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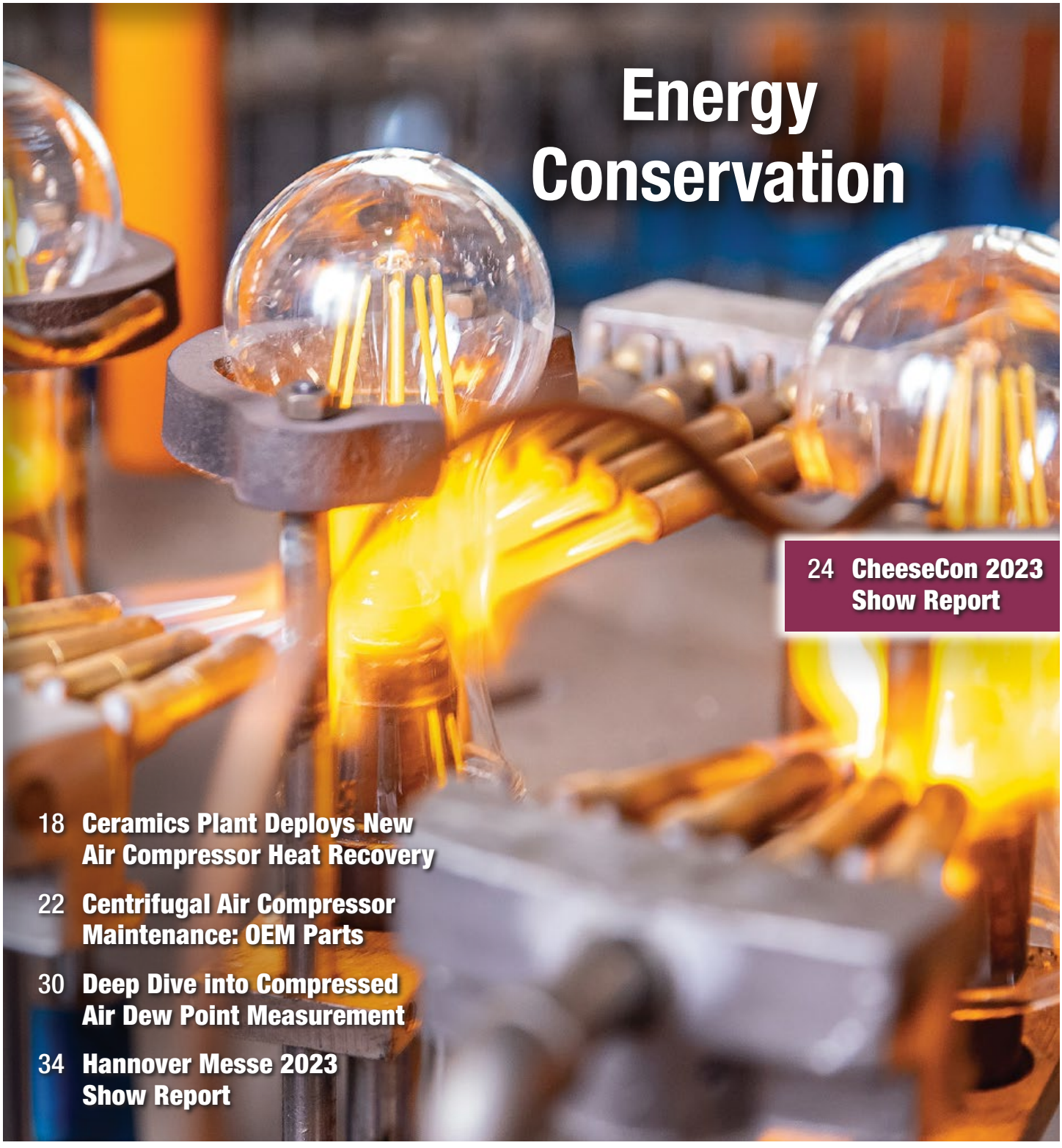

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FROM THE EDITOR

Energy Conservation

Air compressor heat recovery projects continue to gather momentum. We have received an interesting article, sent to us from Poland and written by Mateusz Bartczak, detailing their heat recovery research and a case study at a sanitary ceramics plant.

The Compressed Air & Gas Institute (CAGI) has sent us an excellent article titled, "Centrifugal Air Compressor Maintenance: The Importance of OEM Parts." We thank the member companies of the CAGI Centrifugal Compressor Section (Atlas Copco Compressors, FS-Elliott, Hanwha Power Systems, Ingersoll Rand, Sullair) for sending us this information.

I was pleased to visit the 2023 CheeseCon Show co-produced by the Wisconsin Cheese Makers Association (WCMA) and the Center for Dairy Research. The show report provides a snapshot of those engaged in providing compressed air quality testing to ensure safe cheese production. This trip formed part of my research into cheese manufacturing, driving towards an attempt to define compressed air, vacuum, nitrogen and chilled water best practices for this sector.

Speaking of compressed air quality, we are pleased Vaisala's Antti Viitanen sent us an article titled, "A Deep Dive into Dew Point Measurement in Compressed Air Systems." I appreciate this article as it dives into factors impacting dew point measurement accuracy.

It was good to visit the Hannover Messe for the first time since COVID-19 hit. The compressed air industry is always evolving with new company initiatives and product developments. I hope you enjoy my show report.

Staff members here (Patricia Smith, Kimberly Vickman, Patty Mackey, Clare Heinl) have enthusiastically launched the Women in Compressed Air, Vacuum and Cooling (WCVC) Networking Group. The response to join this group has been exciting! Please check out the announcement on page 11 of the appointment of Dawn Ryan, from JHFoster, to the WCVC Executive Committee and also see the page 12 ad on an upcoming "WCVC Women in Leadership" webinar.

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

RODERICK M. SMITH
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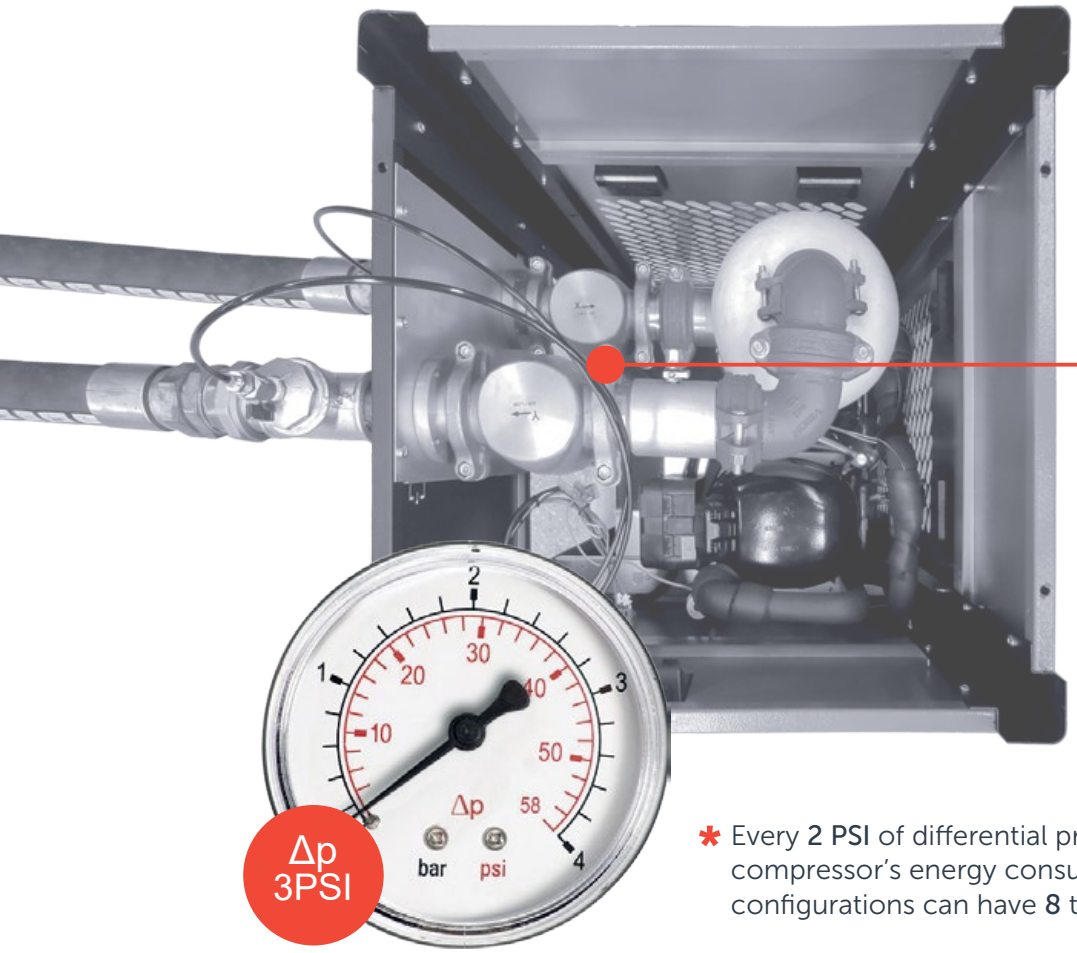

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Compressed Air Industry News

FS-Elliott Invests $2 Million with Expanded Space and New Technology

FS-Elliott, a worldwide leading provider of reliable centrifugal air solutions, has worked with Industrial Engineers to upgrade its layout design for increased efficiency. After a $2 million investment, they have expanded the manufacturing and warehouse space to 180,000 square feet and added two new Mazak Integrex machines.

With the full 5-Axis capability, the Integrex machines have reduced a 6–12-hour multi-machine runtime to a single machine one-hour per part average. The recent addition of a robotic arm further automates the new machining process, an even more efficient way to produce parts. The robotics system features an agile manufacturing robotic arm with a 300lb lifting capacity.

To reduce lead time, the Mazak Integrex machine cell will replace aging machinery, eliminate waste steps, and shorten the production process. This new technology can run with minimal operator interaction for up to two 8-hour shifts. Using the Mazak Integrex, the dual-spindle mill/turn machine centers can turn raw material into a finished part within a single process. Secondary to the original machining process improvements, the new machines will also have multipart capabilities providing additional capacity support in other cells throughout the machine shop. Impeller machining is fully supported in the new machine centers and provides additional efficiencies with these parts. Having the full 5-Axis capabilities, FS-Elliott is committed to full impeller machining with the new machine centers by the end of 2023.

After a $2 million investment, FS-Elliott has expanded the manufacturing and warehouse space to 180,000 square feet and added two new Mazak Integrex machines.

"We are excited to announce this investment in our U.S. manufacturing operations," said John Sinclair, Director of Quality and Operations. "By upgrading our factory space, we can increase production efficiency and reduce lead times for our customers. Continual process improvement by means of waste elimination and new technology while maintaining the highest quality standards is the foundation of our operations. Our highly skilled team will continue to work hard to provide high-quality compressed air solutions our customers can rely on."

FS-Elliott is responsible for the engineering, designing, and manufacturing Polaris and PAP Plus centrifugal compressors. To ensure the highest quality parts and machines are produced, they are committed to a broad range of inspections and full testing of all machines before shipment to their customers. FS-Elliott will continue to oversee these operational improvements and support innovative compressed air solutions worldwide.

About FS-Elliott

FS-Elliott is a global leader in the engineering and manufacturing of oil-free, centrifugal compressors, with operations in over 90 countries. For 60 years, FS-Elliott has combined commitment to quality with advanced technology so our customers can increase their productivity and lower system operating costs. For more information, visit www.fs-elliott.com.

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ABB Invests $170 Million in the US

ABB is accelerating its growth strategy in the United States by investing approximately $170 million and creating highly skilled jobs in manufacturing, innovation and distribution operations. ABB is committed to growing in the US by investing in its electrification and automation businesses that meet increased demand from industry-leading customers, while supporting the clean energy transition and the trend towards reshoring of production. This commitment is highlighted by today's pouring of the concrete foundations for a greenfield drives and services facility in New Berlin, Wisconsin. The US is ABB's largest market, comprising 24% of the company's annual revenue.

ABB will open a drives and services manufacturing facility in New Berlin, Wisconsin.

"The United States is critical to ABB's success as a market that will continue to grow and benefit from our product portfolio that enables the transition to a more energy-efficient future," said Björn Rosengren, CEO of ABB. "Currently, 85% of ABB's sales in the US are from products produced locally, which provides customers with a more secure supply chain and keeps good-paying manufacturing jobs in America."

ABB technology touches every sector of the economy, from transportation to utilities to buildings. Recently passed legislation like the Inflation Reduction Act, CHIPS Act, and Infrastructure Investment and Jobs Act, gives ABB confidence to invest in manufacturing capacity, distribution systems and technology innovation to bring products and services closer to customers.

Investment projects underway across the US include:

- New Berlin, Wisconsin: Opening of Drives and Services manufacturing facility will increase US production capacity of industrial electric drives and provide additional customer services. The business manufactures a wide range of AC variable frequency drives and controls which reduce energy consumption in buildings

and industrial applications in the US market. The nearly $100 million greenfield investment is expected to be completed in late 2024 and is replacing a neighboring existing facility, which employs approximately 720 workers. Some 100 new jobs will be added over the next three years.

- Memphis, Tennessee: Investing $3 million in the opening of an Installation Products Research & Development Lab and Innovation Center to accelerate development of new products. ABB remains the seventh-largest private employer in Memphis.
- Atlanta, Georgia: Opening of packaging and logistics facility for end-to-end robotic automation solutions in warehouse and distribution, retail, and logistics industries. This $2 million investment will open in 2023 and create approximately 15 jobs.
- Albuquerque, New Mexico: Previously announced $40 million investment in a new facility to manufacture Elastimold, the leading brand for underground cable accessories, to support strengthening a more sustainable US electrical grid.

It underpins ABB's commitment to improve reliability and resilience of the US infrastructure and assure greater safety for the American consumers, businesses, and communities. The investment will create 55 new jobs and will be completed by 2024.

- Auburn Hills, Michigan: Previously announced expansion of North American robotics headquarters and manufacturing facility as more customers turn to automation to build resilience while improving efficiency and flexibility as part of the near and reshoring of production. The $20

Compressed Air Industry News

million investment will create 72 jobs and be completed by the end of 2023.

- Lehigh Valley, Pennsylvania: Previously announced opening of Installation Products Division Northeast Distribution Center in 2023. This more than $4 million investment will create more than 100 jobs and further regionalize ABB's global supply chain to help reduce delivery times of high-demand electrification products to contractors by up to 50%.

- Columbia, South Carolina: Previously announced opening of electric vehicle charger manufacturing facility to build up to 10,000 chargers per year, ranging from 20kW to 180kW in power, to support operators building the national charging infrastructure. ABB E-mobility's investment will create over 100 jobs.

"The Inflation Reduction Act is triggering investment in clean energy and supporting businesses that can produce technology locally," said Michael Gray, US Country Holding Officer of ABB. "More than ever before, ABB is designing and producing products domestically to serve our US customers, as they move toward more sustainable electric power generation, clean energy manufacturing, electric transportation, and industrial efficiency including carbon capture and storage, as well as methane reduction."

The US federal government projects real gross domestic product to increase 2.5% in 2023, average 2% annual growth between 2024-2028, and grow 2.3% per year during 2029-2032. This projected GDP growth, combined with an estimated global EV infrastructure investment of more than $1 trillion by 2040, gives ABB the confidence to continue investing. ABB projects 25% of global EV infrastructure investment will take place in the US.

Since 2010, ABB has invested $14 billion in US plant expansions, operational improvements, state-of-the-art equipment, products, and people, making it the company's largest market. With approximately 20,000 employees in more than 40 manufacturing and distribution facilities, ABB is investing, growing and serving customers across America through industries that create jobs, encourage innovation and achieve a more productive, sustainable future.

About ABB

ABB is a technology leader in electrification and automation, enabling a more sustainable and resource-efficient future. The company's solutions connect engineering know-how and software to optimize how things are manufactured, moved, powered and operated. Building on more than 130 years of excellence, ABB's ~105,000 employees are committed to driving innovations that accelerate industrial transformation. For more information, visit www.abb.com.

Atlas Copco Acquires an Argentinian Compressed Air Distributor

Atlas Copco has acquired the compressed air business of Asven S.R.L. The company is located in Rosario, in the Santa Fe province. The acquired business has 10 employees and specializes in sales, installation and service of compressed air systems. Asven, which was founded in 1995, is a privately owned company serving industrial companies in the region.

"This acquisition will give us the opportunity to expand our presence in one of the key industrialized areas in Argentina," said Vagner Rego, Business Area President, Compressor Technique.

The purchase price is not disclosed. The acquired business will become part of the Service Division within the Compressor Technique business area.

Atlas Copco Group

Great ideas accelerate innovation. At Atlas Copco we have been turning industrial ideas into business-critical benefits since 1873. By listening to our customers and knowing their needs, we deliver value and innovate with the future in mind. In 2022, Atlas Copco Group had revenues of BSEK 141 and at year end about 49,000 employees. For more information, visit www.atlascopcogroup.com.

Dawn Ryan Selected as WCVC Networking Group Executive Council Member

Best Practices Magazines & EXPO is excited to announce the selection of Dawn Ryan as an Executive Council Member of the Women in Compressed Air, Vacuum & Cooling (WCVC) Networking Group. Dawn is a Project Manager at JHFoster, a compressed air and automation distributor located in Minnesota. She began her career in the industry more than 15 years ago. Dawn started at JHFoster in 2007 and spent 7 years as a Sales and Marketing Coordinator. After showing aptitude and expressing interest in the equipment sales process, she transitioned to the Capital Sales department, where she

Dawn Ryan, Project Manager – Capital Sales at JHFoster, was selected as Executive Council Member, WCVC Networking Group.

Compressed Air Industry News

has continued to make a positive impact. Her customers appreciate her unique solution-minded approach to problem solving.

When accepting this role, Ms. Ryan commented, "I am pleased to have the chance to help bring awareness to the opportunities in the compressed air industry. I'm grateful for the experiences I've had during my career and hope to lead by example. I take pride in developing interpersonal relationships, and thoroughly enjoy the customer-facing aspect of my job. I'm very excited for the chance to network with my peers throughout the industry and hope to encourage others to consider a career in compressed air, vacuum, and cooling."

Join us in our mission to provide women with personal and professional development opportunities including the ability to establish meaningful connections with their peers, gain valuable industry insight to further their careers and improve their leadership and communication skills. Apply for your free membership today at https://cabpexpo.com/womens-group/join-us/. Join our LinkedIn group at https://www.linkedin.com/groups/14183074/. If you are interested in a leadership role within the group and would like to become a member of the WCVC Executive Council, please send an email to Kimberly Vickman, WCVC Secretary at kimberly@airbestpractices.com.

About WCVC Networking Group

The Women in Compressed Air, Vacuum and Cooling (WCVC) Networking Group provides support to women who have chosen or are thinking of choosing a career in the compressed air, vacuum or cooling industries and welcomes individuals from every job function – engineering, marketing, sales, human resources, finance, production and every job in between. The WCVC Networking Group offers quarterly virtual meetings and networking opportunities in the hopes of empowering women in the compressed air, vacuum and cooling sectors. The group will meet in-person annually at the Best Practices EXPO & Conference. For more information, visit https://cabpexpo.com/womens-group/.

Clean Resources Partners with Next Air & Gas

Clean Resources announced a new partnership with Next Air & Gas. This partnership will capitalize on the Research and Development efforts of Next Air & Gas to bring innovative air treatment product lines to the Clean Resources Brand. This agreement makes Clean Resources the sales distribution channel for Next Air & Gas products in North America.

"We are excited to bring air treatment products that include Refrigerated and Desiccant Air Dryers, and Nitrogen Generators to our premium line of Oil-Water Separator products," said Chad Timmer, Vice President Sales & Marketing, Clean Resources.

This partnership brings over 30 years of Air Treatment industry expertise, exceptional engineering, and manufacturing excellence. The combination of air and water filtration products significantly enhances Clean Resources as a leader in the compressed air

market, providing a more comprehensive range of products to serve its Distributors.

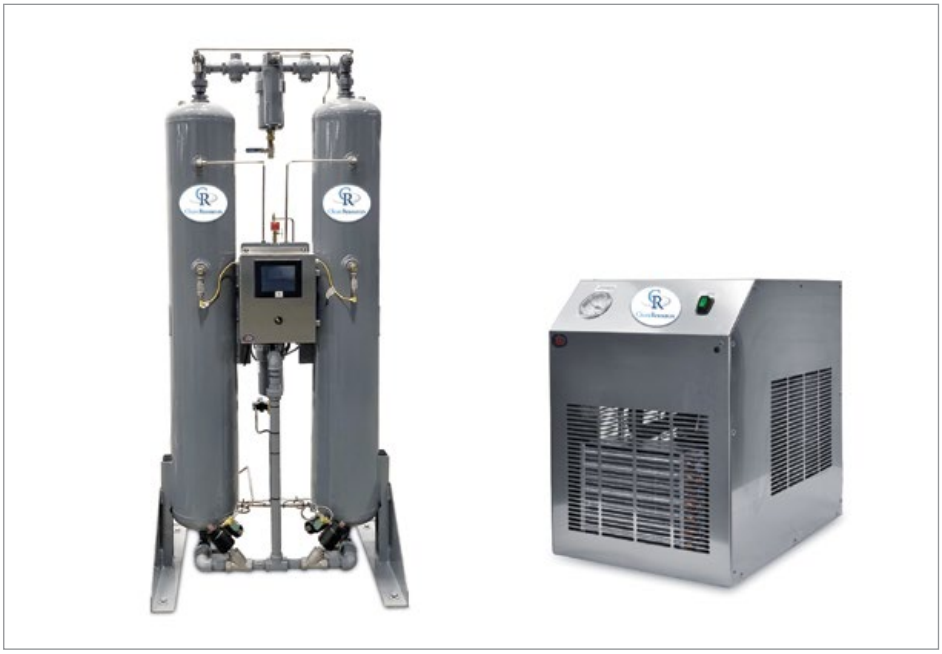
"Our partnership will allow Next Air & Gas to continue its focus on the manufacturing and engineering of quality compressed air treatment products while being able serve the distribution network that Clean Resources has established and continues to grow," said Kevin Zarif, Vice President, Next Air & Gas.

"As we looked to expand our product offering and accelerate our growth, it was important to us that we partner with a company that shares some of the same values. Offering premium air treatment products with a customer-first attitude are just a few of the reasons this partnership is a great fit for both Clean Resources and Next Air & Gas," said Scott Scheuerlein, Vice President of Business Development for Clean Resources.

Clean Resources manufactures its Oil-Water Separators in Batavia, IL and ships to its Distributors throughout North America. All dryer systems are built in Lenoir City, TN, and shipped from Tennessee and Illinois. Both companies proudly manufacture their products in the USA.

About Clean Resources

For more than 20 years, Clean Resources has stood as the pre-eminent environmental leader in oil-water condensate separators for the compressed air industry. Clean Resources primary objective – provide 100% flawless oil-water filtration products. For more information, visit www.cleanresources.com.



Clean Resources announced a partnership with Next Air & Gas.

Compressed Air Industry News

Sullair Changes Company Name to Hitachi Global Air Power

Hitachi Industrial Equipment Systems Co., Ltd. ("HIES"), a wholly-owned subsidiary of Hitachi, Ltd., announced the establishment of Hitachi Global Air Power, a new company bringing together its global compressed air business. Effective immediately, Sullair will change its company name and operate under Hitachi Global Air Power.

"We are the same organization, ownership, leadership, and staff, but now we have a name that more clearly demonstrates Hitachi's breadth of compressed air solutions, product lines and innovation that both Sullair and Hitachi bring to the market," said Yasuhiro (Charlie) Takeuchi, President and CEO of HIES. "In today's relentlessly transforming society, Hitachi Global Air Power is uniquely positioned to raise the bar on the value we deliver to customers through our comprehensive portfolio of compressed air products and solutions such as Air as a Service."

Hitachi Global Air Power will be instrumental to HIES accelerating significant global growth through green (sustainable) and digital products and solutions that match today's environment and digital age. Hitachi Global Air Power seeks to provide ultra-high-efficiency compressed air products and connected solutions that help customers achieve more energy savings and operational efficiencies.

Sullair was founded on July 14, 1965, and became a wholly-owned subsidiary of Hitachi, Ltd. on July 13, 2017. In the nearly

six years since the acquisition, HIES has leveraged the Sullair global sales network and complementary portfolio products and services to substantially increase the size, strength, and competitiveness of its global air compressor business. Hitachi Global Air Power will continue to offer a full range of integrated compressed air solutions, including portable air compressors, industrial air compressors (oil-free and oil-flooded), aftermarket OEM parts, fluids and more.

Hitachi Global Air Power will leverage a multi-channel, multi-brand strategy. While Sullair will change its corporate name, the branding will remain intact on its products, including Sullair, Champion and Air-One. By maintaining market appearance, customers and distributors will continue to recognize the familiarity of the Sullair logo and color (Sullair green).

"The company name change from Sullair to Hitachi Global Air Power is only the latest move in a growing list of Hitachi's commitments to our business and brand," said John Randall, President and CEO of Sullair. "Since our acquisition, Hitachi has invested more than $45 million in our company, and Hitachi has been instrumental in allowing us to expand our caliber and capabilities. We are excited about the opportunities ahead of us – for our business, employees, customers, channel partners and communities."

The new company name combines nearly two centuries of expertise in the compressed

Compressed Air Industry News

air business – Hitachi since 1911, Sullair since 1965, and Champion Compressors (Australia) since 1983.

For more information about the name change or to learn more about Hitachi Global Air Power, please visit www.hitachiglobalairpower.com.

About Hitachi Industrial Equipment Systems Co., Ltd.

Hitachi Industrial Equipment Systems Co., Ltd. ("HIES"), a wholly-owned subsidiary of Hitachi, Ltd. is a leading global provider of electric and industrial products and solutions including air compressors, coding and marking systems, transformers, hoist systems, inverters and more. HIES solves the technical issues of industrial customers with solutions centered on improving customer value and contributing to the development of a global society and environment. For more information on Hitachi Industrial Equipment Systems, visit https://www.hitachi-ies.co.jp/english/index.htm.

OTC Industrial Technologies Opens New Cincinnati Manufacturing Facility

OTC Industrial Technologies' Cincinnati manufacturing facility held a Grand Opening event for customers, vendors, local leaders, and businesses at 9113 Le Saint Drive, West Chester, OH 45014. All were invited to visit the new facility and take a tour. OTC Industrial Technologies (OTC) is an industrial equipment service provider and distributor headquartered in Columbus, Ohio. OTC is a market leader in OEM distribution from top-tier manufacturers, providing custom-engineered and technical solutions. The West Chester facility will focus on compressed air solutions, one of which is DIRECTAIR®, an air utility service solution for customers across the United States.

This new 100,000 sq ft facility will allow OTC to meet customers' increased need for the reliable compressed air that DIRECTAIR® delivers.

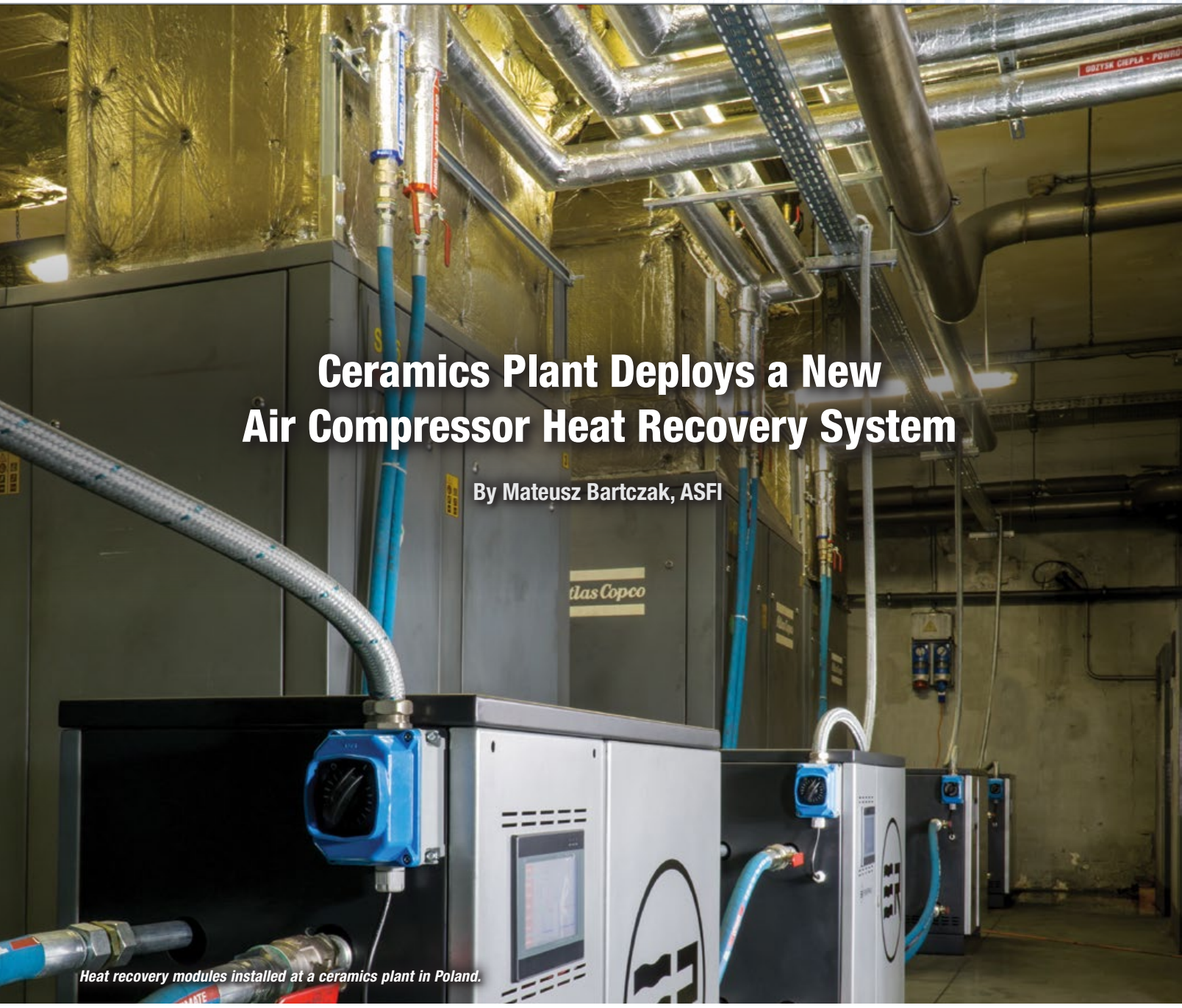
This new 100,000 sq ft facility will allow OTC to meet customers' increased need for the reliable compressed air that DIRECTAIR® delivers.

Following a new facility in Kingman, AZ, this is the second expansion in the last 12 months, increasing the manufacturing capacity of OTC by 300% to support customers' growing demand.

"OTC is the largest compressed air sales, service, and manufacturing company in the United States, and we have more than 210 DIRECTAIR® sites currently operating," said Adam Gibbs, president of air supply at OTC. "We look forward to the next 100 we will produce in our new expanded facility."

About OTC Industrial Technologies

Established in 1963, OTC Industrial Technologies (OTC) is one of the largest industrial distributors and service providers in the United States. OTC provides expert solutions for industrial motion control, factory automation, fluid power, pumping systems, spray finishing, power transmission, and compressed air systems. OTC operates a broad geographical footprint and delivers value to customers through its primary operating brands and divisions, including OTP Industrial Solutions, AAP Automation, Air Technologies, Advanced Industrial Products, American Industrial Corporation, Buckeye Pumps, C&C Industrial Sales, Compressed Air Systems, Contrast Equipment, Crimson Electric, Critical Rental Solutions, Diversified Pump, Filter and Coating Technology, Furey Filter and Pump, IDG Compressor, Industrial Process Equipment Group, Keller Electrical, Laron, Midway Industrial Supply, Ohlheiser, PK Controls, Pumps, Parts & Service (PP&S), PumpTek, PSI Engineering, Tape Industrial Sales, TP Pump, and Tri-Power MPT. For more information, visit https://otcindustrial.com.



Ceramics Plant Deploys a New Air Compressor Heat Recovery System

By Mateusz Bartczak, ASFI

Heat recovery modules installed at a ceramics plant in Poland.

An air compressor is synonymous with an electric heater – providing compressed air as a side effect. 85-90% of the electrical energy taken in by the air compressor is converted into heat, while the maximum efficiency of compressed air generation is less than 10%. In air compressor heat recovery systems, the focus is on capturing the heat energy contained in the oil, as up to 80% of the energy extracted from the power plant is found there.

Investing in energy efficiency is actually paying for a certain amount of energy in advance at the current gigajoule or megawatt hour rate. Once this amount of energy is consumed, it becomes free.

The water heated via the oil heat exchanger, in a lubricated positive displacement air compressor, can reach temperatures as high as 75°C (167°F). This makes the spectrum of application truly wide, including supporting central heating, domestic hot water, heat used in air handling units, the washing process of the workpiece prior to coating, and even for the production of chilled water by absorption and adsorption units.

Sanitary Ceramics Plant Case Study: Using Air Compressor Heat to Support Process Air Handling Units

The plant was running a 200 kW oil-lubricated variable speed drive air compressor. The air compressor was running at an average of 70%

load before the installation of the heat recovery system. After the installation of the heat recovery module (before energy collection started), its operating temperature did not increase.

Thanks to the use of a heat exchanger that guarantees a very low pressure loss, the oil flow was not restricted and the original cooling conditions of the air compressor did not deteriorate. In other words, before we started the heat recovery process the air compressor temperature did not arise. After the start-up of the heat recovery process the overall cooling conditions improved that much to be seen with a bare eye. Moreover when the maximum load was simulated by increasing the pressure setpoint the air compressor operating at 100% load with a discharge pressure of 1 bar higher (14.7 psig) had a 10°C (50 °F) lower work temperature.

On many occasions, my customers have told me they have excess heat and additional heat recovery from the air compressor is unnecessary. I then ask them the question, "Do you burn gas anywhere or heat anything up electrically? If so, please show me where." It turns out that even in production processes involving a lot of waste heat, the plant hall is heated with said waste, but somewhere there is a burner running, a process boiler to maintain the technical process.

Our client, a ceramics manufacturer, operates technical "maturation chambers" in which a temperature of 50°C (122°F) must be maintained throughout the year (see Diagram 1). This means that even in summer, the boiler house has to burn gas. The heating of

before installing the heat exchanger

after installation of the heat exchanger with heat recovery activated

the chambers is carried out by air handling units that recirculate the air and heat it to a set temperature.

As part of this project, additional pre-heaters were installed for the air handling units upstream of the heaters with the boiler house heat. Heat from the air compressors is supplied to the added heaters, thus providing pre-heating. In the event that the heat from the recovery heats the air to the set parameter, the heat from the boiler room will not be

Ceramics Plant Deploys a New Air Compressor Heat Recovery System

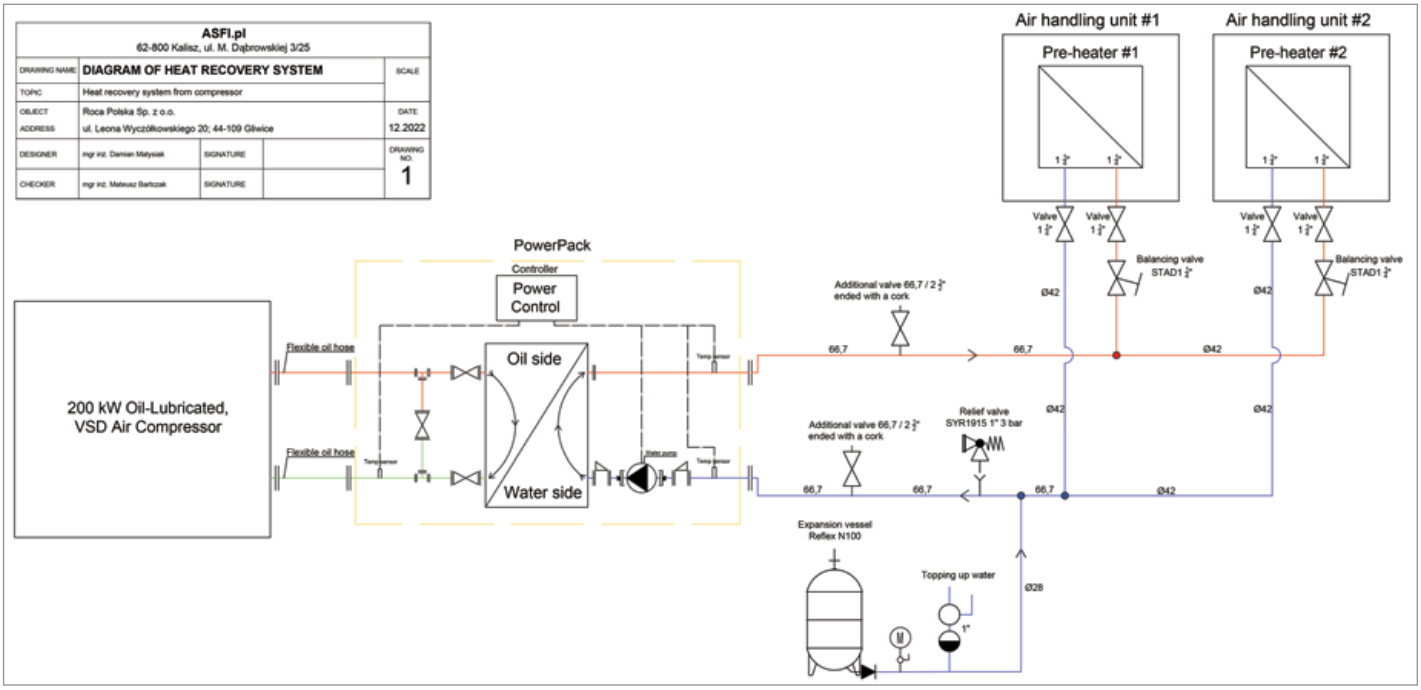


Diagram 1. Heat recovery process diagram from the air compressor to the pre-heaters for the air handling units.

consumed, generating gas savings as the boiler room heat control valve will not open. In case there is a period of downtime when the air compressor is not running, the boiler room takes over the role of maintaining the set temperature in the chamber.

Significant infrastructural expenditures were incurred to complete the installation. This included a long piping system between the air compressor and the air handling units. Despite this expenditure, the return on investment was less than 14 months.

Research into Heat Recovery Module Problems with Overheating

Over the years of working on air compressor heat recovery systems, we have encountered a lot of negative feedback on their performance. By far the most common complaint was that once the heat recovery system was in operation, the air compressor would eventually shut down due to overheating.

This inconvenience has undoubtedly contributed to the negative perception of these systems, inhibiting their applicability in many production plants. As production comes first, compressed air pressure is the primary concern, with heat recovery being considered as a complementary element.

We decided to conduct research into why heat recovery modules were often shutting down to overheating. The research was conducted in a dedicated laboratory, which was established as part of a government grant for the R&D project.

Oil Over-Cooling Leads to Oil Overheating in Air Compressors

Paradoxically, the reason for oil overheating in air compressors, with an operating heat recovery system, is oil overcooling. In an air compressor with an integrated heat exchanger, an additional three-way oil valve is added to act as an over-cooling safeguard for the oil. Over-cooled oil can lead to excessively low discharge temperatures and the risk of steam already appearing in the separator rather than in the aftercooler.

In the event of over-cooled oil, the aforementioned valve bypasses the oil outside the heat exchanger, ensuring a return temperature to the unit of no less than 55°C (131°F). This can occur in variable-speed air compressors at varying loads and in fixed-speed compressors operating at idle. This is due to the fact that the fixed-speed pump removes more heat from the oil than is available at a particular time when the discharge load is relieved or reduced in inverter compressors.

During air compressor reloading, the temperature in the compressor unit increases at a rate of approx. 0.5°C/1s, while the oil behind the heat exchanger is a mixture of warm oil from the separator and cold oil cooled in the heat exchanger. Subsequently, the oil flowing through the thermostatic filter reaches a temperature of 55°C (131°F), followed by a rapid temperature rise to around 75-80°C (167-176°F), at a rate of 4°C/s.

This is too rapid a temperature rise for the thermostatic valve to operate effectively. These types of valves have a time constant of around 20 seconds, meaning the valve will not have time to open allowing higher temperature oil into the injection, leading to the air compressor shutting down due to overheating.

Research into a Solution for Heat Recovery Modules

We have developed an innovative module for air compressor heat recovery called the Powerpack. The module is a complete heating unit equipped with Powercontrol automation, controlling the oil temperature at the heat exchanger outlet in a similar way to the three-way valve at the heat exchanger, but controlling the temperature by regulation on the receiving – water–side.

With oil temperature control achieved by adjusting the secondary side of the heat exchanger, the oil is never overcooled, and in case of no heat demand and no water heat removal, the air/water cooler overrides the compressor cooling function. As part of the project, we carried out almost 6,000 measurement runs on air compressors from five (5) different positive displacement air compressor manufacturers, both rotary screw and rotary vane models.

The mathematical model of the heat recovery system, developed during the research, forms the core of the control algorithm. We tested 21 control methods for heat recovery, arriving at the best-known control algorithm that adapts to changing parameters on the air compressor side and on the receiving side.

The solutions used in the Powerpack have been submitted in a patent application to the Patent Cooperation Treaty (PCT), with a decision on the grounds for granting the patent following a positive assessment of the prior art and inventive step. BP

For more information, visit ASFI at http://asfi.pl/en/

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Centrifugal Air Compressor Maintenance: The Importance of OEM Parts

By the Compressed Air & Gas Institute

Keeping up with preventative maintenance is a vital part of maintaining a centrifugal air compressor's efficiency and lifespan. This requires periodic replacement of air compressor parts such as air filters, oil filters, and lubricants.

Maintenance kits and replacement parts by the Original Equipment Manufacturer (OEM) are manufactured specifically for the compressed air equipment for which they were designed, and therefore offer the best overall performance. Generic parts on the other hand do not provide this assurance and the use of generic, will-fit, aftermarket components may significantly decrease the performance and reliability of your compressed air equipment.

Although generic parts may be less expensive than genuine OEM parts, it is oftentimes at the sacrifice of performance. The money you save by purchasing generic parts is often the most expensive money you will ever save.

Fit, Form, Function

Fit, form, and function are three key aspects of any aftermarket part. Aftermarket genuine parts ensure that the compressed air system will continue to meet the requirements it was engineered to achieve. Replacement parts must fit the compressor correctly so that operation continues to function properly. Parts that are not fitted properly could affect the function of the unit downstream.

Even if a generic part fits properly, the end-user must be aware of the form of the part. This includes shape, size, and weight. Generic parts are generally made without regard to quality and often with inferior materials. For example, using aluminum for a part originally designed with stainless steel could result in a generic part that has a much different weight and size in comparison to the genuine part.

The Compressed Air and Gas Institute (CAGI)

The Compressed Air and Gas Institute (CAGI) is the united voice of the compressed air industry, serving as the unbiased authority on technical, educational, promotional, and other matters that affect compressed air and gas equipment suppliers and their customers. CAGI educational resources include e-learning coursework, selection guides, videos, and the *Compressed Air & Gas Handbook*.

Visit the CAGI web site at www.cagi.org or on LinkedIn.

The Centrifugal Compressor Section consists of the following member companies:

- Atlas Copco Compressors
- FS-Elliott
- Hanwha Power Systems
- Ingersoll Rand
- Sullair, LLC

The functionality of a genuine part is the most difficult aspect to replicate. Genuine parts go through specific quality testing to ensure that they will perform as designed under a defined set of conditions. Additionally, trusted OEM vendors are experts in producing the materials to manufacture the genuine parts, while generic parts typically demonstrate little consistency in quality as vendors change frequently to maintain the least expensive sourcing.

An air filter is one example of the importance of correct fit, form, and function. A genuine OEM air filter with a lower micron rating and a greater number of pleats provides better filtration, as the increased surface area offers more protection against small particles that could make it through the filter. A generic part that is manufactured to less stringent standards may have a higher micron rating and may lead to the introduction of larger particles to the machine, allowing wear to occur to compressor components over time.

Warranty and Accountability

Many genuine air compressor spare parts come with the added reassurance of warranty coverage in instances of malfunction, wear, or failure. Sellers of generic parts are not held to these same higher accountability standards.

Genuine OEM parts have design and manufacturing specifications that the manufacturer has determined to best deliver the required performance needed to assure warrantable equipment reliability and functionality. Genuine parts are designed to maintain unit efficiency and reliability. By using genuine components, you are assured that you are installing parts with the proper fit, form, and function.

Just as OEMs are continually upgrading the performance and reliability of their equipment, so too are they improving the performance of the components that go into the manufacturing of the equipment. Ultimately, centrifugal air compressors are engineered machines that require periodical maintenance using specially designed and tested genuine parts. Contacting an authorized OEM of your centrifugal air compressor is the best way to ensure the component needed will not interfere or cause future issues. BP

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CheeseCon 2023 Show Report

By Roderick M. Smith, Editor, Compressed Air Best Practices Magazine

The 2023 CheeseCon event was held April 4-6, 2023 at the Alliant Energy Center in Madison, Wisconsin. Co-produced by the Wisconsin Cheese Makers Association (WCMA) and the Center for Dairy Research, this event brings together more than 3,000 dairy industry leaders, suppliers, and marketers together to share information about the latest in cheese manufacturing technology, workforce, whey opportunities, product safety, marketing, and dairy exports. The three-day event featured a tabletop exhibit floor on April 5th with concurrent conference sessions focusing on Sustainable and Safe cheese production.

Announced Changes in WCMA Leadership and Growing Membership

Tim Omer of Emmi Roth was elected to serve as President of the Wisconsin Cheese Makers Association. Omer will assume leadership on July 1, 2023, succeeding Steve Bechel of Eau Galle Cheese as he completes his two-year maximum term in the role.

As President, Omer will lead an executive team that includes Doug Wilke of Valley Queen Cheese as First Vice President, Mike Sipple of Agropur as Second Vice President, Kim Heiman of Nasonville Dairy as Treasurer, and Chris Renard of Renard's Cheese as

Secretary. All four were selected to continue in their leadership roles for the new fiscal year beginning July 1.

Four industry leaders were also selected to join the WCMA Board of Directors. Mathew Bartkowiak of Nelson-Jameson, Paul Bauer of Ellsworth Cooperative Creamery, Steve Doyle of Sartori Cheese, and Bob Greco of Cheese Merchants of America will begin their first terms on the Board July 1.

WCMA sincerely thanked the outgoing members who will complete their maximum terms on the Board this year: Steve Bechel of Eau Galle Cheese, Craig Filkouski of Great Lakes Cheese, Mike Neu of Chr. Hansen, and Paul Scharfman of Specialty Cheese Company.

"It's a privilege to have the thoughtful guidance and support of these leaders in dairy processing," said WCMA Executive Director John Umhoefer. "We're grateful to those leaving the Board this year, and we look forward bringing the four first-time Board members into the Association's leadership body."

During the April 4 meeting to elect new officers, the WCMA Board of Directors also voted to expand the board from its current 21 seats to 27. The change, which reflects the Association's unprecedented nationwide membership growth, will take effect beginning July 1, 2024.

WCMA membership is open to dairy processors, manufacturers, marketers, and suppliers nationwide. More information is available at https://www.wischeesemakersassn.org/become-a-member

Notes on Compressed Air Safety and Sustainability

Alex O'Brien, the Quality/Safety Coordinator at the Center for Dairy Research, said the dairy processing industry overwhelmingly

CheeseCon 2023 Show Report

Rod Smith and Frank Melch (left to right) at the Zorn Compressor & Equipment booth.

uses SQF as the quality management system. 3-A is the main standard used to certify the dairy processing equipment. He said most firms are engaged with complying with the Pasteurized Milk Ordinance (PMO) for Grade B milk and cheese processing. Interestingly, his experience in a prior job included having to de-contaminate, at great expense, the entire compressed air piping system – due to a moisture and oil breakthrough.

I met with Frank Melch, from Zorn Compressor & Equipment, whose firm had a booth. He showed me the ISO 8573.1 Quality Class Testing Program, for compressed air, which they are

providing to their clients in the dairy processing industry. They are enabling a sampling program where the Quality Management teams can have compressed air samples sent to a laboratory for regular testing and reporting. "We have found that Maintenance and Quality Control are normally two different groups in cheese manufacturing," said Melch. "It's our job to work with both the quality management teams and also the maintenance staffs, in the mechanical rooms, to ensure reliable and efficient compressed air production and purification systems." I'd like to thank Frank and Zorn for providing guidance as we research "Best Practices" in cheese manufacturing.

IFM Efector Director of Sales, John Isabell, in front of their automation sensors and compressed air flow meters.

Jason Kirsling, from RW Baron, the representative for GD Nash in Wisconsin.

CheeseCon 2023 Show Report

Reflecting these two different disciplines, there were several Process Quality testing firms present and a whole host of process automation and sensor technology firms. Jake Parr, from Certified Group, confirmed that compressed air has long been tested through the process of spraying compressed air onto a sampling "pad". Bob Colvin, from Matrix Sciences, said they conduct compressed air safety audits by doing yeast and mold aerobic APC plate counts. He also had experience using the Parker Balston CAMTU inline compressed air quality testing product.

What I found interesting is most testing firms were focused on yeast and mold – not on the compressed air contaminants the compressed air industry talks about; moisture, solid particulates, oil and oil vapor. My work with the 3-A Committee, working on a new "Guideline for Compressed Air" provided a similar experience. The focus is to prevent biological contamination in the food product.

IFM had their automation process sensors and their compressed air flow meter on display. The flow meter also provides temperature and pressure measurements. Director of Sales John Isabell said the products are manufactured in Malvern, Pennsylvania.

Charles Ries, from J&W Instruments, was displaying a Schubert & Salzer digital positioner (Model 8049) which does not consume compressed air when the process is idle. Jason Kirsling, from RW Baron, the GD Nash representative in Wisconsin, said cheese manufacturing uses dry vacuum pumps, so they were displaying their cheese processing technologies.

The Cheese Auction

An exuberant crowd of dairy processors, marketers, and suppliers raised an impressive $339,835 for dairy education at the 2023 Chr. Hansen Championship Cheese Auction, held the final day of CheeseCon. The funds support industry training programs offered by the Wisconsin Cheese Makers Association (WCMA), as well as the World and U.S. Championship Cheese Contests and university dairy training centers.

"Each year we see the generosity of the dairy processing industry come to life at the

Winners of the 2023 U.S. Championship Cheese Contest were on display at CheeseCon

Auction, and this year's bidders broke the record yet again to benefit the next generation of leaders," said WCMA Executive Director John Umhoefer. "Our sincerest thanks go to all those who raised their paddles to contribute to the scholarships and education that help grow and strengthen our industry."

For over 25 years, Auction dollars have supported emerging dairy professionals through WCMA's Mike Dean and Cheese Industry Supplier Student Scholarships. Funds raised at the Auction have also helped fund WCMA's popular training programs for dairy manufacturers and suppliers, and fueled donations to build the new world-class Center for Dairy Research facility in Madison, as well as dairy pilot plants at the University of Wisconsin - River Falls and South Dakota State University. Thanks to generous Auction bids, the World and U.S. Championship Cheese Contests and the Collegiate Dairy Products Evaluation Contest improve and grow each year. Altogether, WCMA has invested $1.3 million in the next generation of the dairy processing industry.

This year's Auction featured a total of 79 gold medal cheeses, butters, and yogurts from the 2023 U.S. Championship Cheese Contest, organized into 42 lots. WCMA sincerely thanks all of the winning bidders for their generous support: Advanced Process Technologies Inc.; Atlantic Grain; ALPMA, Cheese Market News; the Marvin & Debra Cherney Family Foundation; Chr. Hansen; Complete Filtration Resources; Custom Fabricating & Repair; Cybertrol Engineering; Dairy Connection, Inc.; Dairy Products Marketing; Darlington Dairy Supply; DSM Food Specialties; G&R Foods; Great Lakes Cheese; Hydrite; Kelley Supply, Inc.; Loos Machine & Automation; Marquez Brothers International; Masters Gallery Foods; Nelson-Jameson; Novak's Cheese; ProActive Solutions USA; RELCO, a Koch Separation Solutions Company; Sugar River Cold Storage; T.C. Jacoby; TC Transcontinental; and Wisconsin Aging & Grading Cheese.

Moving Forward

The next event will be CheeseExpo, taking place April 16-18, 2024, at the Wisconsin Center in Milwaukee. CheeseCon will return to Madison on April 15-17, 2025. BP

For more information on the Wisconsin Cheese Makers Association visit https://www.wischeesemakersassn.org/. For more information on the Center for Dairy Research visit https://www.cdr.wisc.edu/

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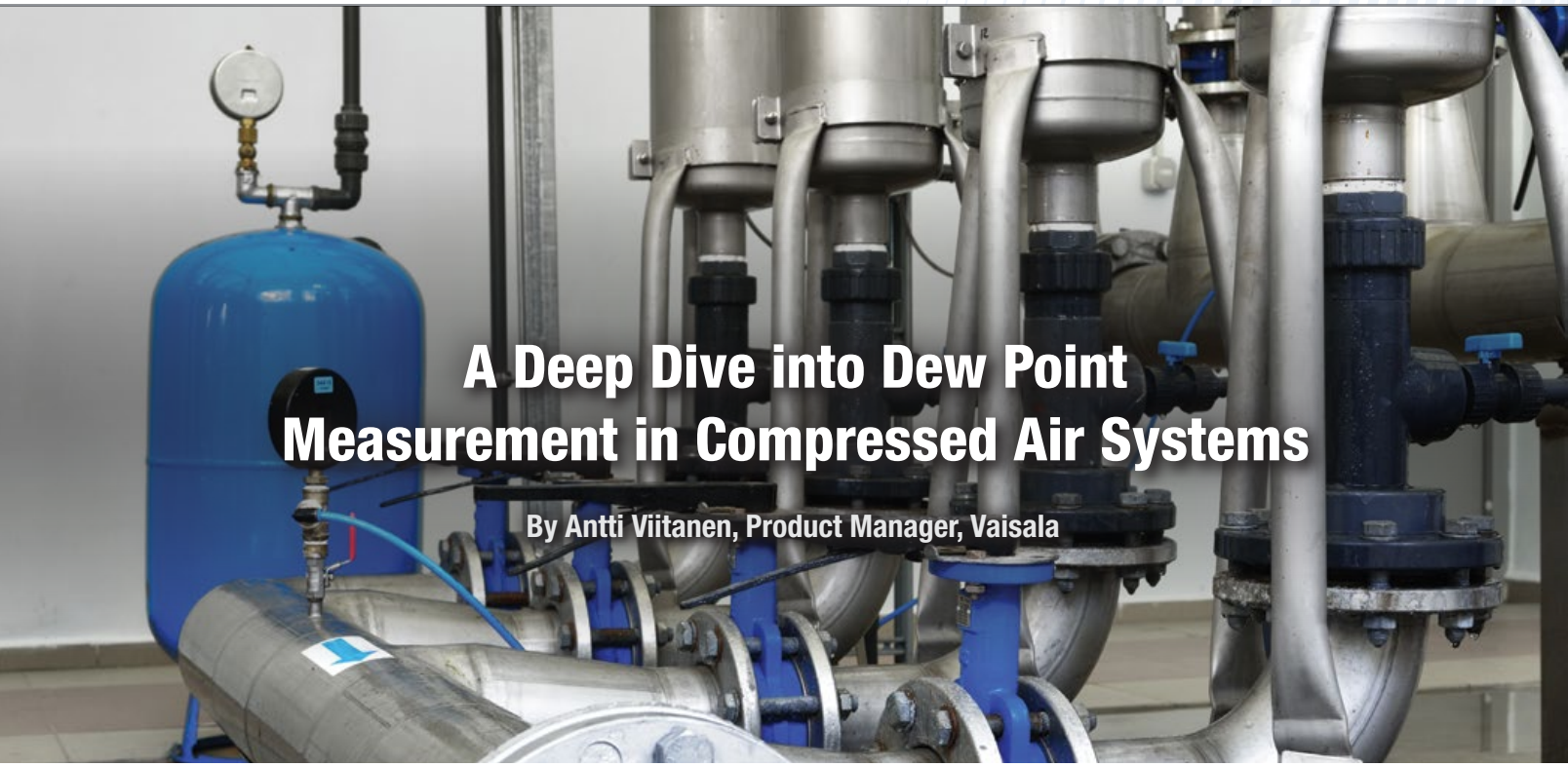

A Deep Dive into Dew Point Measurement in Compressed Air Systems

By Antti Viitanen, Product Manager, Vaisala

Compressed air is critical, from manufacturing, automotive assembly, and food and beverage production to health care facilities, dry rooms, industrial systems and various other industrial and commercial applications. Commonly referred to as the "fourth utility," compressed air is an essential component across different industrial processes, impacting the quality of the process and the end product.

However, the cost of clean, dry compressed air is extremely high – about eight times more expensive than electricity – since compressing air requires a significant amount of energy, most of which disperses as heat. Consequently, accurate compressed air measurement is crucial because carefully managing and monitoring compressed air allows operators to monitor and control the efficiency of compressed air systems.

Dew Point and Compressed Air Measurement

Inaccurate or inconsistent compressed air measurement can result in decreased system performance, increased energy costs, equipment damage and even safety hazards. For example, the equipment can malfunction or fail if the pressure is too low, leading to downtime and costly repairs. If the dew point is too high, condensation and moisture can build up in the system, leading to corrosion, contamination, freezing and reduced air quality.

Dew point is one of the most important parameters associated with the quality of compressed air because moisture in compressed air can cause corrosion, equipment damage and contamination, and negatively impact the performance of pneumatic tools and systems. In compressed air systems, the dew point is a measure of the temperature at which moisture will begin to condense out of the air and into dew or frost, leading to potential problems. Accurate dew point measurements help avoid over-drying, optimize energy usage and protect equipment from adverse impacts.

To reveal energy-saving opportunities, bring excessively high costs down and optimize the performance and lifespan of compressed air systems, decision-makers across industries must manage and monitor their compressed air systems with dew point measurement solutions.

Exploring the various factors that impact the accuracy of dew point measurements is vital considering their implications on the performance and efficiency of compressed air systems. Understanding how each factor influences measurement precision is crucial to optimize operations and boost the bottom line.

Factors Impacting Compressed Air Dew Point Temperature

Recognizing that high-quality compressed air is essential to production and products, decision-makers across industries are installing dew point sensors and monitors to better detect any issues with their compressed air systems. Because several factors can impact the accuracy of dew point measurement in compressed air systems, considering these factors when selecting dew point measurement equipment and interpreting the results of measurements is essential.

Temperature

Even dew point temperature as a parameter is not dependent on temperature. Usually, instruments measuring dew point need accurate temperature information, and depending on structures, measurement can be sensitive to the temperature of the gas or ambient temperature.

Some advanced dew point measurement solutions can compensate for ambient and gas temperature variations, improving the accuracy of the measurements. Since dew point temperatures in compressed air range from ambient to -80°C (-112°F), select stable and consistent solutions that reliably deliver accurate measurements across the necessary scope.

Pressure

Depending on the temperature, air can only hold so much water vapor, with the maximum amount referred to as water vapor saturation pressure. Air compression increases water vapor pressure – and the dew point. If not correctly compensated, this could affect measurement accuracy.

Knowing whether pressurized dew point measurement is conducted or not is a key consideration. Depending on the system design and target specification, the ambient dew point of gas or process pressure dew point of gas needs to be converted if necessary for comparison to each other or system specifications. In addition, measuring in a pressurized environment could be a problem if the pressure has significant variances making the dew point reading unreliable even if the humidity level in line is stable.

Understanding the pressure characteristics of the dew point instrument and leveraging solutions that are suitable for each use case is critical. In advanced transmitters, correct pressure information can be given to the transmitter, which can make needed compensation for output readings for every measurement.

Leak Tightness and Materials

Compressed air and gas systems typically feature shallow levels of humidity; therefore, dew point measurements are susceptible to even the most minor leaks in the system. If ambient air enters the system, pressure decreases, negatively affecting dew point measurement accuracy. As a result, sampling system connections should be leak-tight and properly sealed. Consider Teflon tape for tapered threads like NPT or devices with sealing washers between the probe and the sampling cell for straight thread connections.

Additionally, carefully consider the sampling system's construction materials since water vapor diffusion through the pipe or tubing walls can occur. Even worse, if the materials used in constructing the compressed air system are unsuitable for the intended application, moisture buildup can change the measurement accuracy.

Understanding that even if gas is leaking out of the system, water can still possibly leak into

A Deep Dive into Dew Point Measurement in Compressed Air Systems

the system, which can cause the dew point temperature of the gas downstream to increase.

Flow Rate

When measuring dew point in compressed air systems, consider the flow rate. Higher flow rates can cause turbulence and affect the performance of the dew point sensor, leading to inaccurate readings. Plus, stagnant air in these systems can be a problem for a few reasons:

1. Obtaining a representative sample of the process air is difficult.
2. Response time may be dramatically impaired.
3. The risk of ambient air leaking or diffusing through sampling materials increases.
4. Back diffusion of ambient water vapor through the outlet port of the sample cell can occur.

Although higher flow rates generally improve the sensor response time, high-quality sensors can accurately measure at o 1-2 l/minute (0.035-0.7 ft.^{3}/min.). That said, leveraging a dew point sensor that is not dependent on flow rate is strongly recommended.

Contaminants

Contaminants like water spikes, ambient humidity, compressor oil and chemical impurities can impact sensors. Oil, dust and dirt can also affect the accuracy of dew point measurement by accumulating on the surface of the dew point sensor and affecting its performance. Even worse, moisture contamination increases operating and maintenance tasks and costs.

Calibration

The accuracy of dew point measurement equipment can also be affected by how equipment is calibrated. Over time, the sensors used in dew point measurement solutions can drift from their original calibration, leading to inexact analysis. Regular dew point measurement equipment calibration ensures accurate and reliable measurements.

Field spot-checking is a common method of determining a fixed measurement's measurement accuracy between calibration intervals. The most straightforward spot check is a verification comparing two sensors that measure the same parameter to check for measurement output differences. ISO 17025:2017 and ISO 9001:2015 offer standard guidance on intermediate checks to ensure the accuracy of deployed sensors between calibrations.

Considering these factors can help operators accurately measure dew point to improve the performance and efficiency of their compressed air systems in the long term.

Choosing the Right Dew Point Measurement Solution for Your Compressed Air System

Selecting the correct dew point measurement solution is crucial, but there are several important considerations when choosing the right instrument for your application.

The Basics

Cost and accuracy are, of course, critical factors to consider. The higher the cost, the more accurate and reliable the sensors will likely be in the long run, ultimately saving money on

maintenance and downtime costs. Also consider any installation and maintenance requirements – such as whether the instrument should be installed on the demand or supply side of the compressed air system, which depends on the specific application and the measurement point location. Some applications may require more precise measurements, and different measurement instruments or probes may be necessary to meet those needs.

Response Time

One of the most important – yet often overlooked – factors to consider when deciding on your dew point measurement instrument is the wet-to-dry and dry-to-wet response time. A rapid response time is important in compressed air measurement because it helps quickly detect changes in the dew point of the compressed air.

While some systems reveal fluctuations in hours or even days, state-of-the-art solutions like Vaisala's DRYCAP sensor technology ensure that changes in dew point are detected quickly, allowing for prompt corrective action to be taken if necessary. From hospitals to food and beverage production plants to manufacturing facilities to dry rooms, certain specific applications (e.g., battery manufacturing and semiconductor development) require precise control of the environmental conditions – including very low dew points – to maintain product quality and performance.

In battery manufacturing, for example, a high humidity level can cause corrosion and degradation of the electrodes, leading to reduced performance and a shorter battery lifespan. In extreme situations, raw battery materials can react with water molecules in the air, causing explosions. In semiconductor development, wafer manufacture requires a highly controlled environment and precise data on the manufacturing environment. Moisture can cause defects in the microelectronic components, impacting their functionality and reliability. For each application, a fast response time allows for quick detection of dew point changes, which can be addressed before they cause damage to the product or equipment.

When delayed detection can lead to reduced system performance, increased energy consumption and increased risk of equipment failure or inferior product/process quality, response time is essential in compressed air measurement.

Save Energy and Money with Smart Measurements

With inefficiency and leaks estimated to waste up to 30% of an air compressor system's output and energy consumption, accurate dew point measurement can help improve energy efficiency, creating significant cost savings. Industry-leading measurement tools contribute to an energy-optimized compressed air system by helping prevent equipment damage and improving the efficiency of compressed air systems.

Clearly, myriad factors impact the accuracy of dew point measurements, and decision-makers must consider numerous impacts when selecting the right dew point measurement solution for their application. By considering these factors when selecting dew point measurement equipment and interpreting the results of measurements, decision-makers can avoid over drying, reduce costs, save energy, optimize the performance and lifespan of compressed air systems, and propel their businesses into the future. BP

Antti Viitanen, Product Manager, Vaisala

About the Author

Antti Viitanen is a Product Manager at Vaisala for Industrial Instruments and is mainly focusing on OEM products/Dew Point and Carbon Dioxide products. He has over 15 years of experience in electronic sensor technology. Antti holds a Master of Science degree in Electrical Engineering from Aalto University, Finland.

For more information, visit www.vaisala.com.

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Hannover Messe 2023 Show Report

By Roderick M. Smith, Editor, Compressed Air Best Practices Magazine

The IFM recruiting bus at the 2023 Hannover Messe!

The 2023 Hannover Messe was held April 17-21 at the Fairgrounds in Hannover, Germany. As the first installment of the show since the COVID virus shut things down, it was great to see the European industry back together in one hall. I have been visiting this event, since 1992, and it's great to see old friends, new companies and the latest company and technology developments of firms in the compressed air industry. This article will provide readers with a sampling of compressed air technologies seen. We regret not being able to include all exhibitors or visits made due to article length considerations.

Air Compressor Technology

Kaeser had an impressive presence at the Hannover Messe with a 2-floor booth and an outside pavilion featuring their Kaeser Air System Enclosure products with fully containerized compressed air systems. Kaeser Compressors President, Frank Mueller, gave me a booth tour. The big thing that caught my eye was a focus on oil-free technology starting with the new CSG-2 50-125 horsepower, oil-free rotary screw air compressors with airends designed and built by Kaeser. R&D has clearly been busy, all cooling lines are internal in this two-stage unit. There was also a fully enclosed I.Comp8 Tower T oil-free piston machine. The displayed PillAerator oil-free turbo blower, using magnetic bearings, made me wonder how long it will be before we see this technology, from Kaeser, at 7 bar (100 psi)? Lastly, I was impressed to see the new KM Series line of instrumentation products measuring ambient air temperature/pressure, pressure, dew point and flow.

On the event's first day, I walked up to Vice President David Andrews and he promptly said, "Hey Rod, as of five minutes ago, I no longer work for Sullair." He seemed quite serene so I knew he was up to something. I waited quizzically until he said, "We've just announced the creation of Hitachi Global Air Power – they are my new employer!" The very important strategic news is that Sullair is now a major brand to be developed by the newly formed Company, Hitachi Global Air Power. In my humble opinion, this is a brilliant strategic decision.

Their booth featured Sullair branded machines in the trademark green. They included the DS Series oil-free (45 to 75 kW) rotary screw air compressor with features known to fans of the LS Series including lift-off doors for easy service and a new controller with enhancements to, but building from, the LS Series electronic controller.

Hertz Kompressoren had an impressive booth within the booth of parent company DALGAKIRAN. They showed me their new IMPETUS Series of 22-315 kW 2-stage rotary screw air compressors. With VSD as an option, the 22-75 kW models use a permanent magnet motor while the 90-315 kW range uses asynchronous IE4 motors. A lot of attention to quality showed with oil cooling between the 1st and 2nd stage, a separate intake filter from outside the cabinet and a VSD driven fan on the oil-side cooler.

At the Tamturbo booth, Hannu Heinonen announced having won some exciting contracts in the U.S. Random factoid, did you know Hannu is an avid Arctic snowmobiler? The heat recovery packages are almost always used, he told me, in their 200 to 400 horsepower projects due to the tremendous energy efficiencies they provide. Unlike oil-free rotary screw air compressors, they reminded me that Tamturbo's 100% oil-free turbo air compressors do not have any oil in the machine because the active magnetic bearings are "Touch-Free".

ALKIN is a manufacturer of high pressure compressed air and breathing air compressors and boosters with pressures up to 6000 psi. Industry veteran Nitin Shanbhag is the President of ALKIN Compressors and he walked me around the booth. Excited about the challenge, Nitin told me the firm is committed to growing U.S. market share in the high-pressure market and provides product warehousing and technical support in New Jersey.

ELGi is proudly celebrating, in 2023, their 10-year anniversary in the United States. Senior Vice President Malcolm Lindsay said, "After ten years and together with our sales and service channel partners, we are very proud to celebrate, the installation of 10,000 rotary screw compressors, all under our unlimited air-end warranty." I was impressed to hear ELGi

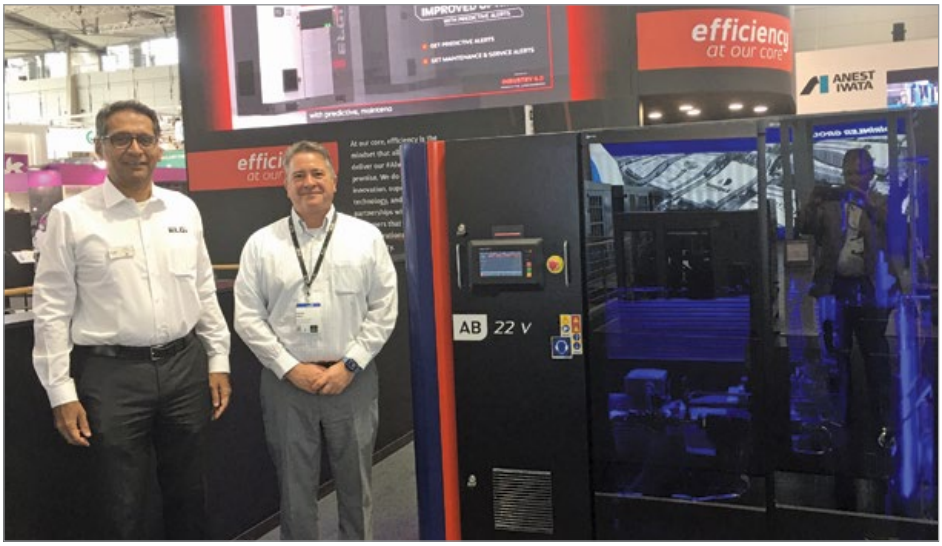
David Andrews in front of a Sullair DS Series oil-free rotary screw air compressor at the Hitachi Global Air Power booth.

Frank Mueller, from Kaeser Compressors, next to their new CSG-2 oil-free air compressor featuring Kaeser airends.

Heli Malinen, Thorsten Frehe and Hannu Heinonen at the Tamturbo booth (left to right).

Hannover Messe 2023 Show Report

was awarded the 2019 Deming Prize for Quality Management. ELGi founder Jairam Varadaj (also known as Dr. J!) said, "We are the first air compressor manufacturer to win the Deming Prize. This recognition, along with the 10-year performance of our products in the U.S., helps people truly believe in our total focus on quality and reliability – and understand why our warranty can be so strong." I was particularly impressed by their water-injected AB22V single-stage rotary screw air compressor. This unit uses condensed water, which one doesn't need to treat, to lubricate the air compressor and the VSD can turn down to 20% of load. Outlet air temperatures are low and most units are air-cooled with max ambient temperature ratings of 120ºF (50ºC).



Jaraim Varadaj and Malcolm Lindsay, at the ELGi booth (left to right), next to their AB22V single-stage, water-injected, rotary screw air compressor.

Industry veteran Bill Kennedy was at the Mattei Compressors booth and was excited to talk about their new RVX 75 ultra performance single-stage rotary vane air compressor. Bill said, "This new RVX 75 kW model has a market-leading specific energy performance. We are truly excited about what this product line can do in terms of energy efficiency."

COLTRI is a manufacturer of high-pressure compressors and boosters for compressed air and nitrogen. They had a 40-bar nitrogen compressor for laser cutting and metal stamping in the booth and also their AC VII

Bill Kennedy, at the Mattei Compressors booth, next to their new RVX Series rotary vane air compressor.

Stephan Brand, at the Aerzen booth, next to the new model of the Delta Hybrid Screw Blower.

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Gökhan Çivkarolu at the Hertz Kompressoren booth.

Andrea Bruni, at the COLTRI Compressors booth, showing their ACE VII Booster for nitrogen or compressed air.

Engin Tüjümet, Nitin Shanbhag and Emre Tüjümet at the ALKIN booth (left to right).

booster able to take 2-5 bar air or nitrogen and boost it to 420 bar. Celebrating the 60th anniversary of COLTRI, industry veteran Andrea Fabris (JOSIMO) is representing them for their entry into the U.S. market.

JOSVAL has been manufacturing air compressors for a long time. Owners Manuel and sister Marga Loren presented a whole new product portfolio with the development of sound attenuated piston compressors, a full range of rotary screw air compressors and a complete extended warranty program. The IBERUS rotary screw air compressor line, for example, ranges from 7.5 to 60 horsepower and comes with a strong 15-year extended warranty plan.

IES Compressors invited me to see their new 3CT Carbon Capture Compressor technology. Developed in conjunction with a government research center, the 3CT rotary screw air compressor is equipped with an advanced system of filtering membranes through which passes a capture fluid able to absorb about 180 ppm of the CO_2 present. The removed CO_2 gas is stored in an appropriate container and is ready for use in another process or for sale. I don't know how the CO_2 market works, but the technology was quite ingenious leveraging the temperature differences of the fluid circuits in an air compressor.

Compressed Air Purification & Piping

Mikropor continues their march towards larger global market shares, in compressed air purification and HVAC filtration. Their booth reflected it in size and in the number of visitors-and not just during the after-hours party featuring a good band! Compressed air industry veteran Volkan Ayhan said their "highly experienced group of U.S. Regional Managers" continues to drive growth with all their compressed air and gas purification, onsite gas generation and breathing air products. They displayed a new MTD Series Turbo Air Dryer designed for flow ranges of 5,850 to 17,500 cfm (10,000 to 30,000 Nm^3/h) at 100 psig (7 bar). The thermal mass design provides energy savings at partial loads while product literature says it can maintain a stable 38ºF (3ºC) pressure dew point. The units feature scroll and screw refrigeration compressors.

Nano is now part of Atlas Copco and is expanding globally with their range of compressed air purification and nitrogen/oxygen generation products. One of the "nano originals", Mark Lauterwasser said their growth in nitrogen and oxygen generation products has been very strong and that they are excited about taking nano global. He showed me their new Gen2 Mini nitrogen generator designed for laboratories and wine

Enrique Fernandez, Ignacio Tabuenca, Marga Loren and Manuel Loren at the Josval booth, next to their new IBERUS rotary screw air compressor.

Antonio Volpe at the KTC Compressors booth.

Mariano Rigotto, at the IES Air Compressors booth, next to their 3CT Carbon Capture Compressor.

Hannover Messe 2023 Show Report

production. Their packaging has always been cutting edge.

When I've walked into a Solberg booth over the years, I've known I can always expect a friendly face, to learn something new and to have a "Solberg refreshment on tap." They set the bar pretty high and this year was no different. Tor Solberg showed me their new Foam Dissipation Element designed to protect dry pumps increasingly being used in breweries (instead of liquid rings) in order to save water. He said this new technology uses UB filter media. He also showed me some interesting vapor condensation filters used in plastics and plastic extrusion markets. The filters have coils with refrigerant provoking the vapor to condense so it can be filtered.

The entire Mikropor team at their booth.

The Pentair booth was displaying their membrane technology for drying compressed air and other gases. What surprised me was when their Sales Director Carlos Rincon-Toro told me they were very active in using their membranes for humidifying applications in automation and EV battery manufacturing. They also surprised me when they said they've recently used membrane dryers to achieve a -75ºC pressure dew point in an application.

We ran into Jon Schwartzman, from AIRpipe USA, and followed him over to his booth.

Mark Lauterwasser, at the nano booth, next to their new Gen2 Mini small flow nitrogen generator.

Tor Solberg, at the Solberg booth, next to their new Foam Dissipation Filter Element for dry pumps in breweries.

Jeroen Le Large, Fred Dugast, Laurence Robic, Tobias Peters and Jörg Hädrich at the AIRpipe Europe booth.

Jay Gatz in front of the AF Series compressed air flow and pressure monitoring module at the Emerson Discrete Automation booth.

We met Frederic Dugast, who is the General Manager for AIRpipe Europe. He explained their head office for the European operation is located in Nantes, France. Products are being supplied to the European market from a central stock in Belgium. He said they have established their business in many European countries and are now expanding to other European areas. AIRpipe is a manufacturer of in-house engineered aluminum & stainless steel piping systems for compressed air, vacuum and non-flammable gases like welding gases, N_2 and CO_2. For other industrial mediums they offer the AQUApipe stainless steel piping system.

Cynthia Kuipers, Menno Verbeek and Pascal Van Putten at the VPInstruments booth displayed their new VPVision Mobile auditor tool (left to right).

Compressed Air Measurement Technology

Compressed air measurement appears to be growing significantly as a market. The products being sold the most are flow meters also able to measure at least pressure and then dew point meters. This market is clearly still in its' early stages of development and the companies pioneering the way with measurement technologies are providing industry with a great service to help this on-site utility be managed more sustainably and safely.

Martin Zeller, from CS Instruments, spent time with me talking about their new UltraCam

Hannover Messe 2023 Show Report

thermal imaging leak detector and their focus on precise measurement accuracy with flow meters. He explained their existing ultrasonic leak detectors, the LD 500 and LD 510 have been well accepted due to the automatic laser distance management feature which automatically adjust the leak flow estimate for distance. The new UltraCam thermal imaging attachment can be retrofitted on LD products built after August 2020. Martin said the list price for the LD 500, with the new UltraCam (including cloud software), is $8,000 – an eye-opening price point vs. models currently in the market. We also discussed flow metering at length and Martin said their philosophy is to provide the highest possible accuracy in flow measurements by taking time up front to determine the velocity of the air in the application with the customer. The velocity will cause them to customize the flow meter sensor to one of four velocities ranging from low to high. Low speed for example is 50 meters per second, standard is 93 m/s and high-speed is 224 m/s.

Martin Zeller, at the CS Instruments booth, demonstrating their newest leak detector, the new LD 500 with UltraCam thermal imaging.

VPInstruments had a Sustainability Superhero cut-out in their booth which made for many humorous photos. President Pascal Van Putten showed me their new VP Flow Scope M inline flow meter. I like how one can exchange the sensor cartridge, when it's time for calibration. They said this sensor cartridge philosophy will be extending out to the entire line. There was also a new auditor tool, a suitcase called the

Thomas Fischer and Jan Hoetzel at the SUTO ITEC booth (left to right).

Marcel-Andre Boi, at the IFM booth, in front of their SD Series flow and pressure meters.

VPVision Mobile – with metering devices, a data logger and the VPVision software to display the data all included.

Thomas Fischer and Jan Hoetzel, at the SUTO ITEC booth, told me the growth of their Company continues to be very strong saying, "Flow, pressure and dew point measurement continues to drive the growth." Their product portfolio is clearly growing as they showed me their new S605 Breathing Air Analyzer (fire fighter systems) and their S451 flow meter certified (ATEX, IECEX, GB) for outdoor and explosive environments. All their meters can now be configured with cell phones.

A surprise for me has been the size of IFM Efector, a manufacturer of sensors and measurement products for automation. Turns out they are a privately held German firm with approx. $1.3 billion in sales! Their booth reflected this with a semi-truck parked next to it which I guess they use for recruiting. I only knew them as a mysterious flow meter manufacturer, whose products I saw, in the hundreds, at a certain tire manufacturing plant, who then didn't allow me to write a story about it - after I wrote it. Yes, I'm still grumpy about it because it was one of the most amazing "best practice" cases I've ever seen on the use of compressed air flow meters! Anyways, I met with Marcel-Andre Boi, at the IFM booth, and he reviewed the newer versions of their SD Series flow/pressure meters which I'd seen back in the day. One thing they do is to "digitize" their measurement data so it can be efficiently integrated into the IT infrastructure supporting automation. He invited me to visit their U.S. production center in Malvern, PA and said compressed air flow/pressure metering is becoming a higher priority product for them due to the market growth potential they see due to the sustainability impact of improved compressed air systems.

Emerson Discrete Automation is a $2.6 billion division of $13.8 billion parent company Emerson. Discrete Automation has major process measurement and pneumatic automation brands like Fischer Rosemount, Rexroth, ASCO and Numatics. I have been very impressed by their focus optimizing the demand side of compressed air systems through their expertise with on-machine pneumatics. They are providing clients with retrofittable time-of-flight (TOF) sensors monitoring pneumatic cylinder performance. This is part of leak audits and an overall compressed air demand-side auditing effort which has already netted some huge wins for some clients in compressed air related energy savings. Director Amit Patel said, "compressed air monitoring (pressure, temperature, flow) with our AF2 modules is one of the first steps we take with each client on this journey." BP

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JAN 19 **The Minimum 24/7 Compressed Air Performance Metrics to Have**
Presenter Tim Dugan, P.E., President and Principal Engineer, Compression Engineering Corporation – *Sponsored by VPInstruments and FS-Curtis/FS-Elliott*
Thursday, January 19, 2023 – 2:00PM EST

FEB 23 **Low Pressure (15-60 psi) Air Applications: Blower or Air Compressor?**
Presenter Ron Marshall, Chief Auditor, Marshall Compressed Air Consulting – *Sponsored by Kaishan*
Thursday, February 23, 2023 – 2:00PM EST

APR 13 **Oil-Free vs Lubricated Rotary Screw Air Compressors: Pros and Cons**
Presenter Paul Edwards, Principal, Compressed Air Consultants – *Sponsored by Kaeser Compressors*
Thursday, April 13, 2023 – 2:00PM EST

APR 27 **Compressed Air as a Quality/Safety Manufacturing Process Variable**
Presenter Tom Taranto, Owner, Data Power Services – *Sponsored by Kaishan*
Thursday, April 27, 2023 – 2:00PM EST

MAY 11 **Vacuum System Fundamentals: Depth of Vacuum vs. Absolute Pressure**
Presenter Andy Smiltneek, President, Growth Solutions Consultants – *Sponsored by Rogers Machinery*
Thursday, May 11, 2023 – 2:00PM EST

MAY 18 **CTI STD-201RS Thermal Certification for Cooling System Heat Rejection Equipment Part 1: Performance Ratings**
Presenter Mike Womack, Thermal Certification Administrator, Cooling Technology Institute – *Sponsored by EVAPCO*
Thursday, May 18, 2023 – 2:00PM EST

JUN 08 **Vacuum Pump Maintenance**
Presenter Tie Duan, Solutions Engineer, E.W. Klein & Co. – *Sponsored by Kaishan*
Thursday, June 8, 2023 – 2:00PM EST

JUN 22 **Greener Compressed Air Systems-Reducing the Environmental Impact**
Presenter Paul Edwards, Principal, Compressed Air Consultants – *Sponsored by VPInstruments and Kaeser Compressors*
Thursday, June 22, 2023 – 2:00PM EST

JUL 13 **Design Considerations When Transitioning to Oil-Free Compressed Air Systems**
Presenter Tim Dugan, P.E., President and Principal Engineer, Compression Engineering Corporation – *Sponsored by Rogers Machinery and FS-Curtis/FS-Elliott*
Thursday, July 13, 2023 – 2:00PM EST

JUL 23 **Engineering Rooms for Aeration Blowers**
Presenter Tom Jenkins, P.E., President, JenTech Inc. – *Sponsored by APG-Neuros*
Thursday, July 23, 2023 – 2:00PM EST

AUG 17 **Compressed Air as a Food Ingredient**
Presenter Roderick Smith, Publisher, Compressed Air Best Practices Magazine – *Sponsored by Trace Analytics and BEKO Technologies*
Thursday, August 17, 2023 – 2:00PM EST

SEP 14 **Chiller Selections for Central Plants: Lowest Overall Costs for Process Cooling**
Presenter Clayton Penhallegon, Jr., P.E., Integrated Services Group – *Sponsored by Carrier*
Thursday, September 14, 2023 – 2:00PM EST

SEP 21 **Information Required to Specify an Air Compressor**
Presenter Loran Circle, Senior Consultant, Circle Training & Consulting – *Sponsored by Vaisala*
Thursday, September 21, 2023 – 2:00PM EST

OCT 05 **Compressed Air Systems for Cheese Manufacturing**
Presenter Frank Melch, Vice President, Zorn Compressor & Equipment – *Sponsored by Quincy Compressor*
Thursday, October 5, 2023 – 2:00PM EST

NOV 30 **Vacuum System Efficiency**
Presenter Andy Smiltneek, President, Growth Solutions Consultants – *Sponsored by Rogers Machinery*
Thursday, November 30, 2023 – 2:00PM EST

DEC 07 **Compressed Air Dryer Maintenance and Monitoring**
Presenter Loran Circle, Senior Consultant, Circle Training & Consulting – *Sponsored by BEKO Technologies*
Thursday, December 7, 2023 – 2:00PM EST

Loran Circle
Senior Consultant, Circle Training & Consulting

Frank Melch
Vice President, Zorn Compressor & Equipment

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Compressed Air Technology News

Sullair Expands LS Series with Higher Powered LS190-260 Series

Sullair, an industry leader in innovative compressed air solutions since 1965, announced the expansion of the popular and highly efficient LS Series lubricated rotary screw industrial air compressors with the release of higher powered LS190-260 Series models.

Sullair Expands LS Series Industrial Air Compressors with Addition of Higher Powered LS190-260 Series.

Building on the legacy and design of the original LS90-160 (90-160 kilowatt) compressors, the expanded LS190-260 Series brings 190-260 kilowatts of compressed air power with the same features customers have come to expect. All LS models feature a redesigned, highly efficient single stage air end, machined in Michigan City. and optional Sullair-exclusive Electronic Spiral Valve Technology that helps match compressed air supply to demand. Added features include the easy-to-use 10" color touch screen controller, super premium TEFC motor (fixed speed and Electronic Spiral Valve models) and easy-to-service design. Like earlier models the LS190-260 Series offers customers lower total cost of ownership while being easily serviceable. And the robust Sullair Touch Screen controller provides the ability to sequence up to 16 compressors, providing ultimate control and flexibility.

"The LS190-260 Series was designed and built based on direct customer feedback and demand," said Peter Modrow, Sullair Senior Product Manager. "Our customers have been anxiously waiting for a higher-powered LS Series compressor and we are thrilled to bring this next generation to market."

The Sullair LS190-260 Series air compressors are used in general manufacturing, steel production, power generation, mining and more.

About Sullair

Since 1965, Sullair has developed and manufactured air compressors with proven reliability and wear-free durability. Sullair is globally recognized as a leading manufacturer of air compressors for use in manufacturing, oil and gas operations, food processing, construction and more. Sullair has manufacturing capabilities in Michigan City, Indiana; Suzhou, China; and a JV (IHI-Sullair) based in Suzhou. For more information, visit www.sullair.com. Sullair is a Hitachi Group Company.

Emerson's New Aluminum Filter Regulators

Emerson has launched its new ASCO Series 641, 642 and 643 Aluminum Filter Regulators, which maximize process efficiency and reduce unplanned downtime in a broad range of process applications. This line of durable, aluminum filter regulators can handle the highest flow rates of any regulators in their class and provides precise pressure regulation to downstream instruments.

An alternative to stainless steel filter regulators, ASCO Series 641, 642 and 643 Aluminum Filter Regulators complete Emerson's full suite of valve piloting technologies. This allows process manufacturers to source their total valve piloting solutions, including solenoid valves, switch boxes, filter regulators and accessories, from one global technology partner.

By using one supplier, manufacturers can simplify their supply chains, improve design accuracy and access comprehensive engineering support. Designing a valve piloting solution that includes technologies from different suppliers splits vendor responsibility and can introduce an opportunity for error.

"Sourcing valve piloting technology from multiple vendors is time-consuming and complicates supply chains, while limited

Compressed Air Technology News

options for conventional filter regulators leave some customers with unmet needs," said Mike Howells, marketing manager, process applications for Europe, Middle East & Africa at Emerson. "Our new ASCO Series 641, 642 and 643 Aluminum Filter Regulators simplify sourcing for our customers and ensures that they have industry-leading technology that enhances process efficiency, safety and reliability."

With the market's highest flow rate capabilities of up to 370.8 standard cubic feet per minute (10,500 liters per minute), the aluminum filter regulators improve process efficiency and ensure that stringent process valve opening/closing requirements like those for emergency shutdown valves are met. Higher flow rates provide more air to the valve actuator, which increases the opening and closing speed of process valves. Depending on the application, slow valve closures can increase safety risks.

These robust filter regulators feature rugged construction and advanced engineering that further enhance safety and maintain plant uptime, while specialized powder coating ensures reliable operation in harsh, corrosive process environments. Effective moisture removal keeps media dry to protect downstream devices, and sophisticated media filtration prevents downstream process contamination.

Able to handle the highest flow rates, ASCO Series 641/642/643 Aluminum Filter Regulators allow manufacturers to single-source complete valve piloting solutions.

This three-tiered regulator line provides a .25-inch to 1-inch coverage and is highly customizable. Process manufacturers can choose advanced features such as Quick Relief, which enhances safety and operational certainty by exhausting downstream pressure if supply air pressure is lost, as well as low-temperature and low-copper variants, manual and automatic draining, global certifications, and many other options that serve specific applications, in the chemical, oil and gas, energy and utilities, food and beverage, and water and wastewater industries.

About Emerson

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

C-Aire Releases Four New Fire Protection Air Compressors

C-Aire's latest riser mount additions to the Whisper Quiet Series come in four different configurations: S164, S163, S253, & S418. The S164 fire protection air compressor features C-Aire's Digital Air Maintenance Device Gen-3 with Leak Detection. The Digital AMD allows users and techs to properly set the system pressure in seconds! It comes factory set at 10 to 20 PSI and is adjustable from 5 to 55 PSI. C-Aire's patent-pending Leak Detection shows techs and owners how many times the system has run in the past 24 hours and 7 days. This is a quick and easy way to quantify how leaky a system is. The three other models feature preset pressure switches instead of the Digital AMD, which are suited for specific dry pipe valves.

The S163 model comes with a pressure switch set at 30-40 psi, which makes it compatible with all Standard Pressure Differential Dry Pipe Valves. C-Aire's S253 model is the perfect fit for Reliable's DDX Low-

C-Aire Compressors is introducing four new configurations to the Whisper Quiet Series.

Pressure Dry Pipe Valve due to its 23-28 psi preset pressure switch. The S418 model is specifically designed for Victaulic's FireLock NXT Dry Pipe Valve with a pressure switch set at 13-18 psi. With their ultra-compact design and patented quick riser mount system, installation is easier than ever. All four models are ETL Listed and NFPA 13 compliant for applications in the U.S. and Canada.

About C-Aire Compressors

Founded in 1979, C-Aire started as a local family-owned operation. Since the beginning, we have worked to provide high-quality compressors at affordable prices. After new ownership in 2009, C-Aire has grown to new levels. With a motivated team that strives to be the best and a "continuous improvement" mindset, C-Aire continues to climb and become a leader in the industry. As we celebrate 44 years of business and 14 years under new ownership, our competitive prices and product excellence still ring true. C-Aire designs, builds, and distributes high-quality commercial-grade reciprocating and dry pipe air compressors for the Fire Protection, Automotive, and Industrial markets. For more information, visit www.cairecompressors.com.

KOBOLD Announces DOG-6 Oscillation Flow Meter

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

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

During the flow through the flow body, part of the media is routed through a bypass into a flow oscillator, which is the element where measurement occurs. Here, the media flows through a chamber with two flow channels, and a bluff body in the flow stream directs the flow to either the left or

The new DOG-6 Oscillation Flow Meter for dry gases, wet gases, and gas mixtures offers outstanding features and an unbeatable price/performance ratio.

Compressed Air Technology News

the right. A channel on the side of the bluff body connects both sides and the flow creates a positive pressure on one side and a negative on the other and this difference in pressure redirects the flow to the other side. The flow begins to oscillate, and the rate of oscillation is used to compute the flow measurement.

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

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

The DOG-6 is not affected by pressure or temperature changes and individual evaluations are made possible by the flow computer. In addition to continuous and cumulative flow rates, temperature and pressure can be evaluated by separate inputs. Data storage and communication can be implemented by numerous output options. The many unique design advantages and low cost of the DOG-6 bring it to the forefront as the solution for a wide variety of current applications and for future energy applications using biogas and hydrogen.

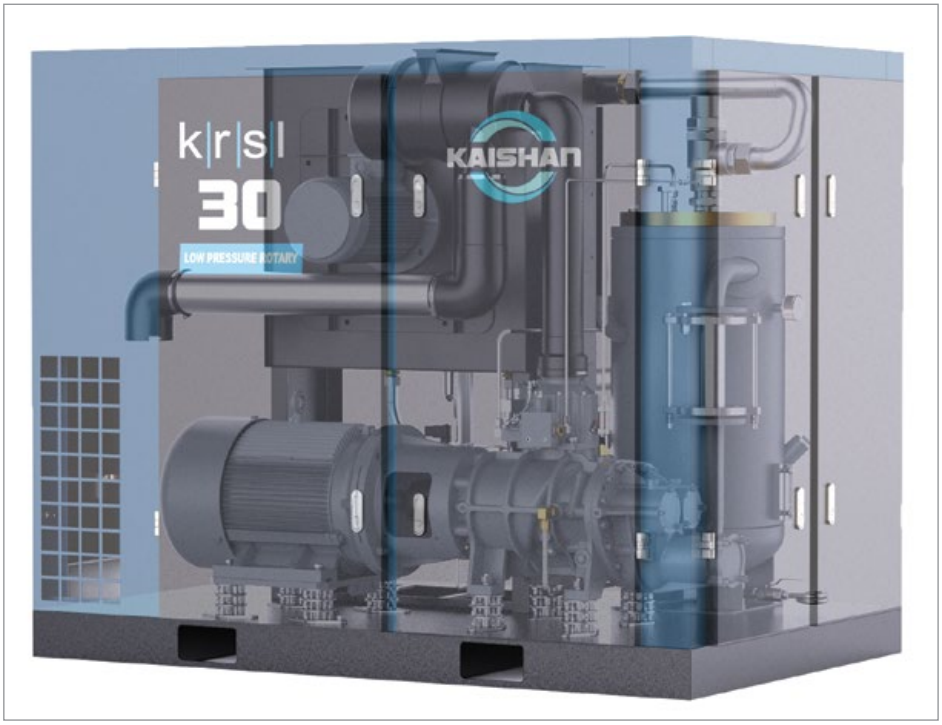
About Kobold USA

For decades, KOBOLD has been a world leader in process measurement and control solutions. We offer one of the industry's broadest lines of sensors, switches and transmitters to measure and control flow, pressure, level and temperature. For more information, visit www.koboldusa.com.

Kaishan USA Launches Low-Pressure Rotary Screw Compressor

Kaishan USA, a leading worldwide manufacturer of industrial air compressors, has introduced a new series of industrial, low-pressure rotary screw air compressors, the KRSL. The new Kaishan KRSL low-pressure rotary screw air compressors are fully packaged and ready to be plugged into any system or operate independently. These compressor packages are equipped with Kaishan's patented "SKYv" airend, enabling them to perform exceptionally well in a wide range of applications with varying demands and requirements for flexibility. With this feature, the compressors can effectively handle applications ranging from 25 psig to 45 psig, all within a single package.

Compared to conventional blower solutions within this pressure range, the KRSL offers several unique benefits. In addition to its innovative SKYv airend, a robust premium bearing design and variable discharge port results in improved efficiency, consistent airflow, reduced noise levels, a smaller footprint and a lower total cost of ownership throughout its lifespan.



The new Kaishan KRSL low-pressure rotary screw air compressors are fully packaged and ready to be plugged into any system or operate independently.

"Our engineers have set a new milestone in the low-pressure compressor market," said John Schmitt, product manager, Kaishan USA. "Kaishan's KRSL maximizes the compressor's efficiency by delivering compressed air at different flow rates and pressures – even in the face of demand fluctuations – to meet the changing needs of the user's application. This design marks a new era in efficient and reliable low-pressure compressed air systems, providing businesses with a powerful and cost-effective solution to their compressed air needs."

For more information about Kaishan USA's low-pressure rotary screw package, please visit https://kaishanusa.com/rotary-screw-air-compressors/.

About Kaishan USA

Kaishan USA engineers the highest quality rotary screw air compressors that enable us to build a better, more efficient future. We streamline our operations by taking direct ownership of 85% of our product content. This process enables us to vigorously control the cost and caliber of our equipment while improving its energy efficiency and safe use. Our solutions range from 5-600 horsepower and are used in a variety of industries. Based in Loxley, Alabama, our new 65,000-square-foot, state-of-the-art manufacturing facility fully stocks over 300 finished units and aftermarket parts that serve customers around the world. We are a proud American manufacturer, with military veterans comprising more than 20% of our staff. To learn more, please visit www.kaishanusa.com.

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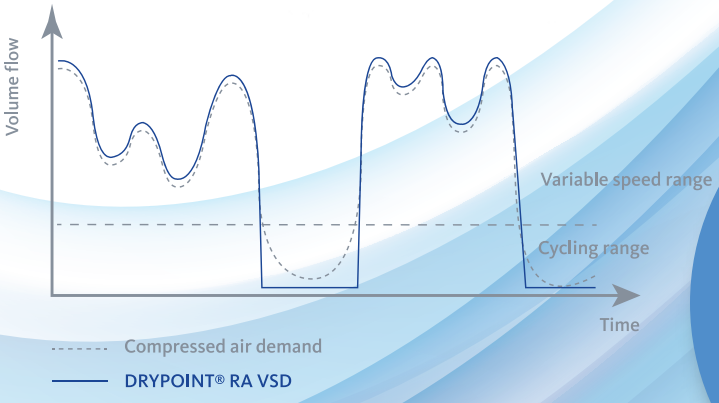

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