partner, conducted a site assessment in December 2024. The team cataloged air compressors, compressed air dryers, flow meters, and sensors across the facility, mapping the network topology in detail. Eleven air compressors, 13 compressed air dryers, 22 flow meters, five dew point sensors and multiple pressure transmitters were integrated into a working digital model.

Egger's goals were clear: higher transparency, faster reporting, and deeper automation – without sacrificing reliability.

Selecting a More Robust Monitoring Platform

Airmatics, the next-generation platform from CMC NV, was chosen to bridge the gap between traditional industrial control and modern digital intelligence, delivering not just automation but actionable insight. In an environment where compressed air systems span multiple zones, brands and generations of equipment, Egger needed more than a controller. It needed a unified architecture capable of harvesting, analyzing and reporting performance data in real time.

Unlike legacy systems that rely on proprietary logic or siloed data, this platform is designed to be brand-agnostic and modular. It integrates four key components that together form a hybrid local/cloud ecosystem:

- AERO: An intelligent controller that sequences air compressors based on live demand, pressure stability and energy efficiency. It adapts to changing load profiles and supports predictive maintenance through runtime analytics.

Egger Modernizes Its Compressed Air System for the ESG Era

- Fortress HUBs: These distributed communication nodes manage data flow within each air compressor room, ensuring resilience and low-latency connectivity. Each HUB operates semi-independently, maintaining local continuity even if the central link is interrupted.

- SmartTags: Field-level instrumentation that captures electrical and pneumatic data – amps, volts, flow, pressure, dew point and temperature – per air compressor and per phase. This enables granular tracking of asset performance, regardless of age or OEM.

- Aircloud: A secure cloud interface that delivers dashboards, alarms, ESG-ready reports and remote diagnostics. It allows maintenance, energy and sustainability teams to access the same verified dataset, streamlining collaboration and compliance.

Together, these components transform compressed air from a reactive utility into a proactive energy asset. This platform doesn't just control air compressors; it contextualizes their performance, correlates energy use with production demand and generates traceable reports for ISO 50001 and ESG frameworks. For Egger, this meant real-time visibility, faster reporting and a scalable foundation for future optimization.

"We had a mix of air compressor brands, ages and controllers, but we needed a unified way to compare performance. The ability to measure flow and power per asset was a game-changer," said Labourdique

This controller is the heart of the monitoring network. Its 12-inch color display offers full system visibility in real time.

The choice was also built on a 15-year partnership. "When it came time to upgrade, it was a no-brainer," said an Egger maintenance engineer. "CMC NV knows our site and expectations. Moving from our old platform to this one with the same partner meant continuity, confidence and minimal disruption."

The Customer Journey from Assessment to Commissioning

The plant's modernization project progressed in five phases:

Infrastructure Preparation: Fortress HUBs were installed across 3 zones and four air compressor rooms (Conti, Finition, Recyclage, Mono), connected through a secure single pair Ethernet (SPE) backbone for reliable, low-latency data. "By reusing Egger's existing two-wire serial-bus network and upgrading it with SPE T1L adaptors, we achieved Ethernet-grade connectivity without rewiring," said Tibo Verbeken, Engineer, CMC NV.

Air Compressor Integration: Eleven CompAir air compressors (including D132 and Ultima 160 models) were instrumented with SmartTAGs and MODBUS gateways to enable phase-level electrical data and pneumatic readings. "Deploying SmartTAGs where logic was unavailable meant we never had to force the lowest common denominator. We could pull real data from every air compressor," Verbeken said.

Data Validation and Configuration: Flow meters were calibrated, communication links tested and naming conventions standardized. Dew point and pressure sensors were verified against live readings to ensure accuracy.

AERO & Aircloud Setup: Local interfaces provide live data per room, while the Aircloud dashboard unified all zones for centralized reporting, alarms and performance visualization.

Training and Handover: On April 3, 2025, CMC NV delivered hands-on training for Egger's staff on dashboards, maintenance tools and alarm management. "Egger's team was fully engaged," said Verbeken. "Together, we ensured the data wasn't just available, it was meaningful."

Technical Transformation: Understanding the Zones

Like many established plants, Egger's compressed air system has evolved over the decades. Each zone was originally added to address local pressure issues, a practical solution that later introduced inefficiencies. The platform doesn't erase this physical structure; it manages it.

With pressure sensors across every header, the compressed air system continuously balances supply and demand. "We didn't add zones to waste energy – we inherited them. What the platform gives us is the ability to balance those zones intelligently, not just reactively," Labourdique said.

The platform collects data from every relevant parameter: amps, volts, flow, pressure, temperature and dew point. By doing this, it provides a full operational fingerprint. The result is verified, time-stamped data ready for ISO 50001 and ESG reporting.

Each Fortress HUB maintains data continuity locally, ensuring resilience if cloud connectivity is lost. This hybrid local-cloud model provides both industrial reliability and enterprise-level visibility.

Project Snapshot: Egger Rambervillers

Attribute	Details
System Integrator	CMC NV
Control Platform	Airmatics AERO + Aircloud
Legacy System	Metacentre XC (installed 2010)
Commissioning	March–April 2025
Air Compressors	11
Compressed Air Dryers	13
Flow Meters	22
Sensors	6 dewpoint + 6 pressure transmitters
Annual Energy Savings	1,438,567 kWh
Annual Cost Savings	$166,500 USD
CO_2 Reduction	889 metric tons

An Annual Energy Reduction Of 1,438,567 kWh and $166,500

Before Airmatics, Egger's compressed air data landscape was fragmented and reactive. Maintenance teams relied on manual logs and visual inspections to estimate runtime, often basing service intervals on calendar schedules rather than actual load cycles. Sustainability reporting was a separate challenge altogether, requiring manual reconciliation of spreadsheets, controller readouts and third-party audits to approximate CO_2 impact.

This siloed approach not only consumed time, but also introduced risk. Without unified, real-time data, teams couldn't confidently correlate air compressor performance with energy use, nor could they detect efficiency drift before it impacted cost or compliance. Decisions were delayed, maintenance was reactive and ESG reporting lacked the traceability increasingly demanded by auditors and stakeholders.

Today, with the new platform fully deployed, Egger operates from a single, verified dataset. Maintenance teams now schedule interventions based on actual runtime and load hours, using automated alerts and service timers embedded in the controller. Energy managers monitor live power draw, flow rates and pressure stability across all air compressors and zones, enabling proactive adjustments and continuous optimization. Sustainability coordinators can export verified kWh and CO_2 data directly, with traceable time stamps and zone-level breakdowns ready for ISO 50001 and ESG submissions.

"Everyone now works from one version of the truth," said an Egger energy coordinator. "We don't debate data; we act on it."

This shift from fragmented oversight to unified intelligence has transformed compressed air from a background utility into a strategic asset, one that supports operational uptime, environmental accountability and cross-team collaboration.

The results were immediate, measurable and strategically significant. Within months of commissioning the new system, Egger Rambervillers recorded verified performance improvements that exceeded initial projections. Post-installation audits confirmed an annual energy reduction of 1,438,567 kWh, translating to $166,500 USD and a CO_2 reduction of 889 metric tons – figures that now underpin Egger's internal sustainability reporting and external ESG disclosures.

"We were confident savings would follow," Labourdique said. "But to see a 1.4 GWh reduction and nearly 900 tons of CO_2 cut – that gave us real proof."

These gains weren't the result of a single intervention; they stemmed from a layered optimization strategy enabled by the platform's intelligent control architecture. The system's adaptive sequencing algorithm continuously evaluates air compressor performance, aligning machine loading with real-time demand across multiple zones. This prevents over-cycling, reduces idle energy and distributes runtime more evenly, extending asset life and improving service planning.

Pressure-band optimization played a critical role. With sensors installed across headers and receivers, the platform maintains pressure stability within ±0.2 bar, a level of control that not only improves energy efficiency but also protects downstream processes from variability.

Flow meters and SmartTags provide granular visibility into both supply and demand-side dynamics, allowing Egger's team to identify inefficiencies, adjust operating parameters and validate improvements with hard data.

Machine use has also improved. Predictive alerts and automated service timers now guide maintenance interventions based on actual load hours, not calendar estimates. This shift from reactive to proactive servicing has reduced unplanned downtime and helped balance wear across the compressed air fleet.

Together, these enhancements have transformed Egger's compressed air system from a reactive utility into a proactive energy asset, one that delivers operational reliability, environmental accountability and financial return.

Compressed Air System Data Integrity and Smart Reporting

Airmatics automates KPI generation and reporting. It can filter results by air compressor, zone,or time period, automatically generating ESG-ready datasets. For ISO

Egger Modernizes Its Compressed Air System for the ESG Era

Intelligent Compressed Air System Management

Rising energy costs, tighter environmental targets and demands for real-time transparency are reshaping compressed air management. Airmatics bridges traditional control and modern data-driven energy management: real-time insights, automated reporting and advanced control logic that help manufacturers improve efficiency, reduce waste,and meet ESG/ISO 50001 requirements from one platform.

At the core, AERO manages sequencing, load distribution and pressure stability. Fortress HUBs and SmartTags collect precise electrical and pneumatic data across air compressors, compressed air dryers and peripherals. The system monitors flow, pressure, dew point, temperature, amps and volts per air compressor and per phase.

Through Aircloud, users visualize performance in real-time. Dynamic dashboards present energy consumption, load/unload cycles, pressure stability and flow efficiency as actionable insights. Teams can drill from system views to individual machines to identify inefficiencies before they become problems, schedule maintenance by actual run hours and balance load to extend equipment life.

The platform logs time-stamped, traceable energy and environmental data supporting ISO 50001 and corporate ESG reporting. Managers can auto-generate reports for:

- kWh consumed per air compressor or zone
- Cost of compressed air per cubic meter
- CO_2 emissions and savings versus baseline

Each Fortress HUB maintains data continuity locally. The system supports LAN and cloud, providing redundancy and flexibility for multi-site operations. Industrial-grade power and communications standards ensure stable operation. Firmware updates and remote diagnostics enhance uptime.

Whether a site runs two air compressors or 20, the platform expands without major rewiring. New assets connect via plug-and-play, allowing the platform to evolve with production and sustainability targets.

Operators maintain pressure stability and respond to alarms faster. Maintenance plans interventions based on usage. Energy managers get verified data for audits. Executives and ESG leaders see plant-level summaries across facilities. Compressed air becomes measurable, manageable, reportable and strategically important.

- View air compressor performance trends.
- Track power draw, flow and pressure stability.
- Plan maintenance using actual runtime and load cycles.
- Generate ESG-compliant reports instantly.

"Compressed air used to be invisible," said a site manager. "Now it's transparent and strategically managed."

Commissioning logs from CMC NV show meticulous calibration and validation, verifying flow ranges, adjusting Modbus registers, fine-tuning I/O mapping and aligning digital readings with sensor reality.

"Once configured correctly, pressure balancing worked seamlessly," said Nils Spileers, Project and Support Manager, CMC NV, part of the commissioning team. "It's an adaptive system that learns the plant's behavior."

Industrial Sustainability through Technology

Egger's deployment exemplifies how digitalization drives environmental performance. By reducing waste, balancing load and improving reporting accuracy, the company directly supports its corporate ESG and carbon reduction goals.

The platform allows Egger to track the CO_2 intensity of every cubic meter of air, providing the transparency required for external verification and internal optimization. Sustainability is now built into the system, not added on afterward.

Egger's partnership with CMC NV spans nearly two decades. The 2010 installation was state-of-the-art at its time; the 2025 upgrade builds upon that foundation, bringing intelligence to proven infrastructure.

"The site is now benefiting from pressure-balance and zone-control features," said Stéphane Martins, Business Development

50001 and sustainability audits, this means verifiable, auditable performance data without manual reconciliation.

Before, energy reporting was a monthly chore. Now, it's instantaneous, consistent and traceable. Each kWh, cubic meter of air and hour of runtime is captured, time-stamped and contextualized.

A key strength of Egger's installation is its distributed architecture. Each Fortress HUB operates semi-independently to ensure data continuity if a network segment fails. All devices operate on protected 100-240 VAC circuits with surge suppression, guaranteeing stability.

During commissioning, minor issues such as defective fuses were identified and corrected. After they were resolved, communications stabilized fully across all nodes and controllers. The final configuration achieved both data precision and network reliability, verified through real-time comparisons with plant sensors.

The platform transformed not only Egger's technology but also its organizational workflow. Previously, maintenance and energy departments maintained separate datasets. Today, maintenance, operations and management all work from shared dashboards:

To read more ***Air Compressor Controls*** articles, visit https://www.airbestpractices.com/system-assessments/compressor-controls.

For expert presentations on ***Air Compressor Controls*** visit our webinar archive section at https://www.airbestpractices.com/webinars.

Manager, CMC NV. "It's a clear example of innovation building on a solid base."

The platform is modular and scalable. As Egger continues to evolve, new air compressors, sensors or analytics can be integrated without major rewiring. The platform's architecture supports remote diagnostics, firmware updates and predictive maintenance tools powered by AI. This ensures Egger's compressed air management remains aligned with future sustainability targets and corporate digitalization initiatives.

Data-Driven Efficiency for the ESG Age

Egger's journey from Metacentre to Airmatics reflects a broader transformation in industrial energy management, from control to clarity, and from automation to accountability.

Through digital monitoring, real-time data and verified reporting, the company has turned compressed air from a hidden cost into a measurable performance asset. The results speak for themselves:

- 1.43 GWh annual energy savings
- $166,500 cost reduction
- 889 metric tons of CO_2 avoided annually
- Real-time transparency across all zones

Egger Rambervillers demonstrates that sustainability, transparency and operational excellence are not competing priorities. They are inseparable pillars of modern manufacturing.

In an era where the smartest factories are also the most accountable, the platform has given Egger not just control over its air but confidence in its data. BP

About the Author

Graham Coats is Director of Strategic Product and Business Development and SCADAR Product Line Management. He specializes in transforming fragmented air compressor systems into efficient, accountable, and data-driven networks. With global experience across the U.K., Europe, the U.S., and APAC, Graham unifies mixed-brand technologies across SCADAR, Metacentre Core and Airmatics while maintaining independence from OEM bias. Known for turning engineering innovation into measurable P&L results, he champions the principle that energy is the hidden P&L, making every kilowatt-hour visible, controllable and accountable.

Lubricant Analysis Improves Air Compressor Reliability

By Dave Brockett, Senior Business Development Manager, AMSOIL Industrial

➤ "High-demand plants experience measurable ROI from lubricant analysis programs." – Machinery Oil Analysis, Methods, Automation & Benefits by Larry A. Thomas and Allison M. Thomas.

Compressed air is often referred to as the "fourth utility," as important to industrial operations as fuel, electricity and water. Compressed air systems are essential in every industry, from powering pneumatic manufacturing tools to driving process systems in oil and gas, mining and utilities. Lubricant maintenance is crucial to efficient air compressor operation.

Reliability-centered maintenance (RCM) programs deploy predictive maintenance strategies and often prioritize air compressors due to their importance to production.1 Proactive lubricant management can significantly reduce operational costs by extending equipment life, minimizing breakdowns and improving energy efficiency. According to Noria Corporation, facilities that integrate predictive maintenance strategies, including oil analysis and condition monitoring, report up to 20% longer air compressor life and 10% lower maintenance costs.

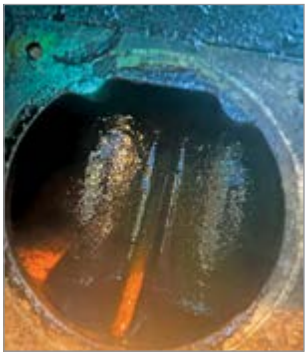
The Purpose of a Structured Lubricant Analysis Program

This article discusses how a structured lubricant analysis program significantly improves air compressor operating efficiency, reliability and equipment life to reduce downtime and total cost of ownership. It explores lubricant degradation mechanisms and the importance of lubricant analysis as part of a holistic RCM program.

Lubricant analysis is especially valuable in compressed air systems where thermal and mechanical stress are constant. Monitoring and understanding diagnostic data helps maximize asset performance by predicting lubricant and component failures to reduce the risk of breakdowns.

Oxidative Degradation. The most common failure mode for air compressor lubricants is oxidative degradation, a chemical reaction that begins at the molecular level. Heat speeds up the reaction between oxygen and hydrocarbons when wear metal particles are present, triggering a chain of chemical reactions that produce organic acids.

These acids react with the lubricant, creating heavy, insoluble byproducts like sludge and varnish. As these deposits build up, they thicken the lubricant and block fluid flow, reducing its ability to carry away heat. This leads to boundary lubrication, a condition where the lubricant film becomes too thin to fully separate moving surfaces, leading to direct metal-to-metal



Above: AMSOIL Industrial headquarters in Superior, WI

Varnish-coated surfaces reduce air compressor efficiency and component life, restricting cooling ability.

contact. The result is increased friction, accelerated wear and performance degradation.

Compressor Thermodynamics. The primary source of oxidative stress in air compressors is high operating temperatures caused by the heat generated from air compression and friction. Adiabatic compression is a thermodynamic process in which a gas is compressed so that all energy transfer occurs as work and exchanges no heat with its surroundings. Thus, air compressors inherently create elevated thermal loads through a combination of heating the air they are compressing and frictional heat from high-speed component rotation.

Condensation is another common byproduct of air compression cycles, leaving behind a condensate mix of water, acids and other contaminants that accelerate oxidation. The air compression process extracts water vapor from ambient air, introducing moisture directly into the lubricant sump. The thermodynamic combination of heat, water and oxygen is the perfect storm for oxidation.

Lubricants help reduce friction and dissipate heat in extreme operating conditions. High-quality air compressor fluids also include advanced additive chemistries designed to mitigate the effects of oxidation:

- **Oxidation inhibitors:** Phenolic or aminic additives that increase thermal stability and interrupt free radical propagation
- **Corrosion and rust inhibitors:** Surface-active agents that protect metal surfaces
- **Dispersants:** Compounds that suspend oxidation byproducts to prevent deposit formation

Despite their importance, all additives are sacrificial in nature and deplete rapidly in harsh conditions, reducing lubricant effectiveness over time. Elevated temperatures, moisture and contaminants drastically accelerate additive depletion, often reducing the oil's service life well below its theoretical life expectancy.

Contaminant Degradation. Solid particles like dust and dirt can enter the system and cause additional damage. Though inlet filtration systems capture most large particles, sub-micron

Lubricant Analysis Improves Air Compressor Reliability

Consistently use correct sampling techniques for the best lubricant maintenance recommendations. (Photo: Noria)

particulates can bypass filtration and become entrained in the oil.

These small particles will eventually attach themselves to other debris or oil molecules and form solids that disrupt hydrodynamic lubrication and cause abrasive wear. These effects lead to compromised compressed air system efficiency and accelerated lubricant and component failure. This underscores the importance of filtration system maintenance and routine lubricant contamination monitoring.

Measuring Air Compressor Lubricant Health

As lubricant oxidation progresses, it leaves behind acids that corrode metal surfaces, create sludge and varnish, deplete antioxidant additives and reduce fluid life. Knowing the concentration of acidic compounds provides maintenance professionals with actionable insights.

The ASTM D664 potentiometric titration test method performed in a lubricant analysis laboratory provides an acid number (AN). It measures the amount of potassium hydroxide (KOH) required to neutralize acidic compounds in one gram of oil and is the primary metric for assessing lubricant degradation caused by oxidation.

AN (mg KOH/g) = (mL of KOH used × Normality × 56.1*)/Sample weight (g)

*Molecular weight of KOH

ANs correlate with fluid lifespan and maintenance recommendations.[2]

Note: AN is a critical measurement in air compressors that cannot be completely drained. When old and new oil are mixed during changeover, it can elevate AN and trigger a lubricant death spiral.

Implementing a Lubricant Analysis Program

Most air compressor manufacturers and industrial lubricant suppliers offer lubricant analysis programs either bundled with product purchase or for a nominal fee. Starting the program during a scheduled service interval is ideal. Sampling immediately after recommissioning ensures data reflects operational conditions rather than residual startup anomalies. To ensure data integrity for a successful program:

1. **Register Assets:** Assign unique IDs to each air compressor for tracking.
2. **Create Baselines:** Analyze fresh lubricant samples to establish reference points.
3. **Schedule Sampling:** Collect samples quarterly and after service completion.
4. **Label Samples:** Include asset ID, fluid type and operating conditions.
5. **Collaborate with Labs:** Work with reputable labs to maintain data history and accuracy and receive actionable analysis reports.
6. **Analyze Data Trends:** Immediately address any negative results and review patterns over time to proactively identify ongoing maintenance needs.

AN Value (mg KOH/g)	Condition	Interpretation	Action
0.02 – 0.1	New fluid	Baseline	No action
0.1 – 0.5	Mild aging	Additive depletion starting	Continue monitoring
0.5 – 1.0	Moderate oxidation	Oxidation progressing	Plan resampling
1.0 – 2.0	Advanced oxidation	Fluid nearing condemnation	Change the oil
>2.0	Excessive acidity	Fluid failed	Drain and flush the system

Oil analysis during maintenance intervals can reduce costs and downtime.

A comprehensive analysis program allows maintenance teams to make informed decisions.

Data Interpretation to Detect When Action Is Needed

Consistency in sampling techniques and information submission is essential to maintain data validity and enable meaningful interpretation. Upon replacing degraded fluid with fresh lubricant of identical specification, several changes should be immediately observable in the analysis report:

- Reduced wear metal concentration
- Lower AN
- Decreased water content

Elevated ANs are usually preceded by high water content. The persistent presence of moisture should be addressed by service technicians to identify and remediate ingress sources.

As oxidation progresses, viscosity increases due to the accumulation of insolubles and molecular polymerization. A viscosity increase of more than 10% over the lubricant's nominal viscosity warrants an oil change and potentially a system flush to maintain efficiency and prevent damage.

Longitudinal data analysis, or trend analysis, offers the greatest insight. Reputable labs offer a complete test suite and include historical test data on their reports, allowing maintenance

Failure Mode	Test Method	Key Parameter
Oxidation	ASTM D664	Acid number (AN)
Contamination	ASTM D5185	Wear metals
Moisture	ASTM D6304	Water content (Karl Fischer)
Viscosity Breakdown	ASTM D445	Viscosity at 104°F/212°F (40°C/100°C)
Additive Depletion	ASTM D2896 ASTM D974	Base number
Varnish and Sludge	ASTM D7899	Varnish potential (MPC patch)
Particulates	ISO 4406 ASTM D7647	Oil cleanliness available in select oil analysis kits

Test Methods, from the American Society for Testing and Materials (ASTM):

- D664 – Acid Number of Petroleum Products by Potentiometric Titration
- D5185 – Multielement Determination of Used and Unused Lubricating Oils and Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)
- D6304 – Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration
- D445 – Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D2896 – Base Number of Petroleum Products by Potentiometric Perchloric Acid Titration
- D974 – Acid and Base Number by Color-Indicator Titration
- D7899 – Measuring the Merit of Dispersancy of In-Service Engine Oils with Blotter Spot Method
- D7647 – Automatic Particle Counting of Lubricating and Hydraulic Fluids Using Dilution Techniques to Eliminate the Contribution of Water and Interfering Soft Particles by Light Extinction

Lubricant Analysis Improves Air Compressor Reliability

teams to track deviations across key parameters over time. Significant deviations like abrupt spikes in AN, viscosity or wear metals should trigger immediate consultation with service providers to determine corrective actions.

Conclusion

Effective lubricant analysis delivers substantial and proven ROI measured in increased productivity, oil drain intervals and equipment life:

- **Proactive Maintenance:** Transition from reactive to predictive maintenance.
- **Extended Fluid Life:** Optimize lubricant performance and lifespan.
- **Reduced Costs:** Minimize equipment failures and unscheduled downtime.
- **Enhanced Reliability:** Maintain peak equipment efficiency.

A consistent, structured lubricant analysis program is one of the most cost-effective ways to increase air compressor reliability, reduce total cost of ownership and avoid production interruptions. With disciplined deployment and technical oversight, lubricant analysis transforms maintenance from reactive to predictive, aligning with industry best practices and RCM principles.

For facilities managing high-capacity compressed air systems, the operational and financial benefit of combining high-quality air compressor oil with diligent maintenance practices is significant. With support from equipment manufacturers and lubricant suppliers already in place, integrating lubricant analysis into your maintenance strategy is a practical strategic move toward improving equipment reliability. BP

About the Author

Dave Brockett is a Senior Business Development Manager with AMSOIL Industrial and an ICML-certified lubrication analyst. With more than 25 years of experience in the compressed air industry, half as a technician and service manager and half focused exclusively on air compressor lubrication systems, Dave brings deep technical insight and field expertise to equipment reliability and lubrication strategy.

POLARIS Laboratories

Lubricant Analysis Report

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0 1 2 3 4
Overall report severity based on comments.

Account Information		Component Information		Sample Information	
Account Number:		Component ID:	003-102168 C	Tracking Number:	
Company Name:		Secondary ID:	LS25-200H #93	Lab Number:	
Contact:		Component Type:	COMPRESSOR	Lab Location:	Indianapolis
Address:		Manufacturer:	Information Requested	Data Analyst:	KDN
		Model:	Information Requested	Sampled:	03-Jul-2025
Phone Number:		Application:	POWER GENERATION	Received:	14-Jul-2025
		Sump Capacity:		Completed:	18-Jul-2025
Filter Information		**Miscellaneous Information**		**Product Information**	
Filter Type:	Information Requested			Product Manufacturer:	Information Requested
Micron Rating:	0			Product Name:	Information Requested
				Viscosity Grade:	Information Requested

Comments: Check for source of water contamination (SEALS, BREATHERS, FILL PORTS). Water is at a SEVERE LEVEL. LUBRICANT and FILTER CHANGE is suggested if not done at sampling time. Suggest monitoring the drain interval and equipment operating temperature. Acid Number is SEVERELY HIGH, which may be due to oxidation, contamination with an acidic product, or lubricant mixing. Elevated acid levels lead to corrosive component wear. Sodium is at a MINOR LEVEL; Sodium sources: coolant (antifreeze), lube additive or supplement, and/or environmental contaminant; In order to properly compare data to the correct standards, please provide COMPONENT MANUFACTURER and MODEL, and the FLUID MANUFACTURER, PRODUCT NAME, and VISCOSITY GRADE. Recommendations were made without knowledge of sump capacity. Please provide sump capacity information with next sample; Please provide filter type and micron rating to allow for proper particle count evaluation.

	Wear Metals (ppm)										Contaminant Metals (ppm)			Multi-Source Metals (ppm)						Additive Metals (ppm)				
Sample #	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
2	0	0	0	0	2	0	0	0	0	0	0	58	2	0	0	0	0	0	1	0	4	349	92	9
3	1	0	0	0	1	0	0	0	0	0	0	66	4	0	0	0	0	0	1	1	3	259	80	13
4	1	0	0	0	1	0	1	0	0	0	0	65	6	0	0	0	0	0	2	0	1	182	76	6

	Sample Information						Contaminants			Fluid Properties					
Sample #	Date Sampled	Date Received	Lube Time h	Unit Time h	Lube Change	Lube Added gal	Filter Change	Fuel Dilution %	Soot %	Water %	Viscosity 40°C cSt	Viscosity 100 °C cSt	Acid Number mg KOH / g	Base No. D4739 mg KOH / g	Oxidation abs / cm	Nitration abs / 0.1mm
2	04-Sep-2024	09-Sep-2024	0	92269	Unk	0	Unk				52.2		0.29			
3	07-Apr-2025	12-Jun-2025	0	97986	Unk	0	Unk				55.8		0.65			
4	03-Jul-2025	14-Jul-2025	0	99376	No	0	No				57.9		0.74			

	Particle Count (particles/mL)										Additional Testing
Sample #	ISO Code Based On 4/6/14	> 4 particles /mL	> 6 particles /mL	> 10 particles /mL	> 14 particles /mL	> 21 particles /mL	> 38 particles /mL	> 70 particles /mL	> 100 particles /mL	Test Method	Water by Karl Fischer - mod. 6304C ppm
2	22 / 21 / 19	36858	16817	5759	3011	1226	100	4	2	ASTM D7647	2647
3	20 / 19 / 15	8686	3108	758	319	112	6	0	0	ASTM D7647	4501
4	18 / 17 / 13	2384	840	179	54	14	0	0	0	ASTM D7647	5430

Comments are advisory only and are based on the sample information provided by the customer being valid. Results related only to the items tested. Missing fluid or component information limits the evaluation. No warranty is expressed or implied. Measurement uncertainty available upon request.

This Polaris Laboratory lubricant analysis report shows AN increases in direct correlation with water content.[3,4]

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Heat Pump Chillers Deliver Energy Efficiency and Savings

By Rob Tanner, Marketing Director, Applied Equipment, Johnson Controls

Today's industrial plants are evolving at a rapid pace. Domestic reshoring, strengthened supply chains and technological advancements present new opportunities to innovate facilities and expand operations. As plant operators embark on their journey toward facility optimization, taking steps to generate ROI can free up budget to support future phases of transformation.

Implementing a waste heat recovery system is one tactic to cut operating costs and carbon in tandem. Recent advancements in heat pump chillers make it easier to integrate waste heat recovery into many industrial plants. With these innovative chillers, waste heat recovery is a viable option even in applications where the rejected heat load temperature was once considered too low.

Waste Heat Recovery Reclaims Untapped Resources

The U.S. Department of Energy estimates 20-50% of industrial energy is lost to waste heat. In many industrial plants, this waste heat is a natural byproduct of critical processes including sterilization, drying and refining. As excess heat is removed from these processes, it is often rejected into the environment or to a cooling tower. These lost resources are present in nearly every sector, from energy-intensive verticals such as cement, steel, and pharmaceutical production to food and beverage manufacturing. Yet only 30% of plants leverage a waste heat recovery system.

For a waste heat recovery system to be truly impactful, there must be a recipient process to use the recovered heat at the same or lower temperature. Although waste heat streams are often abundantly available in industrial plants, the temperature and quality of the rejected heat load can create barriers to establishing meaningful results.

Historically, absorption chillers have largely been used for industrial waste heat recovery, requiring heat sources to be around 300°F (149°C) to maintain an efficient coefficient of performance (COP). Because of this, recovered heat below 250°F (121°C) has been considered low grade, meaning it wasn't high enough to power industrial processes such as kiln firing or distillation or hot enough to operate steam turbines for electricity generation. Depending on the temperature, low-grade waste heat could

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

Only 30% of plants leverage a waste heat recovery system.

even be too low to provide hot water or spatial heating. Additionally, absorption chillers can be complex to install and integrate.

Innovations in electric heat pump chillers now enable a broader range of heat source compatibility, making heat recovery more feasible. In fact, some chillers operate in heat pump mode using liquid heat sources as low as 40°F (4°C), creating a greater value from what was previously considered low-grade waste heat. Today's heat pump chillers also offer a compact footprint, saving space on the plant floor or within the central utility plant (CUP).

Driving Industrial Performance with Heat Pump Chillers

Today's heat pump chillers harvest wasted thermal energy by drawing from the building's chilled water loop or exhaust air streams. Captured heat is transferred to the heat pump's evaporator through a refrigerant loop. Refrigerant vapor is then drawn into the refrigerant compressor, where temperature and pressure are increased. After compression, heat is released from the refrigerant loop into the condenser, where the reclaimed heat can be released into a water or glycol loop or process stream, providing a reclaimed energy source.

Several types of air-to-water and water-to-water heat pump chillers are available and are ideal for waste heat recovery. Engineers and plant leaders can tailor these solutions to meet the temperature, capacity, efficiency, size and cost requirements of their industrial facility.

For example, some commercial water-to-water heat pump chillers can deliver hot water temperatures as high as 180°F (82°C), creating an efficient energy source for space heating and cooling, humidity control, water heating, boiler feedwater preheating or as a source to feed district heating. Using two electric motor-driven centrifugal refrigerant compressors operating in series, the chiller can precisely match temperature output and produce both hot and chilled water simultaneously within a single piece of equipment. With the integration of low-GWP refrigerants and innovative condenser technologies, these heat pump chillers can be three to five times more efficient than a traditional chiller and boiler combination, even within off-design conditions.

In applications where chillers run at high loads throughout the year, optimizing performance for off-design conditions provides another opportunity to further reduce energy consumption and operating costs. For example, in process cooling applications, chillers often run at design conditions for less than 10% of the year. Variable speed rotary screw heat pump chillers are designed to optimize efficiency during part-load conditions by combining variable volume index (VI) rotary screw refrigerant compressors with variable speed drive (VSD) technologies.

Absorption chillers have largely been used for industrial waste heat recovery, requiring heat sources to be around 300°F (149°C) to maintain an efficient coefficient of performance.

In traditional fixed VI rotary screw refrigerant compressors, the volume index ratio is constant, which can lead to inefficiencies when the refrigerant compressor operates under varying load or ambient conditions. Variable VI allows the rotary screw compressor to dynamically adjust to match external system pressure conditions more closely. At the same time, the VSD modulates chiller output, allowing it to continuously adjust to match operating capacities as loads fluctuate. Combined, these advancements optimize performance and efficiency to significantly reduce operating costs and deliver rapid ROI.

Streamlining Operations with Plant Intelligence

In addition to advanced component engineering, leading heat pump chillers are engineered to seamlessly connect to digital CUP optimization platforms. These smart-ready chillers can leverage intelligent solutions that combine real-time data and artificial intelligence (AI) to optimize CUP performance and streamline operations. By reading the live activity of the plant and learning from historical performance data, AI controls continuously adapt to meet and maintain operational objectives. This can enhance energy efficiency, prevent unplanned downtime and streamline service. For example, if performance slippage or potential issues

Heat Pump Chillers Deliver Energy Efficiency and Savings

such as condenser or evaporator tube fouling or low refrigerant charge are detected, they can be addressed in their early stages to avoid more significant problems. This proactive approach not only streamlines maintenance but can also reduce unplanned and emergency chiller repairs and downtime by as much as 66%.

Intelligent CUP optimization can also help unburden operators by automating routine and repetitive workflows so they can focus their time where it matters most. Additionally, intelligent features allow operators to simulate and plan for unpredictable conditions such as extreme weather, equipment lifecycles and fluctuating utility pricing. For example, a digital twin can create a realistic simulation of the facility to model and illustrate changes in equipment integration and energy costs, establishing proof points to inform capital investments and long-term planning.

A water-to-water dual variable speed rotary screw heat pump

An 18% Reduction in Energy Costs and a 25% Reduction in Water Use

Johnson Controls partnered with a global pharmaceutical company located in the Midwest to enhance its laboratory operations. The laboratory had not yet implemented a holistic building intelligence platform, which limited the team's knowledge of environmental, asset and occupant data. Using robust sensors and AI-powered intelligent building software, the entire mission-critical facility was evaluated for efficiency, workflow effectiveness and occupant satisfaction. By unlocking and synthesizing real-time data from environmental monitors, asset trackers, personnel badges and occupancy sensors, the program was able to pinpoint problem areas and provide actionable methods to fix them.

By evaluating spatial and equipment use within the laboratory, the processes revealed some areas were regularly congested while others remained mostly vacant. A redesigned floor plan was rolled out to disperse highly used equipment throughout the lab to allow for increased occupant space and streamlined workflows.

Additionally, extreme temperature differences were identified within several critical working spaces. In some instances, the temperature became so cold it caused reagents to freeze, disrupting crucial processes necessary when testing pharmaceuticals. A closer look at the equipment and temperature controls within the space revealed three large automation systems were causing temperature spikes when in use. In turn, this caused the HVAC system to engage, creating an imbalanced load.

As a solution, the team integrated dedicated heat pump chillers within the space to manage the added heat load generated when the automation systems were active. Excess heat absorbed during these energy spikes was then captured and used as reheat within other laboratory processes. This resulted in an 18% reduction in energy costs and a 25% reduction in water use. Combined, these savings provided a complete payback for the new chillers in just three years.

Conducting a Heat Energy Audit

Collaborating with a thermal management partner is crucial to ensuring the right waste heat recovery system is deployed. The first step in this process is conducting a heat energy audit. This defines where heat is being produced, used and vented throughout the facility. Boilers, refrigerant compressors, chillers, furnaces,


Johnson Controls partnered with a global pharmaceutical company in the Midwest to enhance its laboratory operations.

exhaust stacks and process equipment are typical heat sources with untapped potential. A heat balance diagram helps pinpoint mismatches between heat supplies and demands. This process should be repeated during various plant functions and ambient conditions to identify seasonal or operational patterns.

Excess heat absorbed during these energy spikes was then captured and used as reheat within other laboratory processes. This resulted in an 18% reduction in energy costs and a 25% reduction in water use.

As waste heat sources are identified, temperature and flow rate drive equipment selection. In some applications, multiple recovery solutions may be combined to match varying loads or align with plant processes. For example, modular air-to-water heat pumps can be integrated with larger water-to-water units to optimize specific zones during milder outdoor temperatures.

As heat recovery systems are designed, integration can be scaled to a single facility or division of the plant, creating a pilot program where efficiency and cost-saving proof points can be established. It's important to consider state and local programs available for energy efficiency upgrades, as well as utility incentives to help offset costs and contribute to ROI.

Reimagining Plant Efficiencies Today

In many industrial facilities, waste heat is a natural byproduct of existing processes, but heat recovery is often overlooked. By tapping into this unclaimed resource, plant leaders can uncover measurable energy and cost savings.

Today's innovative smart-ready heat pump chillers make waste heat recovery easier and more viable than ever before – even within applications where waste heat temperatures were once considered too low.

By integrating a waste heat recovery system, plant operators gain a practical path toward advancing their operational goals while gaining ROI for future facility innovations. BP

About the Author

Rob Tanner is the Director of Marketing for Applied Equipment at Johnson Controls located in York, Pennsylvania. Tanner has more than 30 years of experience in the sale, application, design, installation, service and marketing of commercial HVAC products and technologies. Before joining Johnson Controls, Rob was an MEP consulting engineer and co-owner of a design-build mechanical contracting company. Rob received his B.S. in Mechanical Engineering and M.S. in Education and Organizational Development from Pennsylvania State University.

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Understanding 2026 Low-GWP Refrigerant Requirements

By Troy Dreier, Senior Editor, Compressed Air & Cooling Best Practices Magazine

The Environmental Protection Agency (EPA) ruled all industrial process cooling systems with a process temperature above -22°F (-30°C) must use refrigerants with a global warming potential (GWP) of 700 or less beginning January 1, 2026. This is the latest in a series of changes designed to reduce the amount of global warming refrigerants in the atmosphere. Even if the EPA cancels the requirement before then, 12 states, including California, New York, Washington and Colorado, have passed similar requirements creating the same restriction. Mike Shupe, Director, Product Management, Thermal Care, has been giving presentations on the topic to help industrial manufacturers know what to expect.

"There has been some discussion about the EPA rolling back the requirements and perhaps relisting the high GWP refrigerants," Shupe said. "At this point, though, my personal belief is the ship has sailed. We're too far down the path for people to turn around. Some of the large manufacturers, especially in HVAC and comfort cooling, have already switched all their products. I don't think anybody's interested in going through the headache of switching back.

"As part of the Kigali Amendment the U.S. has agreed to, there's a reduction in the amount of high GWP refrigerants available. Starting in 2020, producers reduced down to 90% of what they had produced the year before. In 2024, they reduced to 60%, and that number will be reduced to 30% in 2028. Those reductions result in higher costs for those refrigerants. The cost of R-410A is now far greater than the cost of R-454B. From a financial standpoint, no one's going to choose to use a more expensive refrigerant at this point."

The Challenges of Adopting Low-GWP Refrigerants

A refrigerant's GWP rating is a measure of its ability to trap solar radiation inside the Earth's atmosphere. These gases collect in the upper atmosphere and cause solar radiation that would normally escape to bounce back to the Earth. The GWP for carbon dioxide is 1, which is the baseline. A refrigerant with a GWP of 700 has 700 times the amount of potential to trap solar energy.

This is actually the second time the EPA tried to limit the GWP of refrigerant gases. A move in 2016 was thrown out in court before it could take effect, which is why several states created their own rules this time.

Mike Shupe, Director, Product Management, Thermal Care

Chad Stover, Manager, Marketing Services, Thermal Care

Above: An 80 ton air-cooled outdoor chiller

Thermal Care began its low-GWP planning in 2022, when the current legislation was drafted. The deadline at the time was 2024. The EPA's comment and revision period lasted until 2023, with a ruling published in October 2023. The deadline for industrial operation was then pushed back to January 2026.

The company chose to standardize on two main refrigerants. Its large capacity centrifugal refrigerant compressors used to use R-134A and now use R-513A. That was an easy switch and offers customers cost savings. Its smaller scroll refrigerant compressors previously used R-410A or R-47C, and now use R-454B. R-513A has a GWP of 573 and R-454B has a GWP of 466.

The GWP change includes a grandfather clause, so cooling units produced before the enforcement date are exempt for three years. Plus, any units installed before the enforcement date are exempt. Manufacturers don't need to replace installed cooling systems. Any manufacturer knowingly violating the requirement is subject to a fine of $10,000 per day until the equipment is removed. Fines could apply to either the equipment's owners, manufacturers or distributors, depending on the situation.

If industrial plants discover a leak in their older, grandfathered cooling system or need a repair in the future, they may find the cost of replacement refrigerant makes their system prohibitively expensive.

"There's a big misconception from a lot of the people I've talked to," said Chad Stover, Manager, Marketing Services, Thermal Care. "They think refrigerant is just fluid you pump into any chiller, and you can change out refrigerant easily, the way you might change out washer fluid in your car. But it's a lot more difficult than that. The mechanics are different depending on the refrigerant."

Density and mass flow, both of which are important for heat transfer, vary widely between refrigerants. Even though the list of refrigerants numbers into the thousands, finding one that fits a chiller manufacturer's exact needs can be challenging. Adding to the complication is the fact that lower GWP refrigerants often come with greater flammability. Some, like ammonia, are lethal when inhaled. CO_2 is a refrigerant, but it operates under high pressure, so it requires a different design system to be feasible.

"Every refrigerant system has basically four main components: the refrigerant compressor, the evaporator doing the heat transfer, some sort of expansion device and a condenser," Shupe said. "You have to find a refrigerant that's compatible with four devices and meets the same requirements. There are no true drop-ins as far as refrigerants go. There are a couple that get pretty close. The transition from R-134A to R-513A is fairly simple, and for the most part, you can use all the same components, but that's not true for all cases, for all refrigerants."

A New Refrigerant Category Is Created: A2L

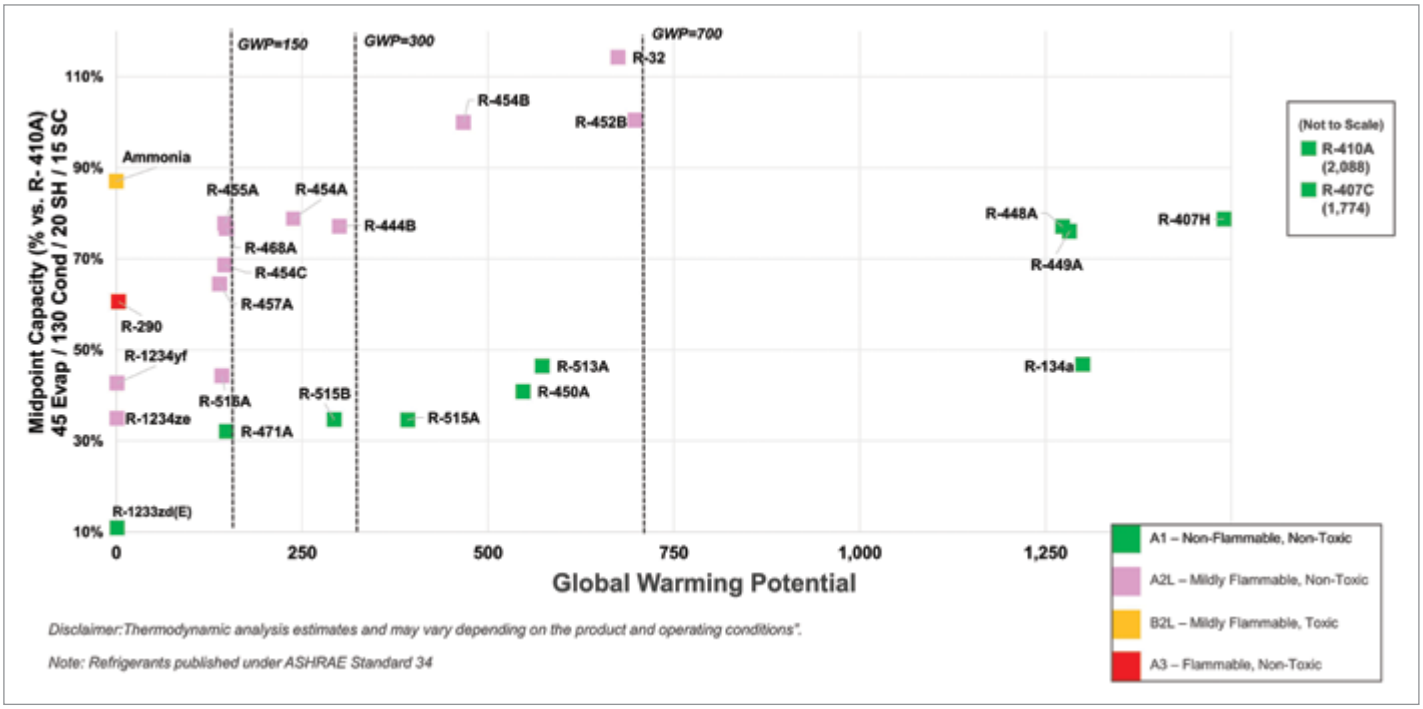
The search for lower GWP refrigerants led to a new classification, A2L. The original categories – A1, A2, A3, B1, B2 and B3 – easily showed the flammability of different refrigerants. A1 is the least flammable. Most newly developed refrigerants don't meet A1 requirements, but they aren't as flammable as A2 refrigerants, either.

"It caused issues for municipalities, because the fire departments didn't know exactly how to treat it or what regulations should be in buildings," Shupe said. "You had state-level rules, federal-level rules, municipality rules that were also company rules. Certain company brands would say we're not allowed to have any A2 flammability issues in any of our manufacturing facilities."

> *"The cost of R-410A is now far greater than the cost of R-454B… No one's going to choose to use a more expensive refrigerant at this point."*
>
> – Mike Shupe, Thermal Care

The solution was to create a new category. For A2L refrigerants, the flame spread is lower than for A2, the ignition source needs to be higher and the amount of refrigerant needed for combustion is higher. Once the category was created, legislation and building codes needed to be updated. Companies could then use A2L refrigerants without breaking their ban on accepting A2 refrigerants.

Understanding 2026 Low-GWP Refrigerant Requirements



The refrigerant landscape

In some areas, using A2L refrigerants requires taking extra precautions, such as installing sensors to monitor for fire, but that's rare. When units are installed outdoors, they don't require any extra mitigation or suppression efforts. If the chiller is installed in a mechanical room, ASHRAE guidelines require sensors and mitigation.

> *This is probably not the last time plant operators will need to worry about refrigerant levels. Shupe expects another push to lower GWP numbers in five to 10 years.*

"However, per ASHRAE, if you have a chiller that's installed in a mechanical room with an A1, you should also have a sensor and mitigation because the risk of confined space is not only flammability, but also asphyxiation," Shupe said. "The refrigerant can displace oxygen, so there's also a factor of UL compliance. For certain products adhering to UL60335-2-40, which is a statute that determines safety for equipment, the chiller should have a sensor for mitigation. Most of our chillers do not fall under that regulation. It's more or less aimed at residential and commercial occupancy. We fall into an industrial environment, so it's a different category."

Low-GWP Refrigerants Come with an Efficiency Tradeoff

One of the biggest questions plant operators have is whether or not the new lower-GWP refrigerants will cool as economically as the previous refrigerants. There is a productivity loss with lower-GWP refrigerants, and it's up to chiller manufacturers to find the right balance.

"The difference between R-410A and R-454B is less than 5%, so there is a slight loss overall," Shupe said. "Actually, R-454B performs slightly better on the condensing side, but slightly lower capacity on the compressor side. Overall, it's less than a 5% loss. We found it to be acceptable for most of our customers within the range of their application.

"There's no free lunch. You help one thing, and it hurts something else. There's a loss in efficiency, there's a slight loss in capacity. However, you could argue the greater good to the environment cancels out the slight productivity loss, and we're willing to accept a little bit. To accept 30%, now you really have to question what we're doing. But so far it's been a fairly smooth transition and we've been able to accommodate what we need."

To make up for the slight loss in refrigerant efficiency, Thermal Care has been trying to improve its chillers in other ways. The refrigerant compressor uses 80% of

A 5 ton air-cooled portable chiller

a chiller's energy, Shupe noted. The company has been working with refrigerant compressor manufacturers and optimizing its own controls to gain efficiency.

"If we can lower our discharge temperature or raise our suction temperature, even if it's just a couple degrees, it gives us a little bit of an edge on how much power we're using," Shupe said. "You buy the chiller once, but you spend money on electricity every single day. It's the same with water consumption. Utilities are a monthly fee. If you can cut those down, then the chiller essentially starts to pay for itself. Those are the things we look at from a design aspect."

Before 2022, plant operators didn't need to know about refrigerants, Shupe noted. Their only concern with chillers was if they made cold water. He spends time educating plant operators on flammability risks. Even if they had 50 or 100 lbs of A2L refrigerant in an area the size of a college dorm room and a lit cigarette or some other small ignition source, that still wouldn't be enough for it to catch fire.

"Once you put it in those terms and people can really understand it's not as scary as it sounds, then they're a little bit more open to it," Shupe said. Plant operators still need to check local municipality refrigerant and fire codes to learn what's allowed. The AHRI's Safe Refrigerant Transition guide (https://www.ahrinet.org/advocacy/safe-refrigerant-transition) is a good place to start.

The Burden Falls on Chiller Manufacturers

Industrial plants should find that selecting a compliant chiller isn't difficult, since the EPA has put the burden on the manufacturers. While manufacturers have tried to educate their buyers online and at conferences, letting them know about changes coming in the near future, purchasing high-GWP cooling systems should no longer be an option.

"The EPA put the onus on the manufacturing side, whereas the state regulations put it on the end user," Shupe said. "That puts a lot of faith in people being up-to-date with what's going on in the refrigerant world. If you're in a manufacturing plant, you generally are not concerned with what refrigerant is in your process cooling as long as you're getting cold water. You just want to make sure whatever you're producing, the process is up and running. "For us to sell a piece of equipment and then have it be flagged at inspection, that's not doing our customer any favors. It's not doing us any favors."

This is probably not the last time plant operators will need to worry about refrigerant levels, Shupe noted. He expects another push to lower GWP numbers in five to 10 years, with an ultimate goal of getting chillers and other refrigeration equipment below 150 GWP.

"I'm not sure that we're ready for that yet, as the refrigerant compressor manufacturers and the refrigerant producers aren't ready. However, they continue to make new blends and have new refrigerants created. Perhaps they will find the solution everyone's been searching for – a low GWP that's efficient and also economical and also maybe even an A1. But even if they don't, I think the EPA's push will continue because if the push is not there, manufacturers won't search for these solutions." BP

About Thermal Care

Founded in 1969, Thermal Care is a developer of leading-edge process cooling technology with energy-saving and cost-efficient product designs. The company provides heat transfer equipment to more than 50 industries and specializes in meeting the specific needs of all customers by offering both standard and custom-designed industrial process cooling solutions. Thermal Care's broad product line includes portable, packaged and central chillers, cooling towers, adiabatic fluid coolers, pumping systems, and temperature controllers. The company also delivers extensive experience and engineering knowledge to develop and execute plant-wide cooling solutions. For more information, visit www.thermalcare.com.

For similar articles on ***Refrigeration Compressors,*** please visit https://coolingbestpractices.com/technology/refrigeration-compressors.

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Best Practices 2025 EXPO & Conference Show Report

By Troy Dreier, Senior Editor, and Brooke Jones, Digital Content Editor, Compressed Air Best Practices® Magazine

The Best Practices 2025 EXPO & Conference was the busiest one yet, with 89 presentations, 84 exhibitors and nearly 1,000 registered attendees. It included two conference tracks, five workshops and five EXPO classroom pavilions. The event was so big, we're splitting our show report into three reports to capture all the activity.

"We're seeing an upward trend in engineering firms, distributors and rep firms able to advise manufacturing plants on the central utility plant encompassing compressed air, chilled water, water treatment, nitrogen, vacuum and blower systems," said Roderick Smith, Publisher, *Compressed Air Best Practices Magazine*, during the event's Opening Session. "That's why we've integrated these central utility plant technologies into one publication. That's why you see a growing presence of cooling on the show floor and in our speaker lineups. We're responding to demand from our industrial readers."

Judging by the responses from manufacturing plants, distributors, rep firms and engineering firms in attendance, the event was a success.

"I'm looking to establish a strong network of some of the world's best compressed air experts, because we need some assistance writing best practices and refinery engineering practices. It all starts with first getting the right network of people," said Raymond Hooks, Utilities and Chemical Transfer Engineer, Phillips 66.

"Today, I've gone to a couple of the conferences and the Maintenance Pavilion," said Steve Leining, Engineering Department Manager, Plastipak Packaging. "I got to learn a lot more about air filtration and microbial contamination that could be in the compressed air system that I didn't think to look for before. I spoke to CS Instruments about different types of dew point monitoring and compressed air systems, and the new communications technology it has available."

"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," said Jesse Becker, Mechanical Systems Engineer, Mayo Clinic. "I learn from our maintenance team what the issues are, and here I can talk to experts who can help me with those issues. I've spoken to Mikropor and BEKO. I'll present different options to our maintenance teams about what's available and have solutions for them."

"There are several more air compressor manufacturers here than in previous years. It seems like the show is growing," said Chad Gooding, President, G3 Industrial Solutions. "I've been catching up with a lot of good people in the industry. New people came in looking for new vendors on certain products, so we talked with them a little bit. Since we're a distributor, we're focused on building relationships with some of the vendors."

Roderick Smith, Compressed Air Best Practices Magazine, kicked off the event's Opening Session.

Neil Mehltretter, Kaeser Compressors, gave a presentation on solving leaks and moisture issues in industrial plant compressed air systems.

Above: The Best Practices 2025 EXPO & Conference included 89 presentations, 84 exhibitors and nearly 1,000 registered attendees.

The Hard Hat Compressed Air Maintenance Workshop gave attendees hands-on experience with fully operational table-top compressed air labs with pneumatic circuits.

Conference Tracks and Five Technical Workshops

Attendees who purchased a Full Conference pass were able to take in two conference tracks and five specialized workshops. Conference Track One, devoted to energy and cooling water conservation, included speakers from Kaeser Compressors, Ingersoll Rand, Atlas Copco Compressors and FS-Elliott. Track Two, on maintenance, reliability and safety, included speakers from EVAPCO, Trace Analytics and Kaishan.

Food safety was a hot topic, with a full conference session devoted to issues impacting food processing plants. Tyler Morrell, Vice President, Sales and Operations, Airmatic Compressor Systems, discussed nitrogen generation and compressed air enclosures for space-constrained plants, while Francisco Lara, Managing Director, Airtec Global, looked at air quality testing for sustainable production. Nikki Smith, Air Quality Business Leader, Trace Analytics, explained testing safeguards for safe breathing air.

Compressed air, industrial cooling and blower and vacuum sales engineers gathered for the standing-room-only Sales Engineering Workshop led by Mark Allen Roberts, CEO, OTB Solutions. Engineers and technicians often take on sales roles, as they have a deep understanding of products and applications. However, over 50% of salespeople never receive sales skills training. This workshop was designed to turn technical product experts into top-performing salespeople. "You can demonstrate competence and build trust by the nature of the questions you ask," said Roberts.

"I like that he involved us in it. He asked the audience questions and had us role-play," said Bonnie Nichols, Sales Specialist, ADG Concepts, about the Sales Engineering Workshop. "I learned about asking higher quality questions, open-ended questions. This was better than any conference I went to last year."

"This was one of the best sales engineering workshops I've been to in the last several years," said Nathan Toro, Sales Consultant, Mobile Mechanical Services. "This was totally relevant information for industry."

EXPO Pass Offers Opening/Plenary Sessions, Networking Events and Classroom Pavilions

Opening and Plenary Sessions were open to all attendees, including those who purchased an EXPO pass, and included presentations from CAGI, St. Jude Children's Research Hospital, Trane, Pactiv Evergreen, 3M, ALPLA and Johnson Controls. EXPO pass holders were also able to attend the Women in Compressed Air, Vacuum & Cooling Networking Breakfast and the Best Practices Networking Event.

The Plenary Session provided a trove of tactics manufacturing personnel can implement to save energy and optimize compressed air systems. Edison Kivatsi, Principal Energy Engineer, Novolex – Pactiv Evergreen, shared how to reduce energy use with smarter compressed air management. "As you fix your leaks, your compressed air system pressure may increase. You should have a strategy of monitoring and controlling your system pressure," said Kivatsi. Tim Wasmer, Founder and CEO, The Wasmer Company, shared a case study on a project for Kirsh Foundry focused on the optimization of its compressed air and nitrogen generation systems, resulting in energy savings of 550,874 kWh per year and $49,579 in annual energy costs.

The Women In Compressed Air, Vacuum & Cooling Networking Group hosted its third annual in-person meeting. Women from all experience levels and job functions came together to enjoy a buffet breakfast, make connections, and get inspired by keynote speaker Stephanie Roberts, Chief

New Products Debuted at the Best Practices 2025 EXPO & Conference

- Bauer BLP Low-Pressure Rotary Screw Air Compressor
- CTA NGDX and DXA Series Refrigerated Compressed Air Dryers
- Fotric H_6-Flex Articulated Acoustic Camera
- South-Tek Systems N_2GEN-FLEX Modular Nitrogen Generator

The annual in-person meeting of the Women in Compressed Air, Vacuum & Cooling Networking Group.

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Nikki Smith, Air Quality Business Leader, Trace Analytics, delivered the presentation "Air Quality Testing Best Practices for Food Safety" at the Food Safety Pavilion.

Patrick Kraemer, Director – Oil Free Compression, ELGi Compressors USA, spoke about oil-free rotary screw air compressors at the Maintenance Pavilion.

Tilo Fruth, President, BEKO Technologies, presented "Efficiency, Connectivity, Reliability of a Compressed Air Treatment System – 10 Easy Tips" at the Technology Pavilion.

Communications Officer at Hitachi Industrial Equipment Systems. "It has been shown time and time again gender diverse leadership helps companies be more profitable, resilient and innovative," said Roberts. "Representation helps unlock potential that's currently sitting on the sidelines."

The Best Practices Networking Event took place in Kansas City's Power & Light District at the end of Day 1. Attendees enjoyed connecting with colleagues, a delicious buffet and endless games. Representatives from the event's sponsors, BEKO Technologies and Mikropor, ended the night with speeches.

The EXPO included five classroom pavilions – on aluminum piping, new technology, food safety, leak detection and maintenance. The Technology Pavilion hosted 15 presentations on new technologies and innovations from leading global manufacturers of oil-free and lubricated air compressors, compressed air dryers, filters, condensate drains and measurement instruments, nitrogen generators, chillers and cooling towers. Tilo Fruth, President, BEKO Technologies, shared 10 practical tips to help reduce energy costs and improve the overall performance of a compressed air system. "Split the quality of your compressed air by the application within your factory. Don't treat all the compressed air the same way if you need different quality for different applications or manufacturing lines," Fruth said.

Distributors, cooling reps, engineers and manufacturing personnel participated in the daily EXPO $1,000 Energy Treasure Hunt Raffle. To enter, attendees collected a stamp from 10 Energy Treasure Hunt sponsor booths. Employees from Ardagh Group, Cushman & Wakefield, CT Compressor, G3 Industrial Solutions and Air Specialty & Equipment took home prizes of $250 or $500.

Nearly 300 attendees joined the Best Practices Networking Event.

The Best Practices team with Day 2 Treasure Hunt Raffle winners: Roderick Smith, Mark Tholen of Cushman & Wakefield (1st place), Ted Moser of Ardagh Group (2nd place), Kevin King of CT Compressor (3rd place) and Erik Klingerman of Best Practices (left to right).

Unipipe sponsored the Piping Pavilion and raffled off three do-it-yourself compressed air aluminum piping kits. Jamie Ray of G3 Industrial Solutions won an eight-drop kit (worth $2,095), Bonnie Nichols of ADG Concepts won a five-drop kit (worth $1,495) and Chad Carpenter of Brandon & Clark won a three-drop kit (worth $975). CS Instruments sponsored the Leak Detection Pavilion and raffled off a LeakCam 600 kit (worth $16,990), which was won by Bill Mellot of Ball Corporation.

Air Compressor Technology

BAUER COMPRESSORS is known for its high-pressure air compressors; however, EXPO attendees were able to witness its latest innovation. The BAUER BLP™3 Series is the company's first low-pressure rotary screw air compressor. Available in multiple standard configurations, the tank-mounted designs produce either 125, 150, or 175 psi. The company also offers made-to-order configurations. The BAUER BLP™3 Series is backed by a 10-year airend warranty and a 5-year bumper-to-bumper warranty.

Tony Corletto, Paul Cenzon, Eric Phelps and Daniel Pinete (left to right) of BAUER COMPRESSORS with the BAUER BLP™3 Series rotary screw air compressor.

BOGE America showcased the S 46-4 LF N for the first time, a new VSD rotary screw air compressor in the BOGE S-4 Series. The series offers models ranging from 60-200 horsepower (hp) and features a premium airend developed in-house. "We've optimized the efficiency of the airend and have created a quiet machine that's well-priced," said Kevin Miller, Sales Director. BOGE also highlighted its sister company INMATEC's nitrogen and oxygen generators offering purity up to 6.0 for N_2 and up to 95% for O_2.

Brian Stober and Joseph Pollitt of BOGE America (left to right) displayed an S 46-4 LF N VSD rotary screw air compressor.

The Compressed Air and Gas Institute (CAGI) was on hand to discuss the organization's January 2025 partnership with Compressed Air Challenge, with CAC becoming CAGI's education foundation. CAGI introduced the Certified Compressed Air System Specialist certification a few years ago, and the Certified Compressed Air System Assessor certification more recently. As the organization's education foundation, CAC will help professionals prepare for those exams. "The integration is going to help compressed air professionals set themselves apart by associating themselves with the leaders in the industry," said Matt Smith, President, CAGI, adding it will raise the level of education and professionalism across the industry.

FS-Curtis highlighted the ECO-Rotary line of air- or water-cooled rotary screw air compressors introduced earlier this year. This water-injected line creates its own water from an integrated compressed air dryer, providing a constant supply of cool water for the compression area. The series ranges from 20-150 hp and delivers 125 psi. "The condensation from the compressed air dryer gets recycled through the system," said Kyle Trandum, Product Manager. "The condensation that comes off the dryer is pure water, so you don't need to run it through an oil-water separator."

Nicholas Durazo, FS-Elliott (right), met with Raymond Hooks, Phillips 66 (left), at the FS-Elliott booth.

FS-Elliott showcased a centrifugal air compressor design that allows for the quick removal of the airend, as well as a program that stores and maintains replacement airends for customers to ensure quick replacements when needed. "That takes your downtime from weeks or months into days," said David Sleeman, Director of Aftermarket Sales.

GlobalVac & Air displayed a facsimile of its mobile engineered systems. The company assembled all the components, pretreated the air and built a mobile mechanical room. This mockup was displayed for the first time. "Mobile engineered systems are becoming more popular because it's so

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expensive to build actual physical space in a plant. You need engineers, contractors, surveyors and permits. When you build those systems, all that is negated. It just shows up completed," said Bob Littman, Vice President of Sales.

Kaeser Compressors showed its ability to provide manufacturer-designed and -built packages containing full compressed air systems. Systems can be created as skids or weather-proof enclosures. All work is done in-house. Plants can purchase the compressed air system or opt for compressed air-as-a-service. They can also sign up for regular monthly maintenance checks. "We've been a partner with *Compressed Air Best Practices* since the magazine began," said Michael Camber, Marketing Services Manager, Kaeser Compressors. "We feel it's important to be here. We have colleagues who attend the conference sessions for learning and presenting. It's a way to keep tabs on what's going on in the market."

Sauer Compressors USA brought a reciprocating compressed air booster to its booth. Model 4399, part of the company's Hurricane line of high-pressure compressed air boosters, has three stages and four cylinders and is capable of 1668-5075 psig at 18-70 scfm. The company's goal was to build awareness about the role of a booster in a compressed air system. "Often, a facility will have normal low-pressure shop air, but it will have an application that needs much higher-pressure air than its current air compressor puts out," said Sean Dempsey, Southeast Regional Sales Manager. The company's compressed air boosters can be rented, allowing customers to prove a concept without spending capital dollars.

South-Tek Systems had multiple new hardware releases in its booth, including the N_2GEN-FLEX line of modular nitrogen generators. These pressure-swing adsorption (PSA) generators can be equipped with two to 10 towers, all providing up to .99999% nitrogen purity. The system offers an efficiency gain compared to twin tower designs. "You might get a 25 psi pressure drop across a twin-tower nitrogen generator. This is only a 5 psi pressure drop," said Dustin Parscal, National Sales Manager. The company also displayed its first line of air compressors, introduced earlier this year. It includes 5-600 hp, single-stage and VSD, air-cooled

Elizabeth Fleming (left) and Bob Littman (right) of GlobalVac & Air showed the company's mobile engineered system to Andrea Fabris, Sales Area Manager, Josimo (middle).

Michael Camber, Kim Pulford, Tareq Saasaa and Tim Pickering (left to right) of Kaeser Compressors.

Kyle Ricks, Chuck Westhofen, Patrick Lamon, Dawn Ryan, John Temple, Crystal Wilson and Sean Dempsey (left to right) of Sauer Compressors.

Austin Wilkins, Larry Colley, Bob Groendyke, Bruce McFee, Scott Seibert, Brice Schultz and Drew Benner (left to right) at the Sullivan-Palatek booth.

and water-cooled rotary screw air compressors capable of 100-218 psi, and one series capable of 290 psi.

At Sullivan-Palatek, the focus was on isentropic efficiency, engineering many small improvements – with airend profiles, total package pressure drop, specific power and rotor profiles – that add up to meaningful results. This focus can be seen in the company's recently released rotary screw air compressors: the SP16+ series (75, 100 and 125 hp, oil-flooded VSD) and the SP20+ series (125 and 150 hp, fixed speed and VSD). "We know we've had a reliable, dependable product for many years," said Bob Groendyke, Senior Product Marketing Manager. "We're now increasing isentropic efficiency to present an even better product."

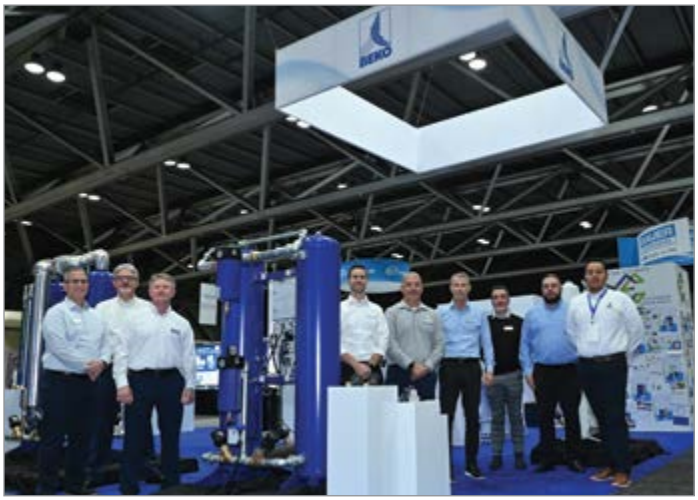
Co-owners of Tamsan-USA Compressors Kyle Green and Josh Wamser highlighted the TVK 15-S package unit, which features a 15 hp, servo-driven rotary screw air compressor with a refrigerated dryer and an inline filter. It's tank-mounted on twin torpedo tanks, making it lower to the floor and easier to access for service. Also at the booth was a TVK 60-S, a 60 hp, direct drive, base-mounted, servo-driven rotary screw air compressor. "The owners and engineers of this company are service technicians. We understand the trials and the work, as well as the expectations and needs of service people," said Wamser.

Tamturbo highlighted the benefits of its touch-free centrifugal air compressors. Built with active magnetic bearings, these air compressors' impellers levitate in the air, with strong magnetic forces keeping them in place. Non-contact seals and non-contact rotation keep parts from wearing out, with the only consumable material being the air intake filter. The company offers air compressors from 240-1890 cfm, 30-130 psi and 42-470 hp. The company also showed its controller that lets air compressors work in parallel. Cost savings of 15-20% are typical, it finds. "A sustainable air compressor with the highest capital expense to purchase can be by far the lowest in terms of operating costs and total cost of ownership," said Hannu Heinonen, Vice President, Americas.

Compressed Air Treatment and Condensate Management

Located at the center of the EXPO floor, the BEKO Technologies booth was a hive of activity. Much of the attention went to the company's recently released DRYPOINT RX refrigerated compressed air dryers. Fully redesigned, this line features a heat exchanger offering improved compressed air

Thomas Wamser, Lisa Lewis and Kyle Green (left to right) of Tamsan-USA Compressors.



Brian Speed, Randall Corthouts, Chris Gibson, Kyle Shipman, Tad Carriveau, Tilo Fruth, Adrian Fernandez, Josh Borrego and Miguel Ceron (left to right) of BEKO Technologies.

Jay Mottley, Juho Ojuva and Hannu Heinonen (left to right) of Tamturbo.

Mirko Krebs, Heike Krebs and Holger Krebs (left to right) of KSI Technologies.

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flow, pressure drop and refrigerant distribution. All the models in the line include pressure transducers. "You don't have to connect refrigerant gauges to see what the refrigerant is doing," said Josh Borrego, Senior Technical Service Specialist. "If you don't have a refrigerant-certified technician and you're having a problem with the system, you can troubleshoot without breaking EPA guidelines for connecting to a refrigerant circuit."

KSI Technologies showcased its TPK25 dew point meter, recently released in the U.S. market. "It's a three-in-one solution that measures the dew point, temperature and pressure in one neat, little unit," said Mirko Krebs, President. "It has a replaceable sensor chamber, so you don't need to send it in for recalibration. The TPK25 is designed with refrigerated dryer systems in mind, offering a calibrated range of -4°F to 68°F PDP (-20°C to 20°C) and operating pressure of 0 to 232 psig.

Mikropor America displayed its wide range of cleanup compressed air equipment. An updated version of one of the company's flagship products, the MK-US-Pro Series of refrigerated compressed air dryers, was recently released. The series supports air flow capacities from 10-5,000 scfm, and uses low-GWP R-513A. "We put a 10-year warranty on this heat exchanger, upgrading it from a five-year," said Jeff Crutchfield, Area Manager. A variety of desiccant compressed air dryers were at the booth, including a MEHD Series externally-heated dryer, an MBL Series heated blower purge dryer and an MMD-VP Series modular purge heatless desiccant dryer.

Eric Bush, Todd Nelson, Jeff Crutchfield, Huseyin Celik, Hallie Utsler, Mike Kinnucane, Volkan Ayhan, Patrick Lapalme and Allan Hoerner (left to right) of Mikropor.

Walker Filtration presented condensate management products, including zero-loss and timer drains, as well as mechanical float drains. The company offers original equipment such as its CondenSmart Drain Series and the SmartSep Oil-Water Separator Series, but also provides variations of aftermarket elements for OEMs. "Energy efficiency and sustainability is something people are looking for, so we've focused on that," said Simon Taylor, General Manager. "We're creating energy-efficient products and sustainable products. We're also removing a lot of the PFAS, the forever chemical, from our materials."

Leak Detection, Nitrogen Generators, Instruments, Piping

The CS INSTRUMENTS booth displayed the company's latest leak detector, the LeakCam 600. With only 64 ultrasonic microphones instead of the 128 typically used, it's able to keep costs down, yet quality is comparable. The leak detector includes a high-resolution 13 megapixel camera, laser measuring and advanced leak reporting with a smartphone-like interface. "We're able to take up to two pictures per leak, which is a new feature," said Martin Zeller, Managing Director. "Sometimes in a leak audit, you need to take a picture from far away, but that doesn't give the auditor enough information. Now, you can take a second picture for the same leak and attach it."

Prevost's Demo Truck was the centerpiece of its booth. "We offer technical products, so we need our customers to see, touch and test our products," said Nicolas Maupillé, Sales Director. The Demo Truck allows people to see all of the company's products and assemble and test a small piping system. Prevost also previewed a new product launching in 2026: AMS, an air monitoring system. This smart valve is able to measure temperature, dew point, humidity, pressure and fluoride.

Jesse Yates, Simon Taylor, Ben Laiweneek and Amy Oligeri of Walker Filtration (left to right).

RJ Bennett, Alia DeLong, Janet Goodwin, Enrico Capetanis and Martin Zeller (left to right) of CS Instruments.

Austin Hensley, Carlo Gatti, Chucody McNiven, Chris Rapp and Nicolas Maupillé (left to right) of Prevost with the Prevost Demo Truck.

Parker Beck, Chris Adams, Nathan Eisel, Leslie Noel and Jon Jensen (left to right) of SMC.

Matt Roden, Jan Hoetzel and Marius Hoetzel (left to right) of SUTO iTEC.

Holly Wysong, Joe Koenig, Derrick Taylor, Michael Heine and Rebeka Nekolová of Unipipe (left to right).

"We've had a good time at the show. We've had good quality leads and good conversations with customers, said Jon Jensen, National Product Sales Manager, SMC. Many of those conversations were about monitoring equipment that lets compressed air system operators monitor KPIs, including dew point, temperature, pressure and flow. The company promoted scalable wireless systems, letting plants add monitoring without huge costs. Wireless systems also let plants stream information from areas that were previously cost-prohibitive to reach. Better monitoring leads to increases in productivity and quality, as well as decreases in scrapped product.

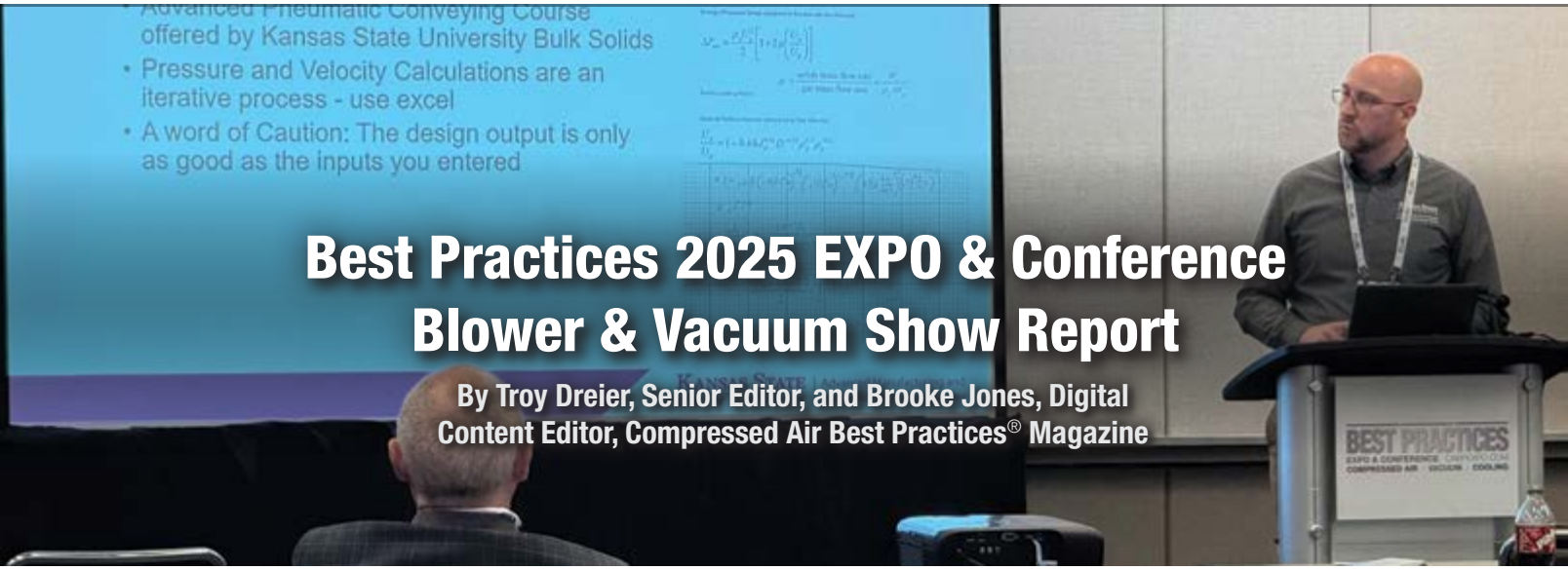
SUTO iTEC exhibited its S600 portable compressed air purity analyzer, an all-in-one device that measures particle concentration, dew point, oil vapor, temperature and pressure. "We've been acquired by Atlas Copco, but, for our customers here in the U.S., nothing will change. The team will remain the same, but we'll have a bit more horsepower and speed to the market with our ideas," said Jan Hoetzel, Managing Director. Hoetzel shared there are new products on the horizon for 2026, including mobile dew point sensors and flooring sensors.

Unipipe Solutions demonstrated the large size of its piping material, with eight-inch aluminum pipe on display. "With Unipipe, there's no crimping, no grooving, no special tools and no extra hardware," said Michael Heine, Director of Marketing. "Our piping is all plug-and-play. Plus, it's reusable, so you can take it apart and reconfigure it." The company also highlighted UnipipeHP, its aluminum piping system designed for pressures exceeding 232 psi up to 1,015 psi.

The Best Practices 2026 EXPO & Conference will take place October 13-15 in Indianapolis. Mark your calendar now, as it's bound to be a must-attend event. The staff of *Compressed Air Best Practices Magazine* gives a heartfelt thank you to all participants and attendees who made this year's show such a success. BP

To learn more about the ***Best Practices 2026 EXPO & Conference*** in Indianapolis, visit https://cabpexpo.com.

To read similar ***Compressed Air System*** articles, visit https://www.airbestpractices.com/technology/air-compressors.



Best Practices 2025 EXPO & Conference Blower & Vacuum Show Report

By Troy Dreier, Senior Editor, and Brooke Jones, Digital Content Editor, Compressed Air Best Practices® Magazine

The Best Practices 2025 EXPO & Conference contained plenty of sessions for industrial vacuum, blower and aeration blower professionals, including conference tracks, workshops devoted to pneumatic conveying and blower engineering and original equipment manufacturers on the EXPO floor.

Aeration Blowers

A conference track titled "Fundamental System Design, Control and Component Selection" brought efficiency to the forefront of the conversation. Bob Kisler, Sales Manager, Hoffman & Lamson, explained how most open valve (MOV) control can lead to major aeration blower efficiencies. To maintain an aerobic biological process, it's necessary to maintain the appropriate dissolved oxygen (DO) concentration in the basin. Inadequate DO can result in poor treatment, but excess DO wastes energy without improving treatment. "For most pressure loop controls, the demand of the tank can change. That DO changes depending on the influx happening during the course of the day, week and year," explained Kisler. Control of the DO concentration is the most cost-effective method of optimizing aeration energy. A properly operating DO and aeration control system can save 25-40% of the energy used by manually controlled systems.

Attendees learned how to improve energy efficiency and reliability through pump system optimization from Matthew Derner, Senior Manager, Education and Training, Hydraulic Institute. His presentation covered a critical skill set required to analyze and optimize pumping systems by reducing energy and maintenance costs. He reviewed pump system economics, optimization based on lifecycle costs and standardized processes to assess and improve pumping systems.

Industrial Vacuum and Blower Systems

The Pneumatic Conveying Workshop, led by Jonathan McPherson, Director of Advanced Manufacturing and Bulk Solids Technology Center, Kansas State University, offered instruction on pneumatic conveying fundamentals plus an introduction to basic calculations and sizing. McPherson included his own rules for pneumatic conveying. "Convey completely flat or completely vertical," he said, never at an incline. Also, avoid "back-to-back elbows," because material needs time to re-accelerate after an elbow turn.

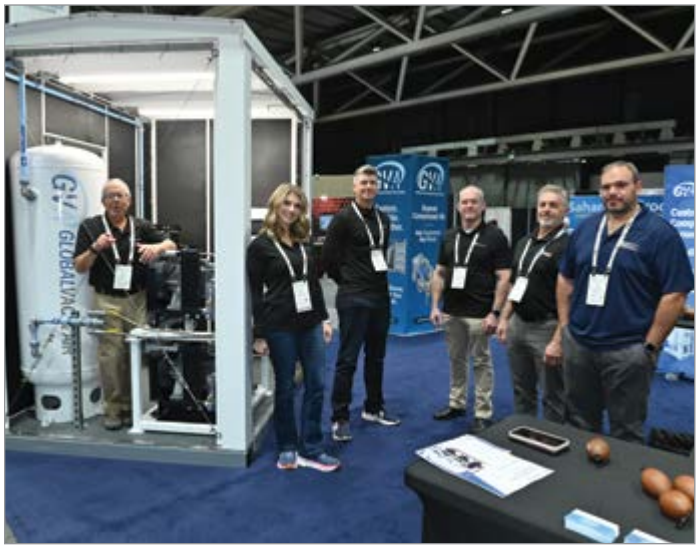
The Blower Engineering Workshop offered five hours of foundational and advanced blower engineering instruction from Julie Gass, P. E., Lead Process Mechanical Engineer, Black & Veatch. "When you talk about running different technologies in parallel, that needs to be considered in design," Gass said, warning about the possibility of surge. "If a plant says, 'We want to add a blower but we never plan to operate it in parallel with our existing blower, which is a different technology; we'll run them at separate times,' okay, great. But if, after it's installed, they decide to run them in parallel, that doesn't necessarily work. It has to be planned for during design."

On the EXPO floor, GlobalVac & Air, part of Flow Control Group, showcased a duplex, dry-claw, lab-based vacuum system that consists of two 5 hp vacuum pumps with a solid-state PLC-driven controller. "It's called a purge system, which

Bob Kisler of Hoffman & Lamson delivered an aeration presentation titled "Most Open Valve Control Drives Major Aeration Blower Efficiencies."

Julie Gass, P. E., Lead Process Mechanical Engineer, Black & Veatch, led the Blower Engineering Workshop.

Above: Jonathan McPherson, Director of Advanced Manufacturing and Bulk Solids Technology Center, Kansas State University, led the Pneumatic Conveying Workshop.



Bob Littman, Elizabeth Fleming, Brett Looney, Jason Cravy, Larry Wilson and Eric Painter (left to right) of GlobalVac & Air.

Joseph Chloe and Bruce Kwon (left to right) of Turbowin by Easyflex with the company's supersonic impellers.

allows the pumps to clean themselves when they're coming off operation. When one pump is scheduled off, the other pump comes on. The one most recently out of operation will run with fresh air purging through. It cleans off oil and whatever else is in there," explained Bob Littman, Vice President of Sales. The other vacuum system featured a single pump and tank with a simpler controller (non-PLC), and was designed for a small lab or small vacuum application.

Kaeser Compressors was ready to talk about the three blower options it carries: lobe blowers, screw blowers and turbo blowers. Lobe blowers are sometimes purchased by OEMs as basic packages and sometimes fully integrated with cabinets, noise insulation and a controller that connects to plant systems. Screw blowers are typically fully integrated into cabinets. Both lobe and screw blowers are popular with wastewater plants, with lobe blowers selected for intermittent use and screw blowers when demand is constant. The third type, turbo blowers, is chosen for larger jobs and offers better isentropic efficiency. Pneumatic conveying is the company's biggest blower market. A small but growing number of customers purchase blower systems as enclosures. "In a remote location, there might be plenty of space, but delivering blowers in a weather-proof enclosure can save a lot of time in construction and commissioning," said Michael Camber, Marketing Services Manager.

Ryan Billings, Evan Sawyer and Will Schwerdtmann (left to right) of NAVAC.

NAVAC displayed its vacuum product lines, which include UniDrive (single-stage rotary vane vacuum pumps), EcoDrive (two-stage rotary vane vacuum pumps), HelixDrive (dry screw vacuum pumps), BoostDrive (blowers packaged with vacuum pumps) and ShieldDrive (two-stage magnetic coupled drives with no oil leakage). For rough vacuum applications in manufacturing plants, the UniDrive, capable of 29.5"Hg, is typically the best fit, although the company sees the HelixDrive also being a contender. "What's unique about the HelixDrive is it comes with a special coating on the screws, and it's designed to handle moisture really well," said Evan Sawyer, Director of Product – Vacuum Technology. "We're slowly starting to take this vacuum pump technology and apply it to different industries than it would typically be sold into. We're starting to drive it into the rough vacuum market to get more exposure to applications that require dry technology but need to handle high moisture content." These industries include freeze-drying and maple syrup production.

Turbowin by Easyflex, a manufacturer of oil-free air compressors and blowers, highlighted the supersonic turbo motor used in its products. The motor is frictionless, oil-free and maintenance-free, and offers dual cooling with motor temperature dropping up to 77°F (25°C). Bruce Kwon, Sales Director, showed the products on display. "This is our impeller, which is our core technology that makes our turbo oil-free engine happen." The company's WL Series is a line of centrifugal turbo blowers with capabilities ranging from 10 to 600 hp and 5.8 to 17 psi. BP

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Best Practices 2025 EXPO & Conference Chiller & Cooling Show Report

By Troy Dreier, Senior Editor, and Brooke Jones, Digital Content Editor, Compressed Air & Cooling Best Practices Magazine

The Best Practices 2025 EXPO & Conference saw a record number of cooling system providers exhibit, a fact appreciated by the many cooling reps in attendance.

"It's been beneficial," said Spencer Kaufman, Sales Engineer, Midwest Machinery. "There are decision-makers and people here who do a lot of design work, not only in our market but all across the country. The conversations we've been having have been very deep – often up to 15 minutes. The quality of the conversations has been really good."

Cooling Towers

The Industrial Cooling Water Workshop taught attendees best practices for optimizing energy and saving water through lecture and interactive classroom exercises. Experts from EVAPCO, SPX Cooling Tech, 3M and Integrated Services Group oversaw the workshop.

"End users have a lot of heat transfer options to choose from, and no single solution works for every owner, installation and location every time. So how can owners and engineers make educated decisions?" asked instructor Troy Reineck, Business Development Manager, EVAPCO. "Manufacturers need to provide quantifiable data on unit performance, annual and peak daily water and energy consumption of all options by using analysis tools."

Rob Tanner of Johnson Controls told attendees how to capture waste heat.

Afterwards, instructor Ryan Schmidt, Mechanical Engineering Specialist, 3M, shared, "I was impressed by the dialogue between our guests and panel. Valuable insights and commentary flowed both ways, and I'm confident we all left with some fresh ideas and perspectives."

"It was nice to hear from the actual manufacturers of equipment and learn about the selection process and different technologies for applications," said Hemant Tiwari, Energy Engineer, St. Jude Children's Research Hospital, one of the attendees. "I learned more about dry cooling and adiabatic cooling, which is interesting because of the lower water consumption or no water consumption, and how these can be integrated into a hybrid system with normal cooling towers."

In a Conference Track 2 presentation on cooling towers in industrial plants, three members of the Cooling Technology Institute presented. Tom Kline, Senior Technical Director – Concrete Repair Solutions, STRUCTURAL TECHNOLOGIES, covered rotating and equipment foundation repair. "We have to make sure to remove all of the contaminants from the top surface, especially when we lift off a machine that's had problems. We need to get oil and lubricants away from the concrete because it will weaken it over time," said Kline.

Troy Reineck shared the importance of CTI certification for dry and adiabatic coolers. Fan-generated noise remains a significant operational challenge for cooling towers. As regulatory pressure and community sensitivity to environmental noise increase, operators must address fan noise without compromising cooling performance or efficiency. Tony McCauslin, Vice President of Sales, Moore Fans, provided strategies to control sound.

The Plenary Session began with an overview of the Cooling Technology Institute's mission and a program update, delivered by Jim Baker, President, CTI. The session brought attention to opportunities manufacturing plants can invest in to reduce energy and conserve water in their process cooling/HVAC systems.

Rob Tanner, Marketing Director – Applied Equipment, Johnson Controls, explored waste heat, an often untapped resource to improve a facility's energy efficiency and cut costs. "Low-quality heat recovery is where the opportunity exists. The standard definition of low-quality heat is somewhere between 100°F and 480°F (38°C and 249°C)," said Tanner. "But I want to focus even lower, under 50°F (10°C). Let's look at the chilled water system, particularly the chilled water return, and the opportunities to capture heat out of this low temp." Monte Hackwith, Infrastructure Specialist, ALPLA North America, turned the conversation to water and chemical conservation in process cooling loops.

The Cooling Technology Institute has been committed to advancing the technology, design and performance standards of cooling towers and related systems since 1950. At its EXPO booth, CTI continued its mission of educating people about heat transfer and today's latest technologies

Above: Ryan Schmidt, 3M Company, presented at the Industrial Cooling Water Workshop and in the Opening Session.

available. "There are so many resources with current information available through CTI," said Frank Foster, Membership Committee Chair. "Everything we do is reevaluated and updated every five years."

Cooling Tower Depot attended to showcase its abilities constructing evaporative cooling towers. It provides custom fabrication, repair and upgrades for small and large jobs alike. The company has divisions focused on light industry, heavy industry, power generation facilities and refineries. Based in Golden, CO, it has 250 employees in offices across the country. It constructs cooling towers from fiberglass, wood and concrete, but noted the industry is trending toward fiberglass. "Fiberglass is anti-corrosive, anti-conductive and fire-retardant. It's impervious to just about anything you can throw at it," said Brian Fuqua, Regional Sales Director.

EMCOR Services Fagan, based in Kansas City, promoted its comprehensive mechanical contracting and maintenance services for commercial, industrial and institutional projects. "A lot of manufacturers are pushing their lines very hard to give as much product as they can. If they have a line that has expansion opportunities, they're pushing to do it, and adding second and third shifts, which increases the wear and tear on the machines," said Samantha Howell, Director of Sales. "Reliability is important. Scheduled shutdowns and doing maintenance on time are really important."

Moore Fans manufactures fans that operate in air-cooled heat exchangers, cooling towers and radiators. On display was its standard core fan. "On our larger, Class 20000 Fan we use for field-erected cooling towers, we're increasing the diameter up to 40 feet, which was previously only 36 feet," shared Spencer Ward, Business Development Representative. "The benefit of having a larger aluminum fan is the larger the diameter, the greater the fan efficiency." The company recently opened a 45,000-square-foot addition to its factory in Marsland, MO.

SPX Cooling Tech, manufacturer of Marley cooling towers, didn't have to travel far from its Overland, KS, headquarters for the EXPO. While there, it talked to attendees about its full suite of products, which includes not only evaporative cooling towers, but water-saving dry and adiabatic cooling systems, as well. Saving water was a popular topic at the booth, with many plants interested in systems for their water-cooled air compressors. "We're well recognized for open cooling towers, but now, in recent years, with water-saving systems, we need to get the awareness out there, and I think

Drew Lawson and Brian Fuqua (left to right) of Cooling Tower Depot.

Jerome Jennings (left) of SPX Cooling Tech and Spencer Kaufman (center) of Midwest Machinery.

people will come for them. They represent the industrial quality Marley has been known for for decades," said Jerome Jennings, Regional Sales Manager.

Chillers and Closed-Loop Cooling Systems

In the conference's Opening Session, Mike Filler, Sustainable Systems Sales Leader, Trane, explained how thermal energy storage produces and stores ice during off-peak hours to reduce peak demand. "These systems act like a battery. We're going to charge the cooling system typically at night when the building's cooling loads are lower. Then, we discharge the system during the day or whenever power is most expensive or dirtiest," Filler said.

The Track 1 conference session "Fundamental System Design, Control and Component Selection," went back to the basics with efficiency being a major theme. Clayton Penhallegon, Jr., Principal Engineer, Integrated Services Group, started the conversation on chiller efficiency. "When selecting a chiller for high efficiency, remember these steps: determine the requirements, prepare the chiller conditions document, review potential choices for possible types and prepare a formal specifications document for specific design chillers," said Penhallegon.

CTA highlighted a product that's just been introduced to the U.S. market, a refrigerated dryer with propane as the refrigerant. This product was created to comply with the AIM Act, which targets an 85% phasedown of the production and consumption of HFCs in the U.S. by 2036. "There's no risk using the propane refrigerant because it's a completely sealed circuit with a double-walled heat exchanger to avoid any contamination between the compressed air and refrigerant circuit," said Thierry Deschenes, Head of International Sales. CTA brought a plug-and-play liquid chiller for process cooling systems, which can be connected directly, meaning there's no need for installation, just piping. It has a capacity of 200 tons.

HydroThrift spoke to potential customers about the reduced maintenance required with its closed-loop cooling systems. Filled with a water/glycol mix, these systems can recirculate the same cooling fluid for 10-15 years. HydroThirft's CD system is closed loop and its CE system is closed loop evaporative. Its PCX system, a closed-loop system using an external water source, can be used to convert an open-loop system to a closed-loop system. The company also highlighted its recently released control system. "Last year, we introduced a new control system called Advanced Control

Best Practices 2025 EXPO & Conference Chiller & Cooling Show Report

Thierry Deschenes and Adrien Perez of CTA (left to right).

Keith Beatty of HydroThrift.

Hamilton Terrell and Don Joyce (left to right) of Industrial Water Chiller.

Jeff Crutchfield of Mikropor America with a 20-ton, water-cooled chiller that uses R-410a.

System," Mike Wlodarski, Regional Sales Manager, said. "It provides more information on the operation of the cooling system. More information gives you better predictability on what you need to do for maintenance."

The people at Industrial Water Chiller had several conversations about low-GWP refrigerants and the transition happening now with industrial chillers. Plant operators want to know how to prepare for the transition. As of January 1, 2026, new industrial chillers need to use refrigerants with a GWP of 700 or less. The company started engineering its new systems as soon as the change was announced, so it wouldn't get stuck with out-of-date inventory. Its new chillers use R-54B, R-513 and R-32. Maintaining chillers with low-GWP refrigerants is an engineering challenge. "If we used the old components, we would have lost efficiency, but by changing the whole thing from the ground up, we've prepared it the proper way," said Don Joyce, National Sales Manager. "Some refrigerants lose 30% capacity. Instead of running them at 10 hp, we run 13 hp."

Mikropor America offers chillers from 1 ton up to 72 tons and this year its booth included a 20-ton, water process chiller from its MCHILL Series that uses R-410a. "R-410a is a three-gas blend, and this product is the only product we use this refrigerant on. Our other chillers use R-134a, and now we're moving to R-513A," said Jeff Crutchfield, Area Manager.

Supply chain disruptions might be inescapable, but SMC wants to make sure its customers aren't delayed. "We're expanding our ability to manufacture temperature control units and thermal chillers here in the U.S. so we're able to meet our customers' demands," said Jon Jensen, National Product Sales Manager. "It's part of our business continuity plan that we're duplicating production capacities, so if something happens in one part of the world, we can be back up to business in a couple of weeks. Our customers aren't going to suffer because of some unexpected event." Under this new business strategy, the company's existing facilities in Noblesville, IN, will gain new production lines and increased production capacity. BP

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THE MARKETPLACE

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