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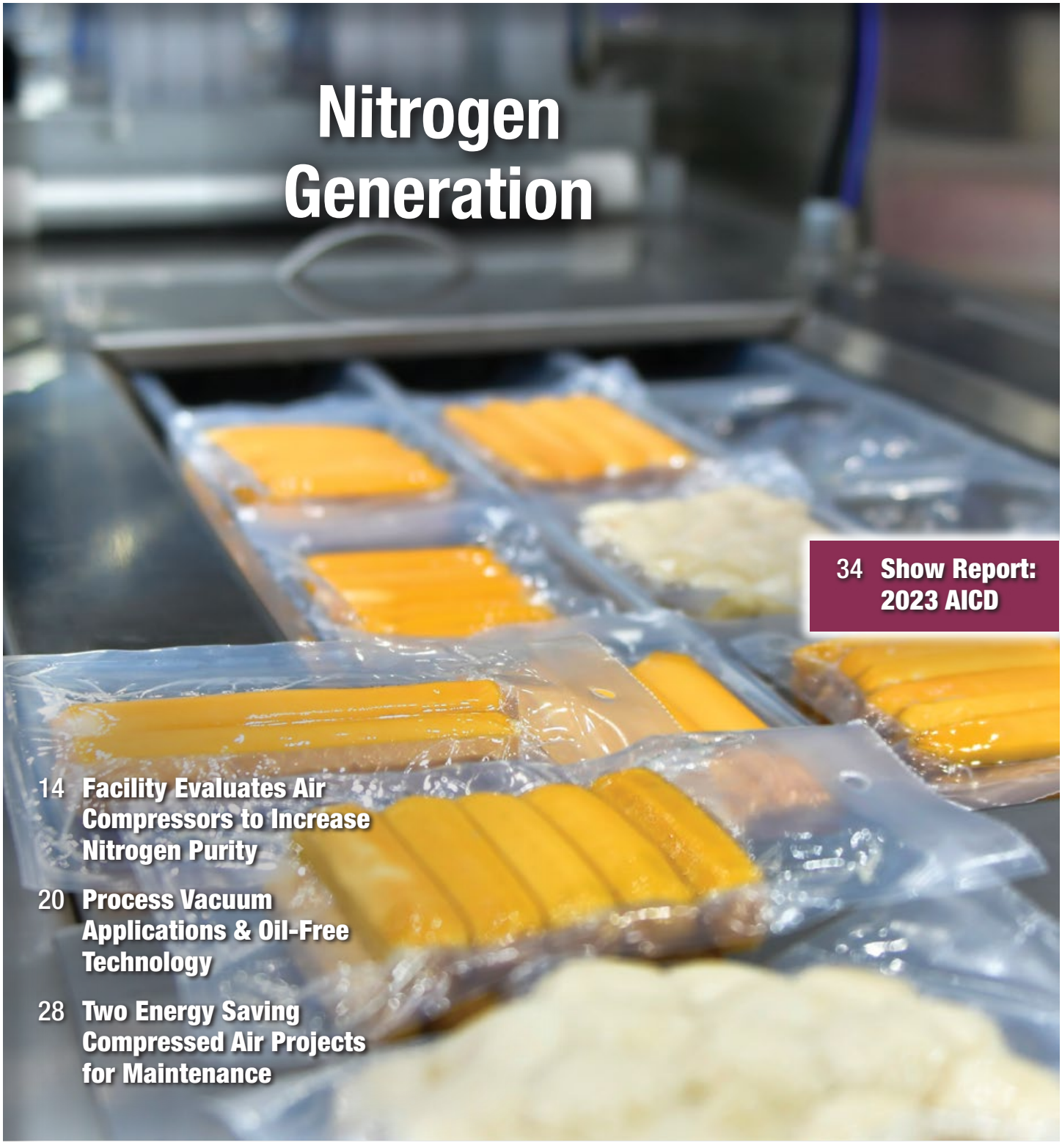

Nitrogen Generation

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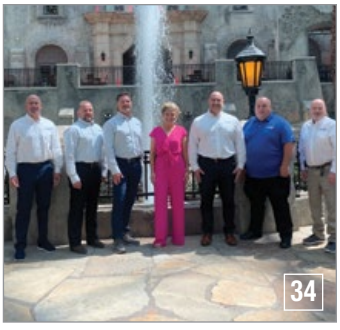

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FROM THE EDITOR

Nitrogen Generation

On-site nitrogen generation, using the compressed air system, brings many benefits to manufacturing plants. Many cite the positive carbon impact created by no longer asking suppliers to transport and remove nitrogen cylinders to and from the facility. Others say it's the reliability and self-sufficiency of generating one's own nitrogen – rather than relying on external suppliers who may have issues meeting plant demand. Lastly, some say this is the most cost-effective way to meet the exact nitrogen purity demands of the plant, rather than be forced into supplied nitrogen purities of 99.99999%.

Air compressors, therefore, are now providing compressed air to a rapidly growing and significant installed base of nitrogen generators, able to provide manufacturing plants with the exact level of nitrogen purity they require. Hank Van Ormer, the Technical Director for APenergy, has sent us an excellent case study about how a manufacturing plant eventually found the best way to re-design their compressed air system to accommodate a decision to increase their nitrogen purity from 98.4% to 99.5%.

Nitrogen is often used for food packaging, as are process vacuum systems. Bryan Jensen, the Engineered Systems Solutions Manager from the Rogers Machinery Company, has sent us an educational article titled, "Vacuum Fundamentals: Process Applications & Oil-Free Technology." This is a must-read for those working on process vacuum systems.

Maintenance teams play a critical role in the sustainable, safe and reliable performance of a compressed air system. Don Van Ormer is a Senior Auditor for APenergy and has sent us an article titled, "Compressed Air Audit Details Two Energy Saving Projects for Maintenance Teams." This article focuses on compressed air leak surveys and on compressed air condensate drains. Please consider forwarding this article to your maintenance personnel for comment.

Bill Smith and I were once again invited to attend the 2023 AICD Conference. We hope you enjoy our Show Report and congratulate the AICD for once again delivering a wonderful event.

The Best Practices 2023 Expo & Conference, taking place October 23-25, 2023, has announced a tremendous lineup of Conference Speakers! Opening and Plenary Session speakers feature experts from The Campbell Soup Company, Givaudan, Gentex, Ingersoll Rand, Hitachi Global Air Power Group, Woodard & Curran, Compressed Air & Gas Institute and The Cooling Technology Institute. Register today for Early Bird rates!

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

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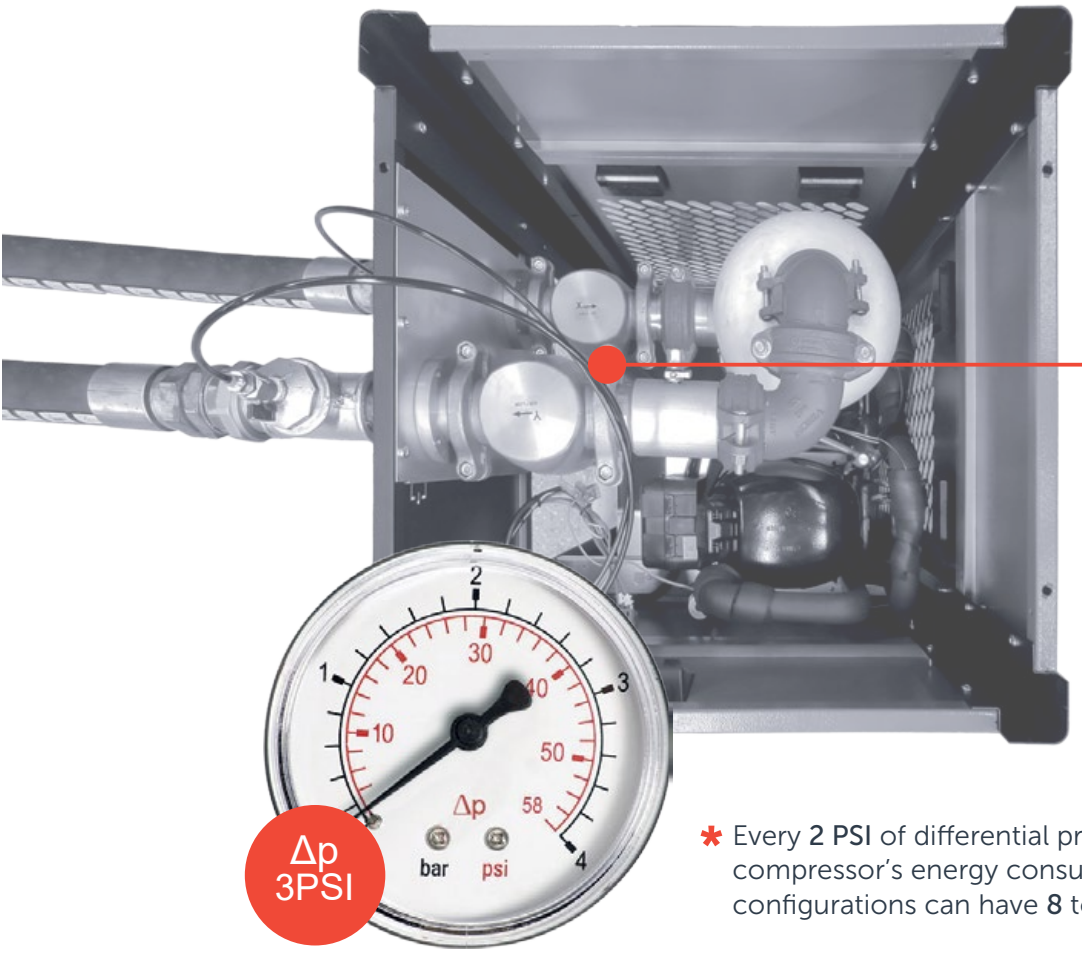

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Compressed Air Industry News

Fluid-Aire Dynamics Marks 40th Anniversary in Compressed Air Industry

Fluid-Aire Dynamics, a leader in industrial compressed air sales and service throughout the Midwest, is celebrating 40 years of excellence in the industry. Over the last four decades, the company has grown from a single shop in northern Illinois to an industry powerhouse with service centers in Chicago, Milwaukee, Minneapolis, Detroit, San Antonio and, most recently, Philadelphia.

Founded by Garth Taylor in 1983 in Franklin Park, Illinois, Fluid-Aire Dynamics built its reputation in the compressed air industry on quality, service and expertise. It is now under the leadership of the second generation of Taylors: Derrick Taylor, Director; Kevin Taylor, General Manager; and Brad Taylor, Sales Engineering Manager. With more than 2,600 active customers across six states, Fluid-Aire Dynamics provides expert sales, service and emergency repair for industrial compressed air systems. With the recent acquisition of The Titus Company in Pennsylvania, they now also have extensive nitrogen generation expertise on staff.

Founder Garth Taylor said, "Never in my wildest dreams 40 years ago was it thought that FAD would be where it is today. This is largely due to the energy and passion my sons have poured into building the business and the PneuTech brand of compressors, dryers, aluminum air piping and accessories. This is also due to the dedication and hard work of every employee within the company, to whom I extend a hearty 'Thank You' to each one."

That commitment has been instrumental in the company's growth over the last 40 years. Industrial compressed air users know they can count on Fluid-Aire Dynamics for their knowledge and expertise, whether they need compressed air system design and engineering or maintenance service and repair. Fluid-Aire Dynamics services all major makes and models of industrial air compressors, dryers and accessories and even offers 24-hour emergency repair with a four-hour service guarantee for active customers.

Their growth has accelerated over the last 15 years through expansions and acquisitions in key metro areas, including Compressed Air Systems in Milwaukee in 2017, Compressed Air Concepts in Minneapolis in 2020, and Philadelphia-area The Titus Company in 2023. Since 2016, the company has grown from 23 Chicago-based employees to more than 100 employees across their market areas, earning them a place on the Inc. 5000 Fastest Growing Companies list for four years in a row. With demand for compressed air systems and services remaining strong, that growth trajectory doesn't show any signs of slowing down soon.

Kevin Taylor said, "Our journey over the last 40 years has been truly amazing, and sometimes it feels like we are still just getting started. While our core values and growth are always at the forefront, the continued focus on the customer's experience by our team is the only way we will continue to succeed. With 40 years behind us, we will continue to use our experience, knowledge, and passion to facilitate the growth of the company in the years to come."

About Fluid-Aire Dynamics

Fluid-Aire Dynamics is a leading provider of industrial compressed air system sales and service in Chicago, Milwaukee, Minneapolis, Detroit, Philadelphia and San Antonio. Specializing in rotary

Kevin, Derrick, and Brad Taylor are leading Fluid-Aire Dynamics through its next phase of success and growth by staying true to the principles laid down by their father 40 years ago.

screw air compressors, they offer compressed air system design and engineering, equipment sales, preventative maintenance, emergency repair and air compressor rentals. Based in Schaumburg, Illinois, Fluid-Aire Dynamics services all major makes and models of industrial air compressors and associated air accessories. They also have their proprietary line of rotary screw compressors, dryers, and in-line filtration, PneuTech and own the Unipipe all-aluminum piping system for compressed air, inert gasses, vacuum, and high-pressure applications. They pride themselves on excellence in service and response for their manufacturing and industrial customers because response matters. For more information, visit www.fluidairedynamics.com.

Chart Industries Agrees to Sell Roots™ Business to Ingersoll Rand

Chart Industries, Inc. ("Chart") announced that it has signed a definitive agreement to sell its Roots™ business ("Roots") to Ingersoll Rand Inc. ("Ingersoll Rand") for an all-cash purchase price of $300 million, representing an attractive low-teens adjusted EBITDA multiple. The transaction, which is subject to customary closing conditions, is expected to close in the third quarter 2023.

Roots is a leading provider of low-pressure compression and vacuum technologies. As part of the transaction, Ingersoll Rand will assume ownership of the Connersville, Indiana (USA) manufacturing facility, which is dedicated to Roots products, as well as retain approximately 300 team members.

"We are excited to have executed a definitive agreement in the second quarter 2023 to sell Roots, which is another key step in accelerating our deleveraging plan while simultaneously allowing us to focus on our core strategic solution offering and integration efforts," said Jill Evanko, Chart's CEO and President. "We also are thrilled that the business will be owned by Ingersoll Rand, a proven strategic partner and a company that will care for the Roots' team members."

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Compressed Air Industry News

"We have long admired Roots and are thrilled to add this iconic brand to our portfolio. This complementary acquisition expands our low-pressure compression and vacuum product offerings and is a great example of our partnership with Chart, where the acquisition was a win-win for both companies," said Vicente Reynal, chairman and chief executive officer of Ingersoll Rand.

Chart is also reiterating its full year 2023 anticipated outlook for revenue, adjusted EBITDA, adjusted earnings per share, adjusted free cash ow and operational cash ow available for debt paydown, as well as our 2024 adjusted EBITDA outlook for $1.3 billion. We also reiterate our year-one annualized cost and commercial synergy targets of $175 million and $150 million as the original outlook did not assume any Roots™ associated synergies.

About Chart Industries, Inc.

Chart Industries, Inc. is an independent global leader in the design, engineering, and manufacturing of process technologies and equipment for gas and liquid molecule handing for the Nexus of Clean™ – clean power, clean water, clean food, and clean industrials, regardless of molecule. Chart is a leading provider of technology, equipment and services related to liquified natural gas, hydrogen, biogas and CO_2 capture amongst other applications. With 64 global manufacturing locations and over 50 service centers from the United States to Asia, Australia, India, Europe and South America, the company maintains accountability and transparency to its team members, suppliers, customers and communities. To learn more, visit www.chartindustries.com.

Atlas Copco Acquires British Compressed Air Distributor

Atlas Copco has acquired Maziak Compressor Services Ltd., a UK distributor of air compressors, nitrogen generators and process cooling equipment as well as related services and support.

Maziak Compressor Services Ltd. (Maziak) is a privately owned company, founded in 1958 and employing 40 people. The company is based near Northampton and covers the East of England and the East Midlands region. In 2022, the company had revenues of approximately 7 MGBP (87 MSEK*).

Maziak provides products and service to companies in all types of manufacturing industries, such as general manufacturing, electronics, food and beverage, aerospace and metal fabrication.

"Maziak has an excellent reputation as a quality service provider and has strong sales and service coverage in the East of England and East Midlands of the UK," said Vagner Rego, Business Area President Compressor Technique. "The acquisition will increase our presence in the region and provide growth opportunities."

The purchase price is not disclosed. The acquired business will become part of the Service division within Atlas Copco's Compressor Technique Business Area.

About 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.

UCA to Supply PIPELINE AIR™ to a Major Glass Producer

Universal Compressed Air (UCA) will design, build, own, operate, and maintain a state-of-the-art facility to provide compressed dry air and vacuum to a major glass producer in the United States. PIPELINE AIR™, UCA's performance contracting model, is designed to allow companies to outsource compressed air as a utility, reduce energy and carbon footprint, preserve capital, and focus on their core business.

Universal Compressed Air to Supply PIPELINE AIR™ to a Major Glass Producer in the United States.

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Compressed Air Industry News

UCA applies a design approach that focuses on the lowest evaluated cost coupled with system reliability, operability, ease of maintenance, and constructability. UCA will execute the design, construction, commissioning, startup, operations, and maintenance of the new plant with startup expected in early 2024. UCA looks forward to partnering with the customer to produce efficient and reliable compressed air while continuing our commitment to building a sustainable future.

About UCA

Universal Compressed Air provides compressed air as a utility. It is a privately-owned and thriving high-technology business in Pennsylvania's Lehigh Valley focused on compressed air systems for industry. UCA brings decades of Industrial Gas expertise to Compressed Air Supply Systems. The systems are optimized to deliver compressed air as a utility and, in every case, an efficient and reliable solution will be designed and built to maximize savings. As a compressed air supplier, the systems are proven, trusted, and designed to optimize the end user's success. For more information, visit www.universalcompressedair.com.

Hydrotech Acquires Isaacs Fluid Power Equipment Company

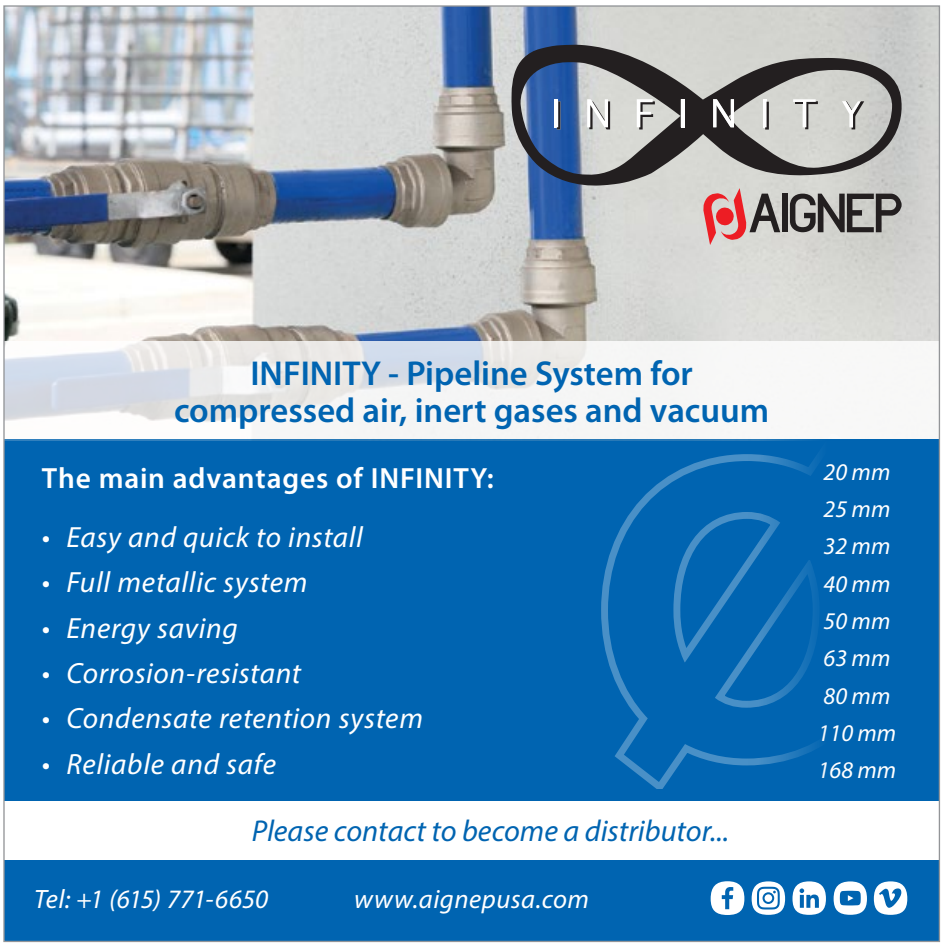
Hydrotech announced the acquisition of Isaacs Fluid Power Equipment Company (Isaacs) – representing progress toward the company's mission to modernize industrial equipment and streamline operations through application know-how, technical expertise and reliable service.

Based in Mason, Ohio, and founded in 1948, Isaacs is a fluid power distributor serving multiple OEM and end-user industries across Ohio, Indiana, Kentucky and portions of lower Michigan and Illinois. By acquiring Isaacs, Hydrotech expands its capabilities and geographical reach to create a new alliance in Midwest fluid power solutions. Isaacs will operate as a division of Hydrotech, which is part of the FSC group of companies, following the completion of this acquisition.

Isaacs has 37 employees, including key members of the leadership team, General Manager Bruce Becknell and Finance Manager Beverley Massey, who will continue in their roles. After over 50 years with Isaacs, President and CEO Roy Carman will officially retire on the date of closing. All six Isaacs office and branch locations will remain open. Specific terms of the deal will not be disclosed.

"Isaacs Fluid Power Equipment Company is a perfect fit with Hydrotech," said John Campbell, President of Hydrotech. "With our overall combined expertise, we will strengthen the value-added distribution proposition that has made our individual companies trusted and reliable partners across a diverse range of industries. Isaacs and Hydrotech share the same cultural values, making this acquisition a win-win for our teams."

Hydrotech benefits from Isaacs' in-depth pneumatic and vacuum technical engineering,



service and application knowledge while Isaacs gains access to Hydrotech's strong complete engineered solutions, quality replacement parts and excellent customer support along with the resources of a larger company.

"Both companies have established a solid foundation while offering unique areas of specialty and experience," said Campbell. "Working together, our customers across the Midwest will benefit from a dynamic fluid power partner that leverages our collective engineering and product knowledge. Under one umbrella, we will be able to take our service capabilities to the next level for our customers."

About Isaacs Fluid Power Equipment Company

Isaacs Fluid Power Equipment Company specializes in pneumatic and vacuum products including control valves, cylinders, linear and rotary actuators, air motors, air compressors, vacuum pumps and systems, compressed air filters and dryers, pressure regulators, lubricators, precision pressure control, pneumatic logic, fittings, tubing, and connectors. For more information, visit www.isaacsfluidpower.com.

Burckhardt Compression Supports Petrochemical Company

A major petrochemical company has been meeting the demand for its products for nearly 60 years, specializing in polymers such as ethylene, polyethylene, polyvinyl chloride, and polypropylene. These polymers are essential components for many industries worldwide, as they are used in the production of a wide range of products, including packaging, construction materials, automotive components, and textiles.

To meet high market demand, the factory relies on robust plant and equipment for flawless production. Although the two low-density polyethylene (LDPE) compressors – a booster/primary and a hyper, critical to the production process required scheduled maintenance, they only needed minor repairs. Additionally, the auxiliary equipment was also part of the factory's major turnaround, which required special care to ensure optimum performance.

Burckhardt Compression's specialist team attended the site and worked with the customer's on-site engineering team to collect site data and provide insight into the condition

Replacement of bearings and overhaul of connecting rod.

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Compressed Air Industry News

of the compressor system for necessary repairs and major turnaround.

The customer faced several project challenges, including the need for OEM expertise to ensure the project was completed professionally and on time due to the compressed timeline for the overhaul. Additionally, there was a requirement for a single-source supplier to coordinate and execute all compressor-related work on the auxiliary equipment like motor and gas piping.

Burckhardt Compression provided comprehensive support and management for the customer's project. This included overhauling a lubrication unit, cleaning and flushing of the auxiliary and gas piping, as well as inspecting and overhauling the compressors to ensure they were fully operational. Burckhardt Compression also coordinated with the motor OEM to assess its condition and source the necessary spare parts.

To adhere to a strict timeline, Field Service representatives from Burckhardt Compression worked in shifts to carry out the required work including crank gear overhaul and con-rod bearing replacement. This was in addition to the other work managed by the on-site Field Service Coordinator, who acted as a single point of contact for project management and oversaw the entire project.

The major turnaround has resulted in an extended lifetime of the customer's plant equipment and ensured safe compressor operation until the next scheduled maintenance.

A contracts specialist for the customer said, "Our organization is extremely satisfied with the exceptional professional services provided by Burckhardt Compression. The entire team provided an unwavering dedication to completing the project on time and within budget. The technical expertise of Burckhardt Compression is second to none, and we are grateful for the quality of work and successful completion of the project."

About Burckhardt Compression

Burckhardt Compression is the worldwide market leader for reciprocating compressor systems and the only manufacturer and service provider that covers a full range of reciprocating compressor technologies and services. Its customized compressor systems are used in the gas gathering and processing, gas transport and storage, refinery, chemical, petrochemical as well as in the industrial gas and hydrogen mobility and energy sectors. Burckhardt Compression's leading technology, broad portfolio of compressor components and the full range of services help customers around the world to find the optimized solution for their reciprocating compressor systems. Since 1844, its highly skilled workforce has crafted superior solutions and set the benchmark in the gas compression industry. For more information, visit www.burckhardtcompression.com.

Facility Evaluates Air Compressors to Increase Nitrogen Purity with Nitrogen Generators

By Hank Van Ormer, Technical Director, APenergy

Over the last two decades, there has been a significant increase of manufacturing facilities deciding to produce their own nitrogen on-site, using compressed air systems and nitrogen generators. They are choosing on-site nitrogen generation, instead of purchasing and receiving deliveries of nitrogen by the cylinder or having a "Nitrogen Over the Fence" supplier. This growth trend has accelerated over the past three years as COVID related demand for nitrogen at critical care facilities created issues with nitrogen deliveries to manufacturing plants.

In addition to taking control of the reliability of nitrogen supply, other reasons plants are switching to on-site nitrogen generation are safety (vs. high-pressure cylinders), sustainability (eliminating truck deliveries and tank storage) and cost.

This market trend has led to an increase in the availability of smaller nitrogen generation units, which plants can connect to the compressed air system. These units have seen significant technological improvements, over the past ten years, with regards to their efficiency in terms of how much compressed air they need to generate nitrogen.

The objective of this article is to first review some fundamentals of nitrogen and the most basic ways it can be generated on-site. We will then review the decision-making criteria a manufacturing plant reviewed, related to the need for more compressed air, in order to increase the purity of their nitrogen generated on-site from 98.4% to 99.5%. We will review the impact this had on the compressed air system and the air compressor options they evaluated and their associated energy costs.

Table 1. Nitrogen Outlet Flows at Different Purity Levels and Inlet Compressed Air Pressures								
	Nitrogen Outlet Flow (scfm) from a Fixed Compressed Air Flow through a Specific Nitrogen Membrane Generator				Same membrane generator at higher pressure will flow 56 to 59% more nitrogen. It will use 45% more compressed air which will cost 20 to 22% more power (kW) per scfm compressed air to produce.			
Compressed Air	**100 psig inlet pressure**				**145 psig inlet pressure**			
Nitrogen Purity	95.0%	97.0%	99.0%	99.5%	95.0%	97.0%	99.0%	99.5%
Model 1	11.6	7.6	3.6	2.5	19.6	13.0	6.6	4.6
Model 2	17.7	11.7	5.6	4.0	29.5	19.8	10.1	7.2
Model 3	24.6	16.4	8.2	5.9	40.5	27.4	14.3	9.5
Model 4	35.9	24.0	12.1	8.4	59.2	40.1	21.0	14.2
Model 5	57.5	38.4	19.3	13.7	94.7	64.1	33.5	22.8
Model 6	80.3	53.8	27.0	19.0	132.4	89.7	46.9	33.7
Model 7	229.6	153.5	76.7	55.0	378.4	256.1	133.5	94.9
Model 8	287.7	192.2	95.6	70.1	474.2	320.8	156.7	119.7

A Brief Review of Nitrogen Fundamental and Nitrogen Generator Technologies

Nitrogen is a plentiful and readily available gas. Ambient air consists of 78% nitrogen, 21% oxygen and the balance is a mix of gases. Nitrogen is a dry gas with an atmospheric dew point of -94°F. Nitrogen is colorless, odorless, and tasteless and additional characteristics that make it the go-to gas for countless industrial and scientific applications.[1]

The most common types of nitrogen generators are PSA (pressure swing adsorption) and membrane separation. The PSA system sends compressed air through a tower filled with carbon molecular sieve (CMS). Oxygen is adsorbed to the surface of the CMS while Nitrogen flows through and is delivered to the system. PSA units will regenerate the CMS beds and will remove the oxygen to a separate

Facility Evaluates Air Compressors to Increase Nitrogen Purity with Nitrogen Generators

On-site nitrogen generation eliminates the carbon impact related to the transportation of nitrogen cylinders to manufacturing plants.

exhaust and can deliver high purity Nitrogen at higher volumes.

Membrane nitrogen generators use the principles of selective permeation to separate gases by separating oxygen, water vapor and CO_2 through the membrane walls, leaving Nitrogen and in the gas stream to be delivered. Not all membranes are the same and are developed and designed for specifically different flow values and nitrogen purity levels. A membrane with high permeability for nitrogen will separate more nitrogen than a similar sized lower permeability material at the same pressure. Some membranes require higher temperatures to perform.

The Relationship Between Nitrogen Purity and Compressed Air Pressure and Energy Costs

Maintenance costs of both PSA and membrane-type nitrogen generators are very low. The primary operating cost of a nitrogen generator is the electricity required by the air compressor(s) required to supply it with compressed air at the proper pressure and volume.

Let's review some basic relationships using membrane-type generators as an example.

- The higher the inlet pressure to a membrane nitrogen generator, the greater the volume of nitrogen is delivered at the same purity.
- The higher the inlet pressure, the more compressed air is used to generate the required volume of N_2.

- The higher the purity of nitrogen required, the greater the amount (at the same inlet pressure) of compressed air flow required.
- The higher the pressure of the compressed air used to generate the N_2, the higher the electrical energy cost will be of the air compressors used to produce it.
- The higher the volume of compressed air required, the higher the operating electrical energy required.

Case Study-Evaluating Compressed Air Energy Costs and Options

A manufacturing plant had a large 200 horsepower (hp) air compressor supporting the compressed air needs of the plant. This air compressor provided approximately 1,000 cfm at 100 psig of compressed air at full load. A laboratory within the plant used two separate PSA-type nitrogen generators consuming 35 scfm (each) of compressed air at 100 psig. The nitrogen purity requirement was 98.4%.

The decision was made by production to increase the nitrogen purity requirement to 99.5% using the central compressed air system. As we have seen, an increase in nitrogen purity requirements places greater demands on the compressed air system. Our team was asked to evaluate what the options were to provide more compressed air and what the associated energy costs would be.

We evaluated the existing 200 hp air compressor and nitrogen generators and established the following energy cost profiles.

- The existing electrical energy cost to produce compressed air for the whole plant equaled $98.27 scfm/yr at 100 psig. This equaled roughly $98,270 per year.
- Two separate PSA nitrogen generators required 35 scfm of compressed air (each) and generate approximately 7 scfm of nitrogen each at 100 psig inlet pressure and 98.4% nitrogen purity
  - 70 scfm x $98.27/scfh/yr = $6,879 total energy cost to generate 14 scfh/N_2 with a PSA system at 98.4% purity

Four Attempts to Meet the Increased Nitrogen Purity Demands-with Different Energy Costs

As stated, production required an increase in the nitrogen purity level from 98.4% to 99.5% nitrogen. Plant personnel responded with a series of different actions.

- Action #1: Ask production if they are able to decrease nitrogen consumption at the same inlet pressure. Production ruled this option out as nitrogen demand remained constant.

Facility Evaluates Air Compressors to Increase Nitrogen Purity with Nitrogen Generators

Modified Atmosphere Packaging (MAP) uses nitrogen to preserve product freshness and extend shelf time.

- Action #2: Raise the air compressor pressure from the main system from 100 to 120 psig
  - Before we arrived, plant personnel raised the discharge pressure of the central system's 200 hp air compressor from 100 to 120 psig. The result was that the cost to generate compressed air, for the whole plant, increased to $108.63/scfm. This raised the annual electric energy cost to produce 1,000 cfm from $98,270/year to $108,030/year – an increase of $9,760/year, almost 10%.

- Action #3: Plant personnel then installed a 2:1 ratio pneumatic booster to boost the compressed air system pressure from 85 to 170 psig in a 2:1 compression ratio design booster and then regulate the pressure down to the required 130 psig.
  - The higher nitrogen purity requirement doubled compressed air demand to 140 scfm instead of the original 70 scfm. The new electrical energy operating cost, for the nitrogen generators, was $13,758/year – an increase of $6,879/year, or almost a 100% increase.
  - This action did represent a small savings of $2,881 (vs. Action #2) in electrical energy per year to produce 7 scfh N_2 at the increased purity level.

- Action #4: A better and final solution was made by supplying a new, separate, dedicated (for the nitrogen generators) air compressor rated for 70 cfm at 135 psig.
  - This smaller 15 kW air compressor delivered 72 cfm at 130 psig
  - Cost to operate this additional air compressor
    - 15 kW x 8,760 hours x $.06 kWh = $7,884 per year
    - This energy cost represented a $5,874 savings versus the use of the booster detailed in Action #3 ($13,758 – $7,884 = $5,874).

This case study shows the varying energy costs, related to providing compressed air to produce 14 scfh of nitrogen at the new nitrogen purity level of 99.5%.

Lessons Learned

To avoid costly (in terms of capital and energy) misapplications of air compressors or boosters, regardless of the type of on-site nitrogen generation, plants should consider the following items.

- Identify the actual nitrogen purity needed and understand the cost of higher purity specifications.
- Identify the average and peak flows in nitrogen demand.
- Select the appropriate nitrogen generator that uses the least amount of compressed air at an acceptable pressure.
- Select an air compressor with proper operating efficiencies and, most importantly, an effective capacity control system to supply compressed air efficiently at the low, average and peak demands for nitrogen. Understand that the solution may be one air compressor or several operating together.
- Compressed air storage may be applied to deliver an efficient compressed air supply.
- Nitrogen storage may also be used to convert high demand periods into lower average demand requirements on the air compressor(s). BP

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1 "Nitrogen Characteristics and Benefits of On-Site Generation", Compressed Air & Gas Institute, https://www.airbestpractices.com

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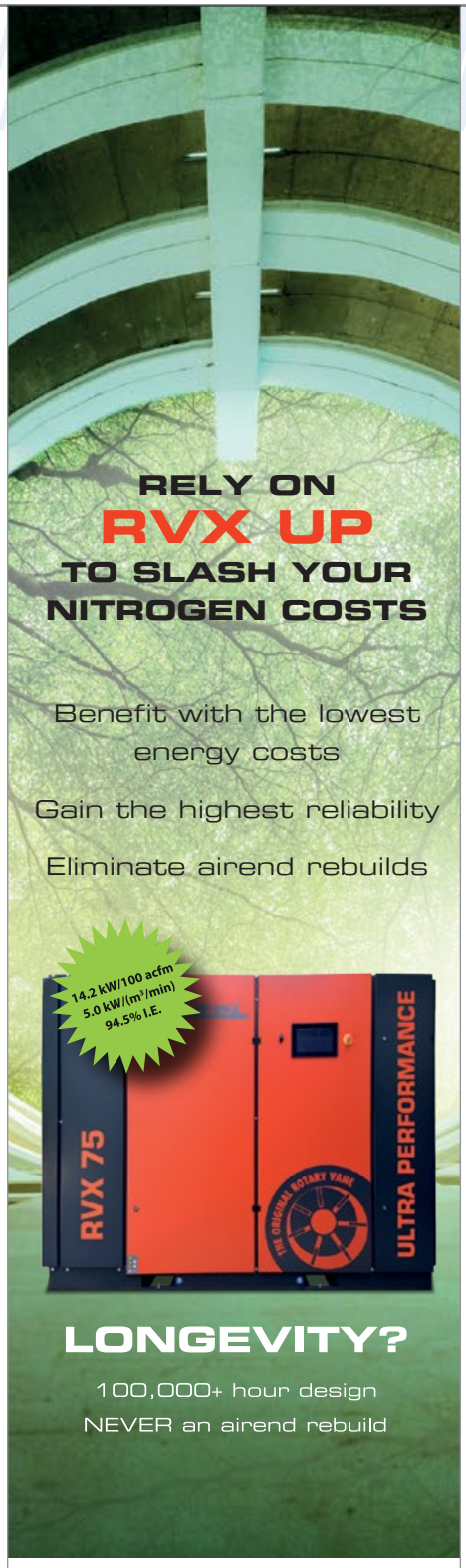

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Vacuum Fundamentals: Process Applications & Oil-Free Technology

By Bryan A. Jensen, Engineered System Solutions Manager, Rogers Machinery Company

➤ "Double the vanilla. Double the salt." …one of the tricks Grammy taught me.

I was standing on the dining room chair pulled in front of the kitchen window, snow in the yard piled up above the sill and icicles dangling down to meet it with dark black evening beyond. From my perch, I could just see up over the counter and into the bowl where the chocolate chip cookie batter was coalescing amidst the whine of the electric motor in her hand.

"Flour, baking soda, salt. Sift dry ingredients together. Combine the sugar and the wet ingredients in a separate bowl with cold butter. Sure, you'll need to put a little extra elbow grease into the beater; but definitively, cold butter is critically important to the final cookie. Nothing worth working for comes easy."

The batter softens a little while mixing dry into wet, so the last tollhouse tweak is to put the oven-ready trayed cookie dough balls out onto the frozen back deck for 9 minutes before the now chilled pan goes straight into the oven. Backyard Moose prefer carrots to cookie dough so you're safe leaving it out there for a short while. Dial up the temperature on the oven a few extra degrees and enjoy the soft-centered golden browned.

Differences Between Process Vacuum & Utility Vacuum Applications

Manufacturing has two major categories of industrial vacuum applications, utility and process vacuum. Utility applications are all about utilizing the differential pressure between the inside of the vacuum system and the higher positive pressure of the atmosphere around us to perform a work-based-task in the physical world. Since utility applications are inherently tied to the atmosphere, and to the gas mixture called air of which it is comprised; it follows that utility applications use measurement of differential pressure ("HgV) with respect to whatever is the local atmospheric pressure ("HgA). Additionally, economically advantageous oil-sealed compression technologies, being best applied to inertly behaving gases such air's 78% diatomic Nitrogen (N_2), are most commonly applied to utilitarian uses.

A "Process" application, on the other hand, is one where it's all about controlling the contents of a vessel, pipeline, or chamber. What is the gas makeup inside the vessel? How much of it is in there? All means to control a chemical and/or thermodynamic reaction so that we add value to some base ingredients to convert them into a marketable product. How do I most cost effectively and deliciously turn this flour, salt, vanilla, and chocolate into a profit maximizing cookie? Now, how do I make its process repeatable and efficient a million times over?

Process Vacuum & Absolute Pressure Measurement

Because of the ingredients-based nature of "Process Vacuum", we should always use a

measurement scale of *Absolute Pressure* to best define the precise conditions inside the ongoing *Process*.

By using absolute conditions, not only are we inherently defining exactly how many molecules of whatever gas is inside the vessel via the Ideal Gas Law; we are also normalizing our specific operating conditions to the performance curve of the vacuum pump we select.

In this way, interpretation of process vacuum pump performance in applications using an absolute pressure scale is simplified relative to utility applications in that only a single variable, operating pressure, is often all that is required to get a reasonably accurate expectation for vacuum pump performance. See Figure 1.

Specifying Vacuum Systems to Process Applications and Defining Condensable Vapors

While the speed curve might be a bit easier to read, 'Process Vacuum' applications are, by in large, much more complex than their utilitarian cousins due to several factors. Two major differences include gas stream composition and vacuum pump control.

In process vacuum applications, we're usually not just talking about compressing air with a little bit of water humidity. Instead, we are now potentially pumping any combined mixture imaginable of a huge variety of process gasses, themselves inert or reactive, and which often include condensable vapors.

Condensable vapors are any chemical compounds which are in the gas phase while under vacuum but exist as a liquid at atmospheric pressure and room temperature. In their liquid phase, as is the case with even seemingly innocuous water (H_2O),

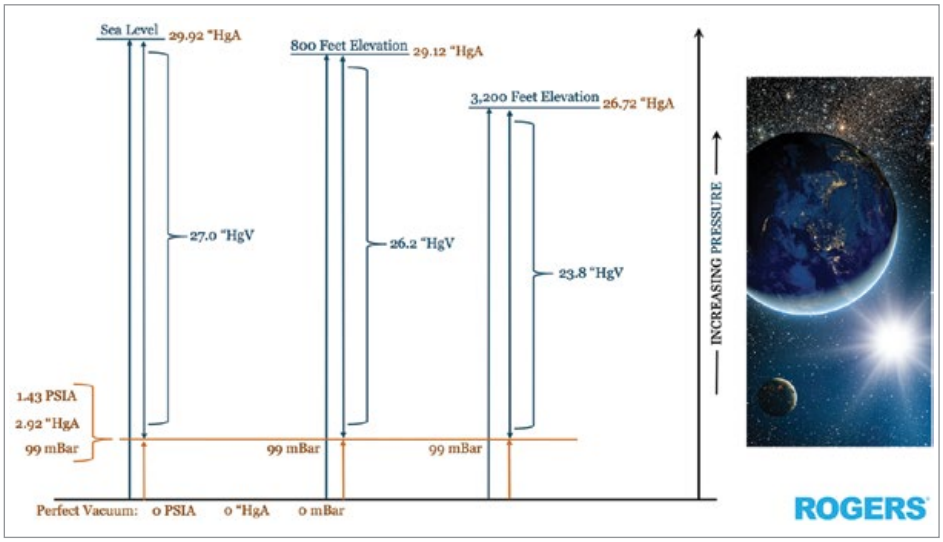

Figure 1.

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these compounds are often found to be quite aggressive chemically when infiltrating machinery.

Additionally, control of these vacuum systems is a major consideration as it is completely required that vacuum pump operation be

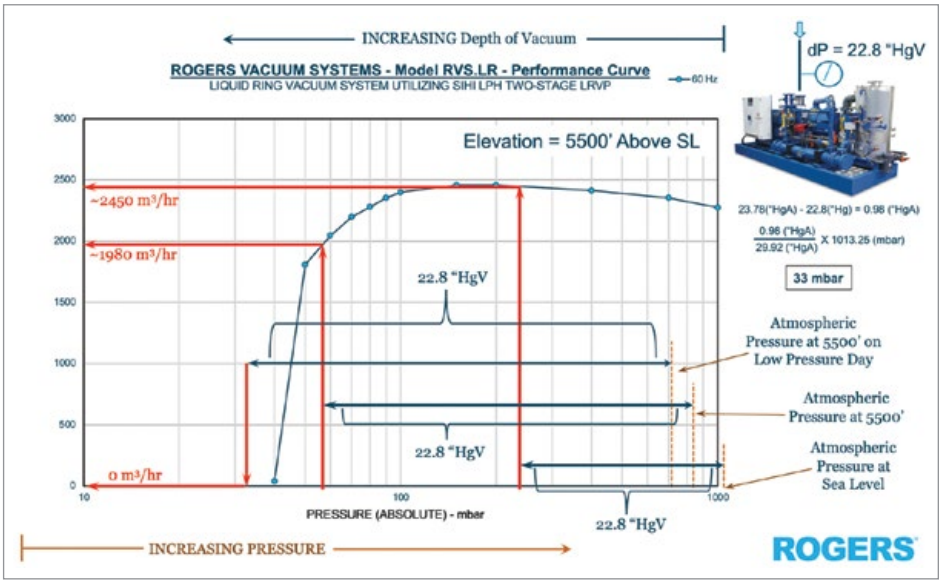

Figure 2.

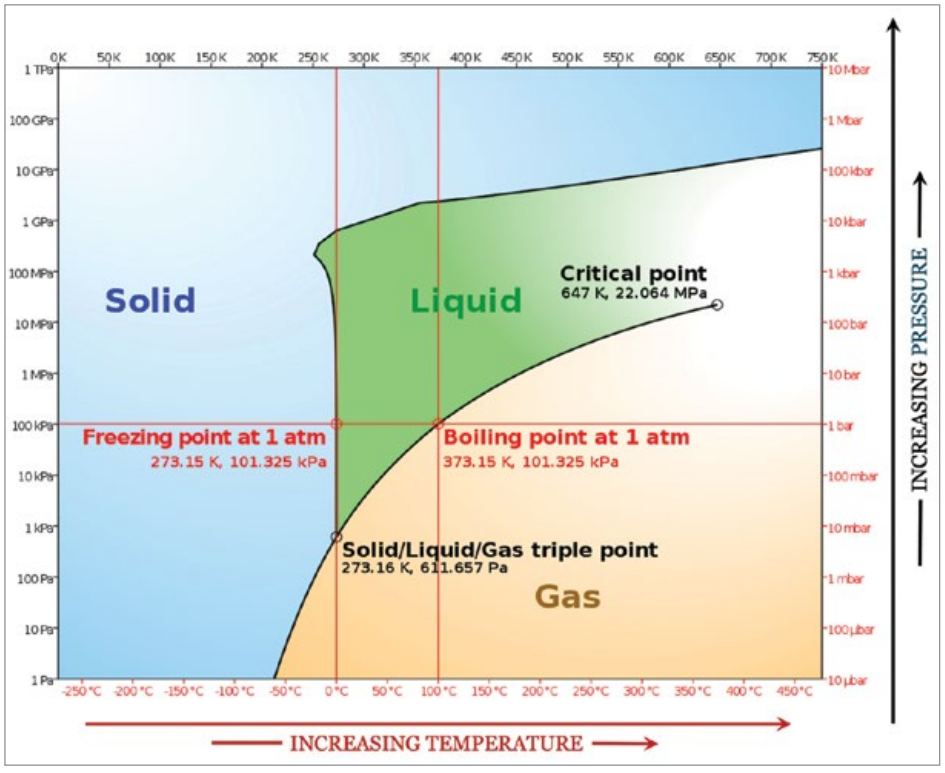

Figure 3.

Additionally, control of these vacuum systems is a major consideration as it is completely required that vacuum pump operation be

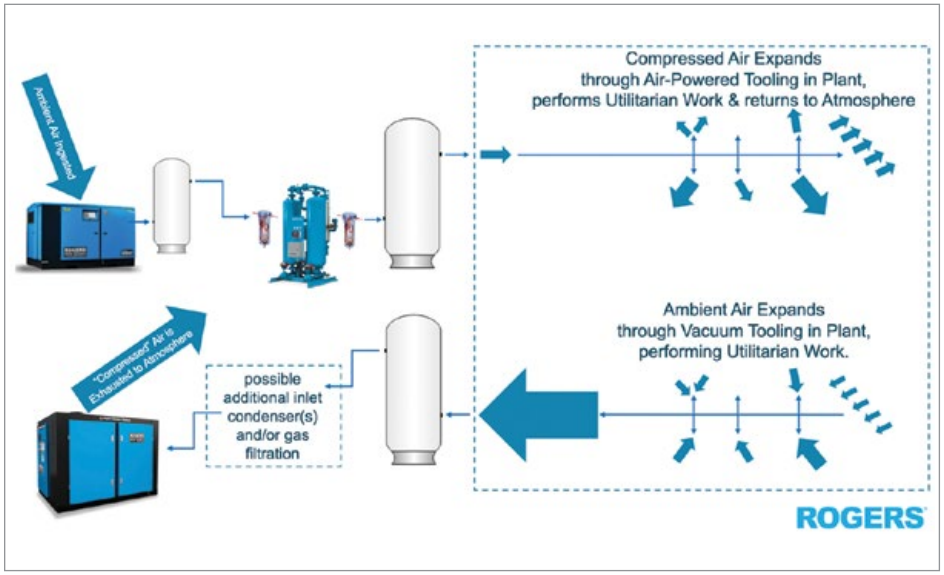

Figure 4.

seamlessly integrated into the end user's overall control approach of their entire process, which usually includes a plethora of proverbial flour sifters, eggbeaters, mixers, and ovens, autoclaves, reactors, or furnaces. See Figures 2 and 3.

Vacuum System Installation: Location Matters

This brings us to another important difference to recognize between a utility and process vacuum system; how and where each is installed. As with a rotary screw air compressor ingesting atmosphere to supply a factory's air tools with utilitarian compressed air power, a utility vacuum pump most commonly has the converse to the air compressor's inlet, an open exhaust, returning the air to the world which had itself been ingested at the factory's vacuum tooling hundreds of feet upstream. See Figure 4.

A process vacuum pump most probably, however, has a hard-piped connection both up and downstream of the gas compression which occurs inside. Put another way, a Utility Vacuum pump can commonly be found on the outside wall of any manufacturing facility, exhausting air pulled from the inside of the building, via the vacuum tooling, out into the atmosphere. The Process Vacuum pump is likely installed right in the heart of the building, underneath or embedded within the production machinery, itself integral to the cookie-making. Process action takes place both upstream ahead of the vacuum pump and downstream of its exhaust.

Further categorizing "Process Vacuum", which will help in our sizing and application of vacuum systems, we find that there are two distinct kinds of processes: Batch & Continuous. See Figure 5.

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Know Your Process: Batch vs Continuous Processes

In a "Continuous Process", at any given time, flow of the raw materials going into a "black box process" equals exactly the flow rate of the refined products and byproducts coming out. A few, albeit crudely simplified, examples of continuous processes, are column or reflux distillation of crude oil into various products such as diesel, kerosene, gasoline & lipstick; air separation of gasses such as argon, oxygen, nitrogen & helium, or the continuous vacuum forming & drying of PVC pipe, polyurethane door & window moldings or delicious crab nuggets.

As it is inferred in a Continuous Process, the "black box" system will be operating at some reduced sub-atmospheric pressure (aka vacuum) continuously. In sizing and applying a

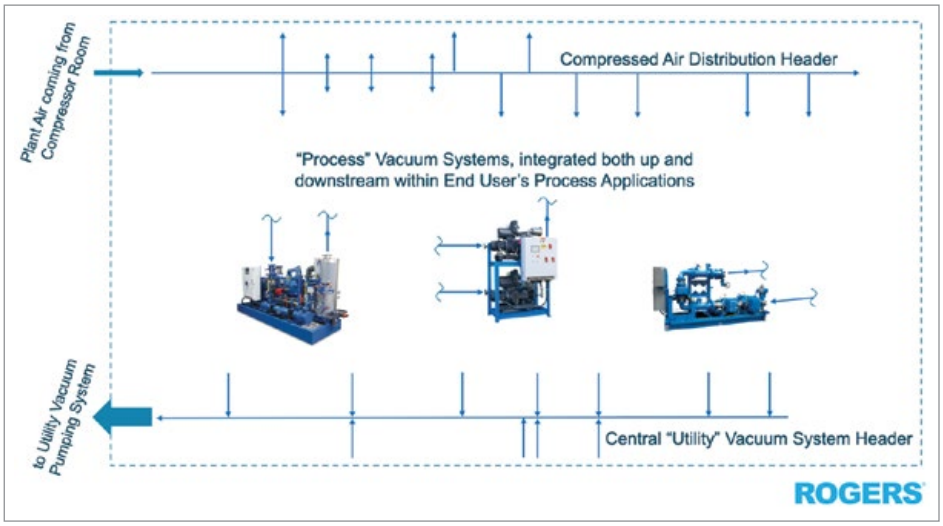

Figure 5.

vacuum pumping system for such application, we then need to only worry about two kinds of loads: the condensable load and the non-condensable load coming from that process.

Condensable & Non-Condensable Loads

If the operating temperature and pressure conditions of the process combined with the chemical makeup of whatever are the specific loads, also considering their respective partial pressures, allow for us to separate and drop out the condensable load as a liquid upstream of the vacuum pumping system; then we should probably seriously consider doing just that. An inlet condenser or cold trap decreases the size of the vacuum pump, sometimes considerably, while also improving vacuum pump reliability since the amount of liquid condensing in the vacuum pump or its exhaust system will be eliminated, or at least greatly reduced.

If we cannot fully eliminate the condensable load from the gas stream prior to the vacuum pump inlet, we must then size the vacuum pump for the combination of any remaining condensable load plus the non-condensable load. In doing this, we must also ensure the condensable load remains in the vapor phase within the vacuum pump, even as its pressure approaches atmospheric where it, by definition, wants to condense into a liquid.

Applying Oil-Free Vacuum Technology for Process Applications

Alternately, we also have the option of suppling and constructing the vacuum pumping system of a type and material such that the vacuum pump can reliably handle the condensable liquid within its compression chamber while exhausting the non-condensable load as a vapor into the end user's exhaust system.

We have a number of tricks to help us accomplish any combination of the above, including directed exhaust temperature control, introduction of dry gas at various stages of compression, application of liquid-ring pumping technology, among others. See Figure 6.

Batch Process: Evacuation Phase

A "Batch Process", as you might infer by imagining the converse of its counterpart's name, requires a bunch of starting &

Figure 6.

Vacuum Fundamentals: Process Applications & Oil-Free Technology

stopping the process and probably some sampling & quality testing at the intermediate stages along the way. Fill a vessel with the proper ratio of ingredients, heat them or cool them, shake them or stir them, react them or reduce them and move the resultant onto the next step. Clean the vessel out and start again a new batch.

The production of titanium sponge from a volatile liquid called tickle reduced through molten magnesium, electronic wafer manufacturing beginning from silica sand, and the freeze drying of Neapolitan ice cream for your next trip to the International Space Station are all examples of "Batch" processes.

As with a Continuous Process, we absolutely must still consider both the condensable and non-condensable loads of a Batch Process, taking the same approach of dropping out liquid or solid precipitate upstream of and/or setting up the vacuum pump for success by ensuring that it will safely and reliably deal with the specific gas loads as described above.

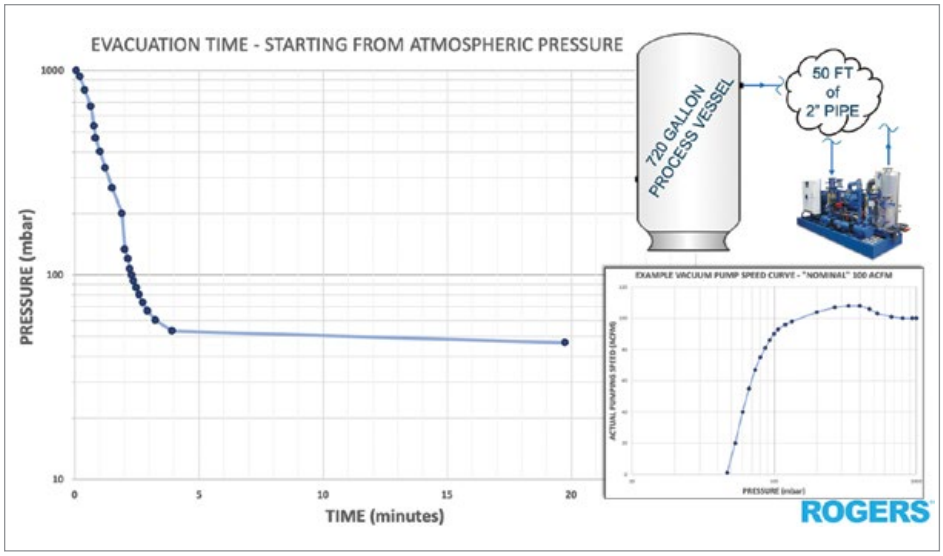

Figure 7.

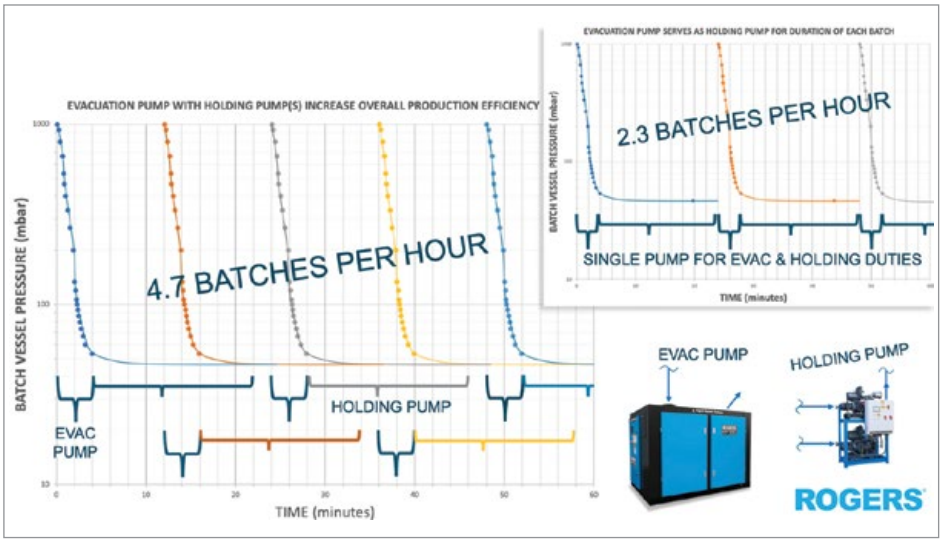

Figure 8.

In addition to these two 'process loads', any Batch Process which requires a reduced gas pressure inside a vessel, pipeline or container which is alternately exposed to atmosphere or otherwise is subject to a pressure change between batches will have an additional phase of its process we call the "Evacuation" phase.

Optimizing Production Efficiency

It follows that we also must take into consideration the end user's batch cycle time as it relates to the physical size and volume of the vessel used in each batch to maximize the overall production efficiency of the process. These factors, of course, ultimately lead to maximizing client profitability, which is essential to their continuing use of our Rogers Vacuum Systems.

If a batch of an example product, let's say a high-grade metal reduced in a vacuum furnace, takes 54 hours under vacuum to complete, but the time to evacuate the furnace with the same vacuum pumping system sized for the process condensable and non-condensable loads takes 15 minutes; then we can likely use only one pumping system for both of the evacuation and holding phases of the process since the evacuation time only accounts for about a half a percent of the overall batch production cycle.

Let's say, instead, that the end user's batch requirements are a product with a much

shorter cycle time and they want to bake the proverbial cookies for 12 minutes under vacuum. Imagine that it takes a reasonable 5 minutes to evacuate the oven of air after sticking the next tray inside. Under these kinds of process assumptions, we'd better either get a bigger vacuum pumping system to evacuate the oven faster, or get more ovens lined up so that we can stagger the batch cycles. After all, we don't want our client's justifiably expensive production staff standing around for the vacuum pump to "pull down" the vessel so they can finally start in on the next batch of cookies. See Figure 7.

Applying Evacuation & Holding Pumps to Batch Processes

With a little cost-benefit analysis of purchasing vacuum equipment vs. production machinery, we'll often conclude that taking the latter approach, lining up a bunch of ovens so that we can put the existing vacuum pump to work on Oven C while Batches A & B are doing their baking, leads to overall higher production volume relative to total initial cost of machinery.

Following this tack, we've now created the familiar scenario where there is an "Evacuation Pump" performing the 'hog-down' of the process vessel with a secondary "Holding Pump" doing the job of maintaining the low pressure setpoint required by the process for the duration of the batch cycle. The Evac Pump is sized for removing the bulk gas in the vessel, reducing the pressure to some predetermined allowable setpoint over the desired period of evacuation time, prior to initiation of the primary process.

The Holding Pump is sized only for the process-specific condensable and non-condensable loads, which often require much lower pumping capacity relative to the Evac Pump, particularly for short duration batch cycles with larger holding vessels. It is also somewhat common for the Holding Pump to be capable of operating at lower pressures, aka deeper in vacuum, picking up where the Evac Pump starts each batch off. See Figure 8.

At the beginning of each batch, a leak check is performed to ensure that the non-condensable leak load will remain low enough that the Holding Pump will be able to do its job maintaining the low pressure setpoint for the entire batch cycle. Interconnected piping and valves, operated by the Process's central control system, hand-off vacuum duty from Evac Pump to Holding Pump once the transition setpoint is reached.

Within Process Vacuum applications, the Evacuation duty often looks a lot like a Utility Application, since the predominate gas being evacuated is commonly air. It's quite possible to therefore see an oil-sealed vacuum pump applied as an Evac pump, even in a scenario where there might be process gasses during the "process phase" of the overall application, to which a process compatible Holding vacuum pump or system would be applied.

Figure 9.

If the product being produced allows for it, dialing in a Continuous Process can certainly result in higher production efficiency through time; though it is often desired or required to use Batch Processes for reasons concerning product quality or other production limitations and considerations. See Figure 9.

Oooh…. gotta go. The oven timer in the kitchen is buzzing and the next Batch is done. Milky cheers to the final phase of this particular process… the tastiest one. Thanks again for the pointers, Grammy. BP

For more information or any questions, call the Rogers Machinery Company at (503)-639-0808 or visit the custom engineered solutions page at www.rogers-machinery.com

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Compressed Air Audit Details Two Energy Saving Projects for Maintenance Teams

By Don Van Ormer, Senior Auditor, APenergy

An important manufacturing plant based in the U.S. southwest was spending an estimated $2.5 million annually on energy to operate the compressed air system at its plant. The plant was also experiencing production downtime and quality issues due to the presence of moisture in the compressed air.

Our team conducted a compressed air audit of both their high-pressure system (100 psig) and their low-pressure system (55 psig). The result was a series of energy conservation projects able to reduce these energy costs by approximately $415,655 /year or 20% of current use. In addition, these projects will enhance productivity and quality by stabilizing pressure and eliminating moisture in the compressed air.

All of the calculations in this survey are based upon the site conditions of 8760 working hours per year and a blended electric rate of $0.088 per kWh.

The major savings identified in this system assessment were on the supply-side of the system and had to do with upgrading to a new air compressor and new cycling dryers. Another significant project involved storage and the use of a flow controller.

In this article, we will provide detail on the characteristics of the baseline system and then share the energy-saving work identified in two projects. These two projects represent work which can be performed by the maintenance teams in every plant. These are also project

Table 1. Compressed Air Demand at the Plant

	Flow (scfm)	Pressure in Pipe
Low Pressure Air System	10,123 to 11,406 scfm	55 psig
High Pressure Air System	10,662 to 11,476 scfm	100 psig
Expected Future Demand		
Low Pressure Air System	300 scfm additional	55 psig
High Pressure Air System	139 scfm additional	100 psig

Table 2. Existing Compressed Air System Characteristics*

Measure	High Pressure Production	Low Pressure Production
Average System Flow	10,662 scfm	10,123 scfm
Avg Compressor Disch Press	98 psig	56 psig
Average System Pressure	90 psig	53 psig
Input Electric Power	1,730 kW	1,279 kW
Operating Hours of Air System	8,760 hrs	8,760 hrs
Specific Power	6.27 cfm/kW	7.91 cfm/kW
Electric Cost for Air /Unit of Flow	$125.08 /cfm yr	$97.36 /cfm yr
Annual Electric Cost for Compressed	$1,333,633 /year	$985,556 /year
	$2,319,189 /year	

*Based upon on a blended electric rate of $0.088 per kWh and 8,760 hours/year.

opportunities we find in almost every plant we visit. The two projects are to (1) repair/replace condensate drains wasting compressed air and (2) to perform a compressed air leak survey.

Characteristics of the Existing Compressed Air System

The compressed air system is supplied by four TA6000, 3-stage centrifugals, two 250-hp class high-pressure compressors, and two 1,000-hp low-pressure units. An additional TA48, 3-stage centrifugal 1,250-hp class is the high pressure swing unit. The air compressors are apparently very well cared for and maintained and experience timely and professional maintenance. At the time of the survey, they were 6 to 7 years of age and running very well.

Compressed air is dried by three non-cycling, shell-in-tube heat exchanger, refrigerated

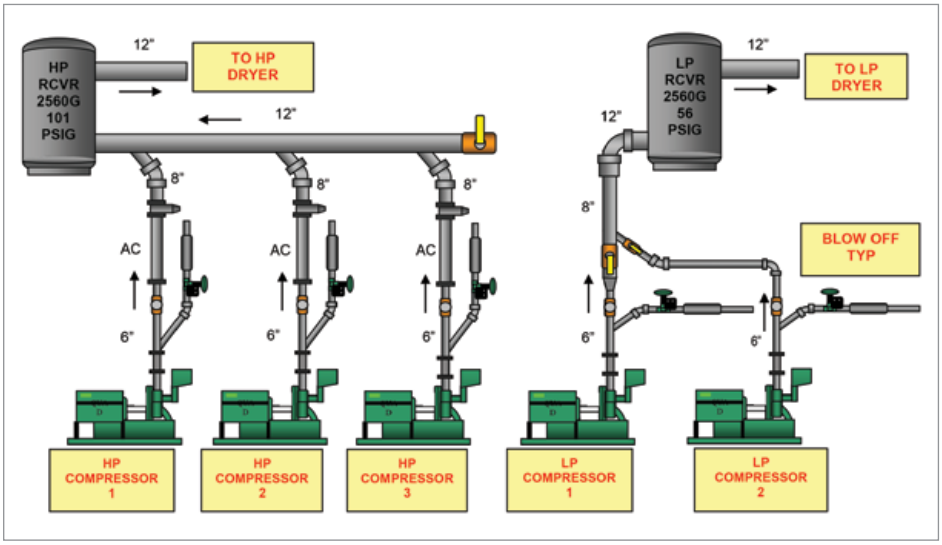
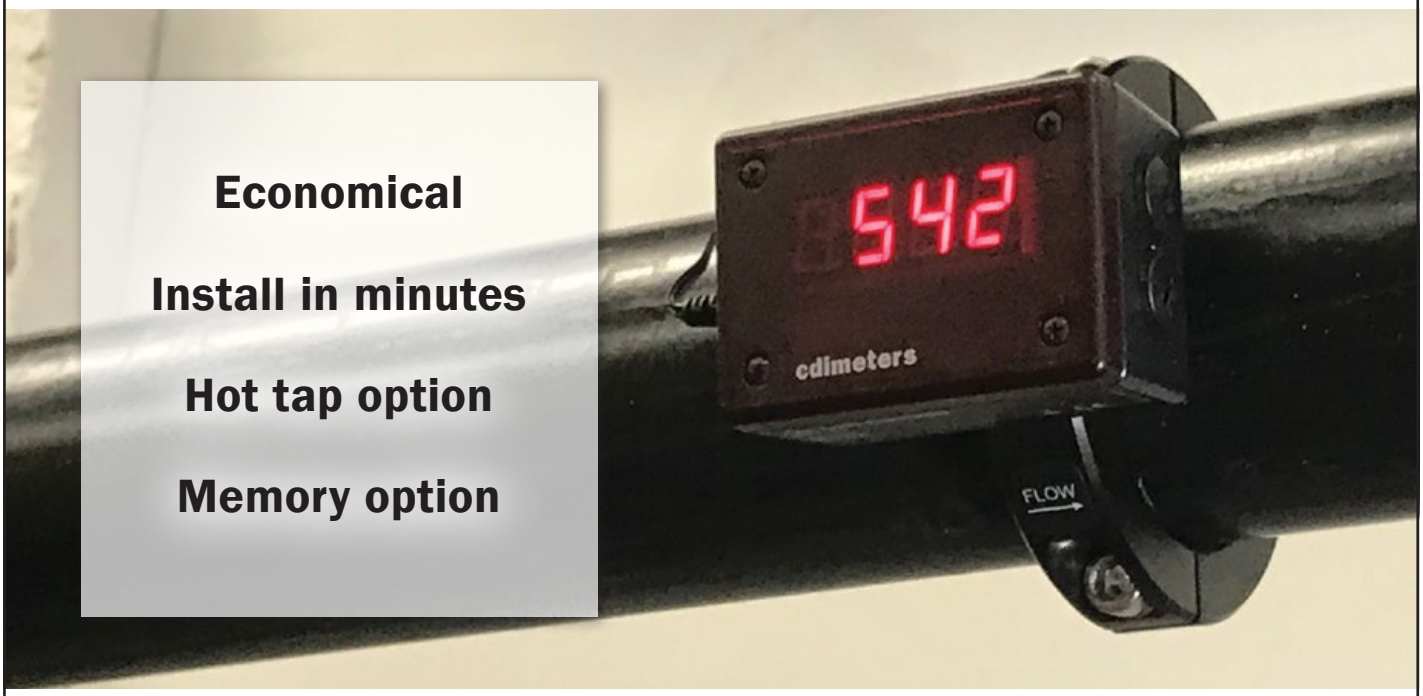


Figure 1. Existing Compressed Air System Schematic

Flowmeters for Compressed-Air Management



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dryers. One dryer is for high pressure and one for low pressure. The third dryer is for either high or low pressure and is used as a swing dryer. During our site visit, the high-pressure refrigerated dryer had a 10 psid pressure loss and was not drying the air as it should. This was during a moderate temperature day with 50°F (10°C) ambient temperatures and 34% relative humidity. Significant amounts of condensate are in the high-pressure header and showing up in the packaging area. This will increase during the hot and humid weather this southwest plant sees every year.

The plant intends to expand production in the near future. This will increase the high-pressure air demand by 139 cfm and the low-pressure demand by 300 cfm.

Potential safety compliance issues exist. There are five 80-gallon vertical ASME code air receivers in palletizing that do not have safety valves installed. The plant should immediately install appropriate safety valves that are compliant to local codes. There are also a few 20 to 30-gallon air tanks that should be reviewed with regard to the same situation.

Table 2. Compressor Use Profile – Current System

Unit #	Compressor: Manufacturer/Model	Full Load		Actual Elec Demand		Actual Air Flow	
		Demand (kW)	Air Flow (scfm)	% of Full kW	Actual kW	% of Full Flow	Actual scfm
High Pressure Production: Operating at 700 psig discharge pressure for 8,760 hours							
1	Cooper/Joy TA48	895	5,139	OFF			
2	Cooper/Joy TA6000	971	6,200	89%	865	86%	5,332
3	Cooper/Joy TA6000	971	6,200	89%	865	86%	5,332
			TOTAL (Actual):	1,730 kW		10,664 scfm	
Low Pressure Production: Operating at 55 psig discharge pressure and 8,760 hours							
1	Cooper/Joy TA6000	775.5	6,288	92%	719	90%	5,659
2	Cooper/Joy TA6000	775.5	6,288	92%	560	71%	4,464
			TOTAL (Actual):	1,279 kW		10,123 scfm	

Table 3: List of Condensate Drains to Repair/Replace

High Pressure Air	Qty	Air Loss (each)	Total Air Loss
(3) Compressor 2 each HP	6	10	60
(1) High pressure dryer	2	10	20
(1) Swing dryer	2	10	20
(3) Aftercooler	3	10	30
(1) Bypass	1	5	5
(1) Bypass	1	20	20
(1) Air receiver	1	10	10
		Total High Pressure	16 drains / 165 cfm
Low Pressure Air	**Qty**	**Air Loss (each)**	**Total Air Loss**
(2) Compressor 2 each LP	4	10	40
(1) Air receiver	1	10	10
		Total Low Pressure	5 drains / 50 cfm

Calculating the Baseline Compressed Air Flow Demand

Two newly calibrated, heated wire, thermal mass, flow meters were installed at the plant. One was installed in the 10" header of the high pressure air line and one in the 12" header of the low pressure air line going from the air compressor room to the production areas. These flow meters revealed the following flow profile.

The numbers shown in Table 1 reflect operating the compressed air system during normal full production with the high to low bypass valve open.

To establish a proper baseline we analyzed two weeks of running power data supplied by the plant. Using Compressed Air Challenge curves, we show an average low pressure flow of 10,123 and is sustained with peaks of 11,400. The high pressure data showed average flow is 10,667 scfm with a sustained peak of 11,470 scfm.

Two Energy-Saving Compressed Air Projects Ideal for Maintenance Teams to Tackle

In almost every plant we visit, we find issues with compressed air condensate drains, either not working or wasting compressed air. We also find a "healthy" amount of compressed air leaks. After we've completed the system assessment, we share the results with the maintenance teams who help us repair/replace the condensate drains and the compressed air leaks. We then try to train them to make these two projects part of the on-going maintenance of the compressed air systems.

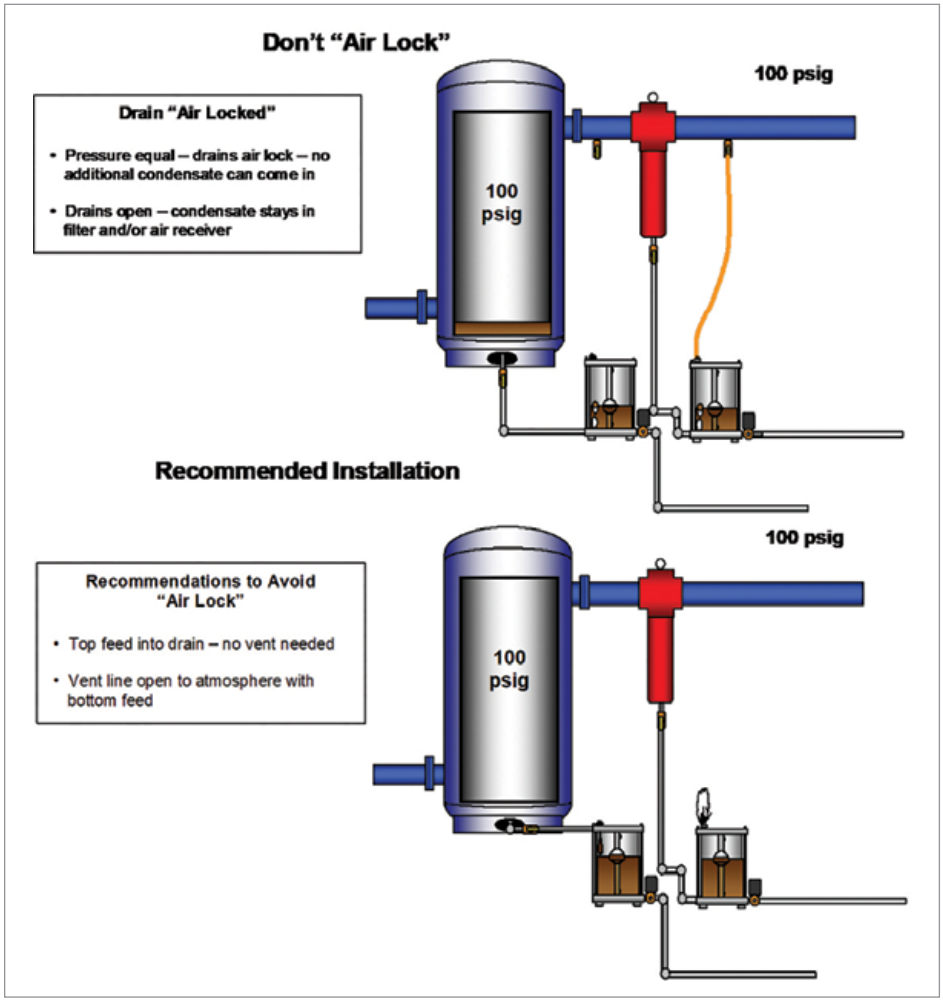

Figure 2.

The ROIs of these two projects are very high and they fall comfortably within the skill sets of maintenance teams. Performing these two projects, at this plant, created energy savings of $70,000 with a cost of approximately $14,000.

Project #1: Replace/Repair Condensate Drains Wasting Compressed Air

The configuration and performance of the condensate drains in the plant's air compressor area and in the distribution system need to be modified. There were twenty-four (24) level activated, pneumatic actuated "no loss" automatic condensate drain valves. All drains have bottom entry connection. When this is done, the air above the condensate in the valve body has to be vented to avoid an "air lock" keeping the condensate from draining out. Twenty-one (21) of these valves vent to the atmosphere through an adjustable vent valve on top of the drain; which are set very high. On the low-pressure system, there are six drains which vent back to separator filter bodies and therefore, create no lost air.

The plant should repair or replace the 24 level activated pneumatic drains (leaking) with new level-activated drains, either electronic or

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pneumatic actuated at each point. In either scenario, it's critical to re-pipe the condensate line to the top of the drain to eliminate the vent valve. Remove the vent valve and enlarge the entry hole on top to 5/8" size. Then run a 5/8" line to the threaded hole.

- A conservative estimate for the average vent loss = 10 cfm each
- The bypass line drains are leaking on the inside seals, one is medium size at 5 cfm and the other very large at 20 cfm
- A significant portion of these drains will have to be rebuilt in order to work properly. They are an excellent automatic drain.
- After replacement or rebuild, the drains should be installed with the condensate entering the top of the drain instead of the bottom. With top installation, you can eliminate the vent valve and there will be 165 cfm of high-pressure air saved and 50 cfm of low-pressure air saved (see Figure 2).

Table 4: List of Compressed Air Leaks to Repair

Tag #	Location	Description	Est Size	HP Cfm	Comments
1	Compressor Room	After Cooler Drain Manifold	XL	20	Leaking Drains
2	Compressor Room	Drain on HP Dryer	M	4	Leak Through
4	Compressor Room	HP 2 Compressor	S	1	2nd Stage Drain Bad
7	Compressor Room	Cross Over Station	M	4	Lubricator Leaking
8	Hot End	Shop 11 Machine	M	4	Blank Side Blow Gun Leak
9	Hot End	Shop 13 Machine	LG	10	Bad Air Hose
10	13 De-Pall	De-Pall Ground Level By Piab	M	4	Leaking Regulator
11	Shop 11 Machine	Push out Air Tank	S	1	Leaking Lubricator
12	13 Bulker Area	Oms Strapper	S	1	Solenoid Valve Leak
13	12 Bulker Area	Samual Strapper	S	1	Leak Under Frame
14	11 Case Palletizer	Top Platform	LG	10	Leaking Regulator
15	13 Palletizer	Oh Carton Line	M	4	Leak Above-Carton Line
16	11 N Tray Inserter	Discharge Conveyor	M	4	Cylinder Seal Leaking
17	11 N Box Machine	Leak Inside Box Machine	LG	10	
18	13A Inspection Line	HST 1000	S	1	Leaking Regulator Inside
19	13C Inspection Line	Video Jet	S	1	Lubricator Leaking
20	13D Carrier Machine	QDC Hose Leak	LG	10	1/2" Large Split
50	Mould Shop	Paint Booth	M	4	Regulator Leaking
51	Shop 13 Machine	Forehearth Platform-Spout	M	4	Regulator Behind Ring Cooler
53	Batch House	2nd Floor	LG	10	Flex Kleen Union
21	Hot End	11 Machine Blank Side	XL	25	Hose On Reel Bad
22	Hot End	11 Machine Mould Side	XL	25	Hose On Reel Bad
23	11 Lehr	Cold End Spray	S	1	Regulator Leaking
24	Shop 12 Machine	Blow Gun Leak Mould Side	S	1	
25	12 Lehr	Cold End Spray	S	1	Regulator Leaking
26	Batch House	Syntron Floor	S	1	Lubricator Leaking
27	Batch House	Mixer Floor	S	1	Solenoid Valve Leak
28	Batch House	Mixer Floor	M	4	Solenoid Valve Leak
29	Warehouse	Pallet Discharge Area	S	1	Regulator Leaking
30	Compressor Room	Hose In Hose Reel	L	10	
31	De-Pall	Multiple Valve Leaks	XXXL	30	Valve Bank Near Vacuum Pump
TOTAL HP LEAK CFM				208	

Total of number of drains to be reworked	21
Total compressed air saved (50-hp low pressure / 165-hp high pressure)	165 cfm
Recoverable energy savings from air flow reduction	$188.78/cfm yr
Total annual energy savings	$31,148/yr
Cost per drain (materials and installation)	$500 each
Cost of project (all drains)	$10,500 if replaced (less if reworked)

Project #2: Identify/Repair Compressed Air Leaks and Set Up a Leak Management Program

Most plants can benefit from an ongoing air leak management program. Generally speaking, the most effective programs are those that involve the production supervisors and operators working in concert with the maintenance personnel. Accordingly, it is suggested that all programs consist of the following:

Short Term – Set up a continuing leak inspection by Maintenance Personnel so that for a while, each primary sector of the plant is inspected once each quarter to identify and repair leaks. A record should be kept of all findings, corrective measures, and overall results.

Long Term – Consider setting up programs to motivate the operators and supervisors to identify and repair leaks. One method that has worked well with many operations is to monitor/measure the air flow to each department and make each department responsible for identifying its air usage as a measurable part of the operating expense for that area. This usually works best when combined with an effective in-house training, awareness, and incentive program. You cannot manage it if you do not measure it!

Compressed Air Leak Survey – A partial survey of compressed air leaks was conducted at the plant and 31 leaks were identified, quantified, tagged, and logged. Potential savings totaled 208 cfm for the 31 leaks that were identified. We estimate this will result in an energy savings of 495,884 kWh resulting in $39,266 per year.

Number of leaks	31 leaks
Estimated reduction of air flow with proposed project	208 cfm
Recoverable savings from air flow reduction	$188.78/cfm yr
Annual electric cost savings with proposed project	$39,266/year
Total unit cost of leak repairs ($25 materials per leak and $75 labor per leak)	$3,100

Conclusion

The goal of this article is to encourage plants to understand the energy costs of their compressed air system and to encourage their maintenance teams to be vigilant in the two project opportunities we find in almost every plant we visit. The two projects are to (1) repair/replace condensate drains wasting compressed air and (2) to perform compressed air leak surveys on a regular basis. BP

For more information on APenergy visit www.apenergy.com or call 740.862.4112

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The 2023 AICD Show Report

By Bill Smith and Roderick Smith, Compressed Air Best Practices® Magazine

The 2023 AICD Board: Rob Grizzle, Sal Calvo, Bart Frush, Jeff Brennan, Kasey Gould, Dave Nosal, Joe Torchia, Bob Coppel and Michael McCulley (left to right).

➤ The Association of Independent Compressor Distributors (AICD) held its annual show at the Gaylord Texan Resort just outside Dallas, Texas, in May of 2023. Participating distributor members and guests enjoyed a few days of networking events, trade show, speakers, the AICD Golf Tournament and more.

"The AICD enjoyed a record turnout of exhibitors," said Jeff Brennan, President, AICD. "We've added over 20 member companies this year and our membership again has delivered a strong turnout at this year's event." This report will recap a sampling of exhibitors – not all exhibitors present at the show could be featured due to article space limitations.

Air Compressors, Vacuum, Controls & Components

Hertz Kompressoren was displaying their Counts Kustom 7.5 hp HBD5 tank-mounted show package as part of their push into the automotive aftermarket industry. COO Stephanie Brockman said, "We are seeing continued steady growth from our loyal distributors and have seen a great response to the new maintenance kits for our air compressors."

The Sullivan-Palatek booth was in a great mood about both their business and market conditions. President Bruce McFee said, "We have just released the redesigned SP-13 direct drive rotary screw air compressor with a newly redesigned airend. We are excited about the very efficient specific power

Stephanie Brockman next to the Counts Kustom tank-mounted 7.5 hp package at the Hertz Kompressoren booth.

Horace Douglas, Bruce McFee, Larry Colley, Austin Wilkins and Melissa Shepherd at the Sullivan-Palatek booth (left to right).

numbers, tested through the CAGI Performance Verification Program, and fully manufactured at our plant in Michigan City."

Bauer has launched high-pressure air compressors for applications above 5,000 psig (340 bar). Eric Phelps stated, "The applications usually require an NDA and often deal with leak testing for sensitive industries like rockets and satellites." He also said their new medium pressure rotary screw air compressors designed for 145 psig (10 bar) are gaining popularity.

Industry veteran Nitin Shanbhag showed me around the booth of Alkin Compressors. Their specialty is in manufacturing high-pressure air compressors and boosters up to 6,000 psig (408 bar). Shanbhag said, "Our strength has been in scuba diving, fire departments and industrial high-pressure applications. We are based in New Jersey and investing to grow our presence in the U.S. market."

Doosan Bobcat had a lot of people at their booth due to their announcement to use the Bobcat brand name for their industrial air compressor product lines. Based out of their 1 million square foot facility in Statesville, North Carolina, Bobcat is a major consumer brand for portable compressors, tractors, forklifts and ground maintenance equipment. Patrick Jakeway said they are introducing air compressor product lines step-by-step with an iron-clad commitment to have all parts in stock for all introduced products. They currently offer 30 to 200 hp lubricated rotary screw air compressors (fixed and VSD). A line of 10-20 hp belt-drive rotary screws is launching soon.

Baki Topac, Michael McCulley (Quality Compressed Air Services), Nitin Shanbhag and Ayden Dereci at the Alkin Compressors booth (left to right).

Neal Stephan, Kyle Schafer, Brandon Taylor, Patty Moffitt, Michael Musseau and Patrick Jakeway at the Doosan Bobcat North America booth (left to right).

Eric Phelps and John Mirabelli at the Bauer Compressors booth (left to right).

John Schmitt, Tom Guthrie, Dave George, Chris Downs, Curt Greifer, Brandon Dial and Nathan Haley at the Kaishan Compressor USA booth (left to right).

The 2023 AICD Show Report

Mark Spaeth, Jerry Kellner, Fabio Rosa and Troy Hudson at the Schulz Compressors booth (left to right).

Keith Sportsman, Tyler Morrell, Carol Calvo, Alexandra Moreno, Kevin Ray and Bruce Lidie at the ELGi Compressors booth (left to right).

Kevin Miller, Pam Tetterton and Brian Tober at the BOGE America booth (left to right).

Kaishan was displaying their new KRSV rotary screw vacuum pump. Dave George said, "This energy efficient product line covers a 10 to 125 hp range, 286 to 3,505 cfm and vacuum levels to 29.9 HgV." In light of recent discontinuations of rotary screw vacuum product lines (by other manufacturers), this is a very interesting and timely product launch.

Schulz Compressors is celebrating the 60th Anniversary of the Company. Schulz America is based just north of Atlanta in a new, company-owned, distribution center to support this market. Fabio Rosa said, "In celebration of our 60th anniversary, we are gifting a free pneumatic impact wrench with every air compressor we ship!" At the booth they were displaying a 5 hp, tank-mounted two-stage, direct drive, reciprocating air compressor in a sound attenuating enclosure.

The ELGi Compressors booth was featuring the AB Series single-stage, water-injected, rotary screw air compressor. Models range from 15 to 150 horsepower with a maximum working pressure of 175 psig. The unique water-injected design requires only an initial water fill and no reverse osmosis water treatment. The system takes moisture from the intake air to maintain the required water level. They also explained the unit is designed for easy serviceability and sound attenuation. The units are designed in a manner that any qualified lubricated rotary screw technician can work on them and feature the Neuron4 digital controller. The single-stage airend runs at low speeds of 2,000 to 4,500 rpm and the decibel range is 65 to 74 dBa.

BOGE Compressors was excited about their oil-free, two-stage, SO Series rotary screw air compressor line-up. Kevin Miller said, "This competitively priced range runs from 60 to 480 hp with air-cooled units to 125 hp and water-cooled for larger sizes."

Tamsan Compressor has introduced 10 to 330 hp oil flooded rotary screw air compressors (single and two-stage) to the market. Options include fixed and VSD and permanent magnet motors from 50 to 330 hp. Josh Wamser said they are warehousing product in Greenville, South Carolina.

Sauer Compressors was talking about the new "next generation" Orkan Series for pressures ranging from 1,470 to 7,350 psig for almost all gases (100 to 500 bar). We met Chris Leonard and Kiel Locklear, at the

Air Production & Service booth, and enjoyed their story of starting their firm 10 years ago to meet the rising demand for containerized packages of compressed air systems. Distributors can call them to package a system for them. COLTRI Compressors is introducing a line of high-pressure air compressors and boosters and specialty products like their AC VII booster able to take 28 psig (2 bar) air or nitrogen and boost it to 6,174 psig (420 bar).

Solberg was excited about the launch of their new CAM Series Compressed Air Muffler for desiccant dryers. Clint Browning said, "Our new patent pending design uses absorbent and reactive media to optimize tower depressurization time and reduce noise levels." They have launched 1 1/2" and 2" connection sizes and are working on more models.

Nicolas De Deken and Joe Henke, at the ENERGAIR Solutions booth, presented their new AERO master controller. A very intuitive product for the user, standard features included kW monitoring, capacity %, specific power efficiency in terms of kW per 100 cfm, system pressure, dew point, outlet air flow (cfm) and many other variables.

Compressed Air Purification, Condensate Management and Cooling

BEKO Technologies personnel said demand for desiccant dryers is growing and they observe many plants switching to them from refrigerated dryers. The main reason they cite is poor maintenance on refrigerated dryers leading many to believe they need a lower -40˚F (-40˚C) pressure dew point. They were exhibiting their Drypoint XCP premium heatless desiccant dryer, manufactured in Atlanta, with the BEKO TOUCH controller as standard with humidity control for tower switching. This model is ideal to install with an optional dew point meter on the outlet.

Mikropor was talking about their new MTD-US Series High Capacity Turbo Dryer for flows from 5,000 to 15,000 scfm. Regional Manager Jeff Crutchfield explained the units feature thermal mass technology and for 10,000 scfm and below use scrolls while the larger units deploy screw refrigeration compressors. These energy-saving, cycling, refrigerated dryers have standard 4.3" and 7" touch screen controllers. I'd like to thank Mikropor General Manager Ryan Loeffler for allowing me to do a recent

Jessica McCarty, Megan Smith, Duane McCarty, Josh Wamser, Kelly Wamser and Emren Bekeç at the Tamsan USA booth (left to right).

Anthony Harris, David Swartz, David Jen and John Temple at the Sauer Compressors booth.

Joe Thode, Charlie Solberg, Clint Browning and Andy Spicer at the Solberg Filtration booth (left to right).

The 2023 AICD Show Report

Ethan Grosstick, Ryan Dixon and Tomi Mize (all from Air Specialty Equipment) with Sarah Porterfield and Rusty Welch at the BEKO booth (left to right).

Nathan Toro, Sawyer Burns, Hunter Burns, Mike Herring and Chris Burns (all from Mobile Mechanical) with Jeff Crutchfield, Allan Hoerner and Steve Briscoe (Pattons) at the Mikropor booth (left to right).

David Schluckbier, Bill Peters, Scott Scheuerlein, Molly Powers and Chad Timmer at the Clean Resources booth (left to right).

tour of their warehousing and testing campus in Michigan City. Their inventory levels and commitment to fast deliveries is impressive.

Clean Resources debuted its new compressed air dryer portfolio in partnership with Next Air & Gas, along with enhancements to its oil-water separator lines. On display was the HHD Series heatless desiccant dryer that comes standard with PLC and angle body valves, and NRDSS Series refrigerated dryer with a stainless-steel flat plate enclosure and heat exchanger.

Following its acquisition of Engineered Air Products (EAP) in Lancaster, NY in March 2023, Altec AIR has expanded its North American footprint and its desiccant compressed air dryer portfolio. EAP has been designing and manufacturing large desiccant air dryers since 2009 and will continue its manufacturing and operations under the Altec AIR brand. Altec displayed a 250 cfm desiccant air dryer with regulated purge valve with a dew point recovery mode operation at the show.

Nano-purification solutions displayed its core compressed air treatment products including the new DXR fridge direct expansion refrigerated air dryers, the new GF filtration range, the NDL modular desiccant dryers and the Sepura condensate treatment products. Nano recently acquired Aircel LLC which has a long history of building high-quality refrigerated and twin tower desiccant dryers at its Maryville, TN facility. "We took this opportunity to formally launch the rebranded Aircel dryers as a 'product brand' with a fresh new look which better depicts our

Jon Brom, Joe Rodenbucher, Gregg Lesniewski, Chris Foster, Jeff Ewers, Bob McKay, Charles Algiene and Jim DiMaiolo at the Altec AIR booth (left to right).

approach to modern compressed air dryer innovation with an emphasis on sustainability," said Tony Hergert, nano Brand Manager. Nano will continue to support the Aircel distribution network and will build heatless, heated and blower purge twin tower dryers for nano in TN.

Hydrothrift Corporation discussed its complete line of thermal transfer systems and nationwide heat exchanger repair and remanufacturing services. While also offering open loop systems, its custom-engineered closed loop (dry type and evaporative) cooling systems offer reliable temperature control and efficient operation. Its Closed-Loop Evaporative-Type systems (20 – 2,000 gpm) are equipped with heavy-duty prime surface evaporator coils, close-coupled centrifugal pump, surge and vent tank and more in a packaged pump and control skid.

This summer, Walker Filtration is celebrating 40 years since its founders started operations in the family garage in the United Kingdom. On display at the Walker Filtration booth was its SmartSep oil-water separator (32 – 6,621 scfm), its zero-loss CondenSmart Drain Series (6 models, 106 – 5,650 scfm), and many more OEM and aftermarket air treatment products. In April 2023, Molly Spaeder was promoted to Group Marketing Manager for all marketing activities and branding decisions throughout the global divisions the company. Ben Laiweneek was also promoted to Senior Sales Manager after four years in his role as Distribution Sales Manager.

Air System Products introduced the Accu-Drain 2, a new electronic zero-loss drain light enough to be suspended from pre-filters and after-filters, or any system component. Designed to provide the same reliability as the first generation Accu-Drain, it still has its signature translucent vessel for a simple operational check, a robust non-clogging Posi-Valve eliminating the need for additional strainers, and for its size has a large discharge capacity of 1.5 oz.

The 2023 AICD Show Report

Chris Brooks, Nick Herrig, Mark Lauterwasser and Matt McQuillin at the nano booth (left to right).

Keith Beatty at the Hydrothrift booth.

JORC Industrial displayed its Level Sensed Drains (SMART-GUARD, MAG-11, NUFORS XF), time drains (COMBO, OPTIMUM, TC-11, D-LUX-N/O), and EPA-compliant SEPRIUM oil-water separators (70 – 2,500 cfm), and more. JORC's oil-water separators have useful features like a visual element life indicator to let you know when your elements need replace and an overflow indicator to avoid any messy spills.

KSI Technologies is based in Ontario, Canada and offers distributors a full inventory of CRN Certified heatless desiccant dryers and pressure vessel-sized compressed air filters. Moritz Bojahr said they supply heated desiccant dryers by project.

Andy Freyer, Director of Business Development with Kingston Valves shared they will be introducing new angle check valves, as well as a safety valve for refrigerated air dryers, and other refrigeration applications in the second half of 2023.

At the ZEKS Compressed Air Solutions booth, Chris Ursillo – ZEKS Commercial Leader shared they are introducing new large non-cycling and high-pressure refrigerated compressed air dryers in July 2023. From its flagship HeatSink cycling refrigerated air dryers, to non-cycling, high-pressure and water-cooled refrigerated air dryers, ZEKS offers a full range of refrigerated drying solutions. ZEKS also specializes in desiccant air dryer technology, filtration, condensate management, flow control and more.

Thomas Conforti, Jesse Yates, Molly Spaeder and Ben Laiweneek at the Walker Filtration booth (left to right).

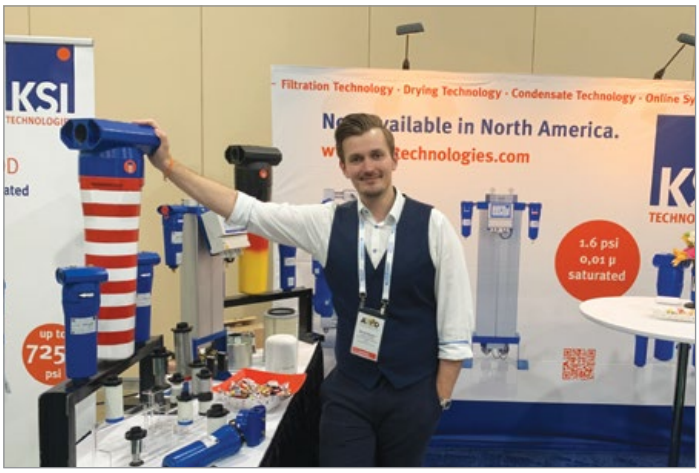
Mike Zacharko, Austin Keppler, Sean Van Auken and Abbey Hopkins at the Air System Products booth (left to right).

Compressed Air Piping and Storage

The Unipipe booth featured the new 8" and 10" aluminum piping technology for standard 100 psig (7 bar) plant air. Derrick Taylor said, "The high-pressure piping for 1,015 psig (70 bar) is taking off for compressed air, inert gas and high-pressure fluid applications." He explained a growing application has been for hydraulic oils and fluids used in vehicle maintenance facilities. These multi-fluid systems use their piping solution and have become a standard catalog item for the dealership networks of a couple major automotive brands and heavy machinery companies.

Aignep USA displayed its INFINITY aluminum piping system for compressed air, vacuum and inert gases. Its push-in fitting technology is standard on all diameters, limiting the use of labor-intensive installation tools. National Sales Manager Jason Dove also displayed new larger 80 mm, 110 mm and 168 mm automatic couplings, and a new pneumatic shut off valve – providing the user the ability to isolate a compressed air system remotely. Aignep USA also displayed its new flex hose for tight installation spaces, available in 20 – 63 mm diameters.

AIRpipe USA is introducing new 10" diameter aluminum pipe for the centrifugal market. Darren Phillips has been promoted to AIRpipe Product Sales Manager with more than six years of experience at AIRpipe. Scott Kramer has also been promoted to Regional Sales Director in the Midwest in his seventh year working with AIRpipe. "We're excited about our recent growth. We have doubled our warehouse space in Arizona and



Moritz Bojahr at the KSI Technologies booth.

Al Gallo, Chris Nelen, Chris Ursillo and Mark Beauchamp at the ZEKS Compressed Air Solutions booth (left to right).

Anthony Yacucci and Ross Klein at the JORC Industrial booth (left to right).

Jeremy Gaitsch, Lance Frederick and Derrick Taylor at the Unipipe booth (left to right).

The 2023 AICD Show Report

Michael Coles, Matteo Pomelli, Jason Dove and Matt Rosser at the Aignep USA booth (left to right).

Chad Hills, Darren Phillips, Mike Chapman, Scott Kramer and Steve Kwiatkowski at the AIRpipe USA booth (left to right).

Luigi Lorenzetto and Andrea Fabris at the Sicomat and COLTRI booth (left to right).

can also reach customers from our Ohio and South Carolina locations," said Chad Hills, Managing Director, AIRpipe USA.

Sicomat offers four different lines of compressed air piping systems, plus a complete component offering for reliable compressed air distribution. The SR Series aluminum pipe has a range of diameter sizes up 110 mm (4.3"). The latest SK Series aluminum pipe and quick push fit fittings offers 15, 22 and 28 mm (0.59 – 1.1") aluminum pipe assembled with nylon fittings. Temperature tolerance ranges from -4°F – 158°F (-20° – 70°C), and working pressures range from 11.6 – 181.3 psi (-0.8 – 12.5 bar). The SA Series has a square extruded aluminum profile, and the S2 Series is a multifunction system with two parallel ducts to transport two different pressures or gases.

Samuel Pressure Vessel Group is a leading supplier of ASME air receivers in North America, stocking vertical and horizontal configurations from 12 – 5,000 gallons. They also provide made-to-order air receivers up to 60,000 gallons. Its facility in Tucson, AZ is now providing air receivers, along with its two facilities in Wisconsin, plus Virginia and Ontario.

Compressed Air Measurement Instrumentation, Testing and Leak Detection

Trace Analytics was talking about the Air Check Kit K810 Sampling Unit able to take compressed air samples for solid particles, water vapor and oil aerosols. We were impressed by the simplicity of use and yet the accuracy the device has. Managing Director Nikki Smith said, "Demand for compressed air testing has never been higher. We believe plants are understanding the critical importance of compressed air quality verification." Trace Analytics also hosted us for a tour of their Austin laboratory and we were very impressed by the advanced testing technologies and testing procedure rigor they deploy.

CS Instruments introduced its IAC 500 in-take air monitor for compressed air stations, a 3 in 1 sensor for ambient pressure, temperature and humidity. Special features include Modbus-RTU, Ethernet or M-Bus interface, alarm relay, and more. CS Instruments is also introducing the PTS 500, a 2 in 1 sensor for pressure and temperature of gases and liquids. It's capable of temperature measurements from -68° – 257°F. Lastly, its LD 500 Leak Detector can be upgraded to perform all functions of the new LD 510 with purchase of the newer acoustic trumpet attachment to access

new cloud solution features, automatic sensor detection and unique laser distance measurement for automatic cost determination.

Prosaris performed live demonstrations of its OL and HL Series ultrasonic air and gas leak detectors. The devices attach to phones and tablets via cable, and connect to its cloud-enabled leak lifecycle management solution via mobile app. The ultrasonic technology quickly analyzes a large area, detects the leak, and visually guides the user to the leak for further action, all within a few seconds. It requires no headphones or full sweeping of an area in search of a leak by directing the user to the precise leak source. It can detect even the smallest of air and gas leaks (approximately 8.5g/hr for compressed air).

Brett Greenlee, Nikki Smith and Alec Thompson (left to right).

Conference

The AICD conference format has an engaging agenda, aimed at helping senior management at air compressor sales and service companies better manage their businesses today and tomorrow.

- Economic Check-Up – Professor J.R. Gillette, Ph.D.
- Managing Employees and Connecting Across Generations, Lisa Walden
- Get a Grip on Your Business: 6 Keys to Getting What You Want from Your Entrepreneurial Company – Lorie Clements
- Hacking the "Rockstar Attitude" – Mark Schulman, Rockstar Drummer for Pink, Foreigner, Cher and many more

Martin Zeller and Florian Buchner at the CS Instruments booth.

Conclusion

Throughout the duration of the event, attendees testified to the impact this association has had on their careers. Here, members connect with peers to share ideas, discuss business methods develop solutions to industry problems, see the latest technology on the market and enjoy a world-class event produced by the AICD team. Mark your calendars for next year's show, April 28-30, 2023 at the Grand Sierra Resort & Casino in Reno, Nevada. BP

For more information, please contact Kasey Gould, AICD Administrator, email: admin@aicd.org, or visit www.aicd.org.

Grant MacIsaac and Colin Sewell at the Prosaris booth (left to right).

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President, JenTech Inc.

Francisco Lara
Manager, Airtec Global LLC

Paul Edwards
Principal, Compressed Air Consultants

Ron Marshall
Chief Auditor, Marshall Compressed Air Consulting

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

JUL 27 **From Fresh to Soggy – Quality Monitoring: How Compressed Air Condensate Affects Food Quality**
Presenter Francisco Lara, Manager, Airtec Global LLC – *Sponsored by SUTO iTEC*
Thursday, July 27, 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

AUG 24 **ASME PTC 13: Efficient Blower, Sustainable Systems**
Presenter Tom Jenkins, P.E., President, JenTech Inc. and John Conover, Business Development Manager, Air Clean USA – *Sponsored by Lontra*
Thursday, August 24, 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 09 **Chiller Selections for Central Plants: Lowest Overall Costs for Process Cooling**
Presenter Clayton Penhallegon, Jr., P.E., Integrated Services Group – *Sponsored by Carrier*
Thursday, November 9, 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

John Conover
Business Development Manager, Air Clean USA

Tie Duan
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Compressed Air Technology News

Kaeser Expands CSD Series Range from 60 to 125 HP

CSD series compressors now feature five models from 60 to 125 hp with significantly improved efficiency over a wider range of flows and pressures. Capacities range from 261-693 cfm at pressures from 80 to 217 psig. With new airend designs and IE4 Super Premium Efficiency motors, the already outstanding CSD compressors now have even better specific performance (kW/100 cfm) and deliver up to 25% more air than competitive models.

Our standard SIGMA CONTROL 2 includes superior external communication capabilities and data storage for better asset and energy management. Routine maintenance is easier than ever with an open package layout, oversized access doors, and convenient placement of fluid level indicator and fill port. Standard features also include a frequency controlled fan with a brushless DC motor and an eco-friendly fluid filter element. All five models are available with integrated refrigerated dryers and Eco-Drains.

For more information, visit us.kaeser.com/rotaryscrew, or to be connected with your local authorized Kaeser representative, please call (877) 417-3527.

New redesigned CSD series compressors provide more air and feature expanded pressure options.

About Kaeser Compressors

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

PEAK Scientific Launches Energy-Efficient Nitrogen Generator

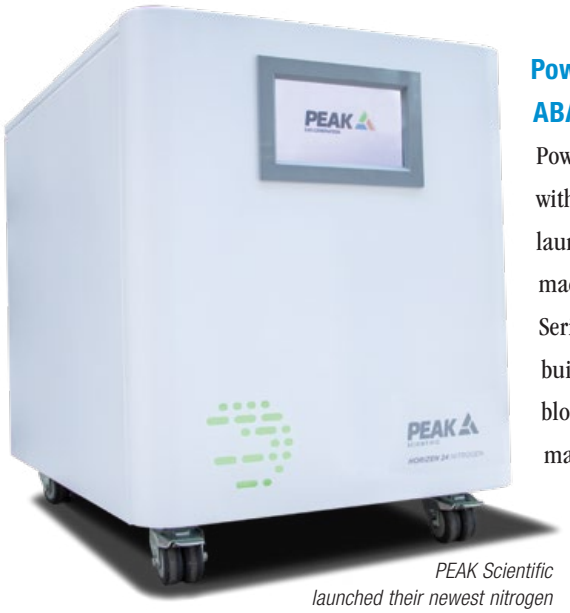
PEAK Scientific launched their newest nitrogen gas generator, Horizen 24. Designed for Single Quad LC-MS, Horizen 24 is the culmination of 25 years of dedication to manufacturing nitrogen generation solutions for LC-MS. PEAK Scientific, industry-leaders in laboratory gas generators, bring to market a solution that will save laboratories money, space and environmental impact without compromising on gas quality and reliability.

PEAK has introduced a range of proprietary technologies to create its most efficient nitrogen generator to date. Features include brushless compressors which reduce power consumption by over 50%, two stage active moisture safeguard reduces the risk of moisture entering the gas stream, and heat optimization technology to protect membrane from water droplets enhancing performance and reliability in the gas stream. This exciting innovation also houses advanced multi-stage purification to produce ultra-dry, high purity nitrogen gas for LC-MS analysis.

With demand growing, PEAK Scientific set out to manufacture the most energy-efficient nitrogen generator on the market in the smallest footprint in its class. Using over 50% less energy, the Horizen 24 can save labs on power consumption and with 55% less heat your lab's air conditioning costs can be reduced. Horizen 24 can also help labs to minimize their operational carbon footprint compared to cylinders and equivalent generator models.

Fraser Dunn, PEAK Scientific's Head of Design Engineering, said of the launch, "Horizen 24 has truly been a giant leap for us at PEAK in the benefits we can provide to labs around the world with this latest nitrogen generator for Single Quad LC-MS."

Compressed Air Technology News



PEAK Scientific launched their newest nitrogen gas generator, Horizen 24.

"The generator has been fitted with a number of new technologies which have helped us to achieve better energy efficiency than any other single quad nitrogen generator on the market. We've not only reduced the cost of ownership for labs, we've produced a nitrogen generator that is significantly smaller than its predecessor without compromising on quality, reliability or purity."

For more information on Horizen 24, visit peakscientific.com/horizen or contact PEAK Scientific directly for a quote at peakscientific.com/contact.

About PEAK Scientific

PEAK Scientific produces market-leading nitrogen, hydrogen and zero air systems mainly for the fields of LC-MS (Liquid Chromatography-Mass Spectrometry) and GC (Gas Chromatography). What differentiates us is our world-class technical support and ongoing service care throughout the generator's lifespan, wherever you may be in the world. For more information, visit www.peakscientific.com.

Power Equipment Direct Launches ABAC Air Compressors

Power Equipment Direct has partnered with ABAC Air Compressors to lead the launch of its innovative rotary screw machines in the United States. The AS Series of rotary screw air compressors is built using groundbreaking integrated block technology that mitigates downtime, maximizes efficiency, and simplifies maintenance, making it a great fit for automotive, industrial, and other applications requiring an efficient and reliable source of air.

"We're going to utilize Power Equipment Direct as our partner to launch this brand into the entire North American marketplace," said Dave North, national sales manager for ABAC. "I don't think there's anybody else that would do this as well with us together, so we're very, very excited about that."

The compact, integrated block on the rotary screw compressors replaces traditional piping with internally cast channels eliminating the possibility of leakage. Its vertical, single-block design improves oil separation, while aluminum construction limits condensation buildup and prevents corrosion.

"Because we've been able to eliminate parts and create new efficiencies, the likelihood of downtime is far less than we would find with a conventional rotary [screw air compressor]," said North. When maintenance is required, the compact design makes all components easily accessible, streamlining the entire process.

Besides greater efficiency, these new rotary screw compressors minimize vibration to deliver the quietest performance in the industry, a feature verified by Compressed Air and Gas Institute (CAGI) testing standards. "The advantage with ABAC and other members of CAGI is they are subscribing to the same standards, so when we tell you what the decibel level is, or the performance, you can trust it," said North.

Joshua Ayres, air compressor product expert at Power Equipment Direct (left), and Dave North, national sales manager for ABAC, stand before one of ABAC's groundbreaking rotary screw air compressors with an integrated block design.

Power Equipment Direct now carries a wide assortment of ABAC rotary screw compressors ranging from 3-20 horsepower. This includes base-mount, tank-mount, and tank-mount with dryer configurations.

Among the offerings is a 3-horsepower, 24-gallon portable rotary screw air compressor. "The reason we're able to offer this unit is because, by using integrated block technology, everything has been shrunk down so much smaller, that we can easily fit it on a small 24-gallon tank," said North. "The market has never ever seen anything like this before, so we're pretty excited."

Drew Dudek, category manager for air compressors at Power Equipment Direct, is equally excited. "ABAC's air compressor design is cutting edge, and we're thrilled for the opportunity to introduce it to the U.S. market," he said. "Both of our companies share a passion for making this technology simple and accessible, and I'm confident our partnership will benefit the industry and market as a whole."

About PED

Since 2002, Power Equipment Direct's mission is to "Make buying technical products simple." Utilizing specially-trained product experts, its wide selection of power equipment and HVAC products, and its U.S.-based support team, Power Equipment Direct provides a streamlined shopping experience designed to save customers time, money, and hassle. For more information, visit www.powerequipmentdirect.com.

Teledyne FLIR Introduces New Multimeter and Clamp Meters

Teledyne FLIR, part of Teledyne Technologies Incorporated, announced the DM286 Infrared Guided Measurement (IGM™) Multimeter, and two new clamp meters, the CM57-2 and the CM85-2. The reimagined multimeter and clamp meters replace the predecessor DM285, CM57, and CM85, respectively, providing technicians with upgraded tools to perform safe and accurate electrical inspections and to identify hazards before contact is made.

Teledyne FLIR CM85-2 clamp meter.

"The FLIR DM285 IGM multimeter and the CM57 and CM85 clamp meters have proven to be enormously popular for electrical inspection, and we are thrilled to reintroduce these flagship products with even more compelling features," said Rob Milner, business development director, Teledyne FLIR. "The redesigned FLIR DM286 Industrial Imaging Multimeter with IGM now features FLIR-patented multispectral dynamic imaging (MSX®) that adds visible light details to thermal images in real-time for greater clarity. It also includes video recording, longer run time, and compatibility with the new FLIR METERLiNK app."

The DM286 is designed to enable electricians to pinpoint hot spots and other problem areas faster, safer, and more efficiently. It features 160 × 120 thermal resolution from the embedded Lepton thermal micro-camera along with an embedded visible-light camera and bright LED work light to operate MSX in low light. MSX is additive in that the visible light edge details are displayed on top of the thermal image without sacrificing any thermal detail or resolution.

The multimeter can also store up to 30,000 radiometric thermal images and log files and includes longer battery life for inspectors to capture images and log files all day long. For those using other FLIR test and measurement tools alongside the DM286, the new FLIR METERLiNK app, which replaced the FLIR Tools app, can work independently or in concert with compatible FLIR devices.

It is also effective for complying with the updated National Fire Protection Association (NFPA) 70B 2023 rules released in April, which changed the use of thermography for electrical equipment maintenance from "recommended" to "required." For more on the updated thermography rule changes, visit: https://www.flir.com/discover/industrial/nfpa-70b-2023-new-guidelines-for-electric-inspections/.

Compatible clamp meter tools provide access to difficult-to-reach areas and adapt to operating condition-specific voltage measurement needs. The CM85-2 Clamp Meter is an industrial power

Compressed Air Technology News

clamp meter with advanced power analysis and variable frequency drive (VFD) filtering functions required by electrical troubleshooters for full-scale equipment. Technicians can accurately analyze voltage in complex machinery by including harmonics, inrush, current, and phase-rotation testing.

The CM57-2 Clamp Meter is designed to simplify difficult current measurements. Its narrow, 18-inch (45.72 cm) flexible coil clamp lets users easily take measurements in awkward and tight spots and it is ideal for multiple conductor measurements and double-wrap requirements. Like the CM85-2 and the DM286, the CM57-2 is also compatible with the FLIR METERLiNK app.

For more information on each of the products, visit the following links:
FLIR DM286: www.flir.com/DM286.
FLIR CM57-2: www.flir.com/CM57-2.
CM85-2: www.flir.com/CM85-2.

About Teledyne FLIR

Teledyne FLIR, a Teledyne Technologies company, is a world leader in intelligent sensing solutions for defense and industrial applications with approximately 4,000 employees worldwide. Founded in 1978, the company creates advanced technologies to help professionals make better, faster decisions that save lives and livelihoods. For more information, please visit www.flir.com.

Festo Now Offers CPX to Emerson DeltaV DCS Systems

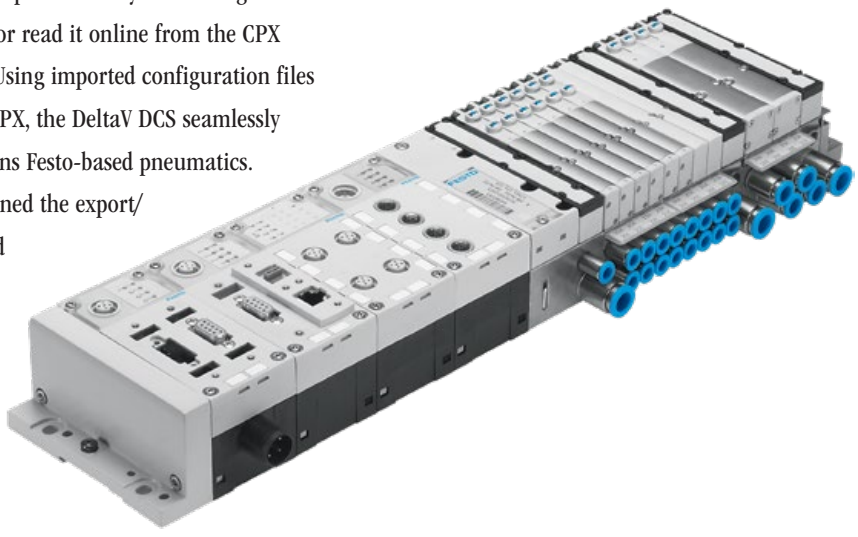
Festo now offers CPX valve manifold configuration to Emerson DeltaV DCS systems for fast, simple, and effective programming, commissioning, and validation of Festo-based pneumatics for skids and machines. This first-of-its-kind third-party commissioning solution brings one of the world's most versatile valve manifold control platforms, CPX, to the DeltaV DCS ecosystem. Fast commissioning enables system integrators to speed up time to market, lower engineering overhead, and design new, innovative, and unique distributed control solutions. Simple CPX configuration commissioning is available for the Rockwell ecosystem as well.

The CPX electric terminal is a modular peripheral system for valve terminals. System integrators and original equipment manufacturers (OEMs) adapt CPX to a wide range of applications. The modular design of the CPX enables a virtually endless range of pneumatic system configurations.

Engineers use the CPX Festo Maintenance Tool to build the pneumatic system configuration manually or read it online from the CPX terminal. Using imported configuration files from the CPX, the DeltaV DCS seamlessly commissions Festo-based pneumatics. Festo designed the export/import and commissioning process to be as efficient as, and offer similar capabilities to, the Emerson CHARMS I/O interfacing process. The export integrates directly with the hardware and software paths of the DeltaV environment. It facilitates error handling and custom tag names in DeltaV. Dynamos are created for the operator interface to clear alarms from CPX modules. The new commissioning capability is compatible with Ethernet I/P and Profibus communication protocols.

About Festo U.S.

Festo is a leading manufacturer of pneumatic and electromechanical systems, components, and controls for process and industrial automation. Celebrating 50 years in the U.S., Festo Corporation has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performing, more profitable automated manufacturing and processing equipment. Through advanced technical and industrial education, Festo Didactic Learning Systems and its partners prepare workers for current and future manufacturing technologies. For more information on the full range of the company's products and solutions, visit the Festo website www.festo.com/us.



The Festo CPX is one of the world's most versatile valve manifold control platforms.

Tsunami Introduces CORE Series Desiccant Dryer

Tsunami CORE Series Desiccant Dryer is the newest addition to the Air Dryers product line, designed to better serve the automotive and professional coatings industry.

Tsunami CORE Series Desiccant Dryer installation.

This manual change desiccant air dryer features a spring-loaded cartridge style desiccant canister that eliminates dusting and tunneling of the media.

"This improves our flexibility to meet the needs of the automotive and professional coatings industry," said Troy Robins, Product Manager for Tsunami. "The CORE Series dryers are easy to maintain, have quick installation, and the dual layered desiccant media sets this dryer apart from others in the industry."

The new Tsunami CORE Dryer is available for pre-order with August 2023 launch.

About Tsunami Compressed Air Solutions

For over 35 years, Tsunami Compressed Air Solutions, a division of Suburban Manufacturing Group, has set the industry standard for quality compressed air filtration and drying solutions. While we strive to bring cutting-edge technology to the world of pneumatics, we continue to focus on the core principles that built the foundation of our successful business: quality, value, and world-class customer service. For more information, visit www.tsunami.us.com.

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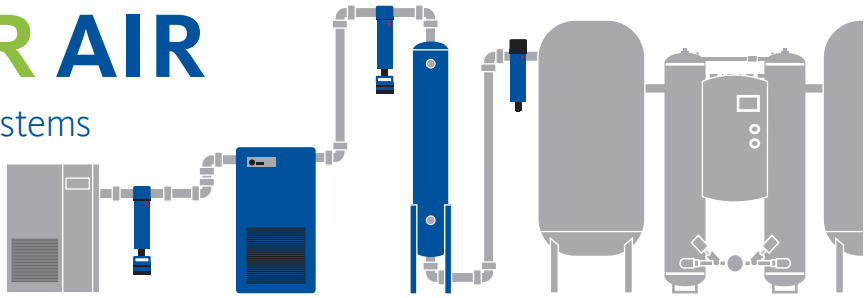
PREPARE YOUR AIR

for downstream nitrogen generation systems



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