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August 2024

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

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# FROM THE EDITOR



## Announcing the European 2025 Industrial Sustainability Best Practices Expo & Conference

Taking place June 17 to 18, 2025, in Barcelona, we are thrilled to announce the inaugural Industrial Sustainability Best Practices Expo & Conference. The slogan for this new bi-lingual (English/Spanish) annual event is *“The facility utilities decarbonization and water conservation event for design engineers and facility/maintenance managers.”* We greatly look forward to hearing the expertise of our European subscribers in person! For more information, see our ads on pages 23 and 35, and visit <https://cabpexpo.com/>.

Arkansas Industrial Machinery (AIM) was founded in 1971, employs over 50 professionals and has locations in Arkansas, Tennessee and Louisiana. For many years, it's taught plants how to decarbonize their compressed air and gas systems. We'd like to thank AIM's Kevin Conley for sending a useful article titled “Selecting a Reliable and Efficient Nitrogen Generation System.”

Hitachi Global Air Power (HGAP) keeps generating positive momentum, and recently announced the launch of the Sullair TS Series two-stage, lubricated, rotary screw air compressor. I hope you enjoy my interview with HGAP President and CEO John Randall, and learn more about the advances in efficiency this represents.

CFM Air Equipment has provided compressed air systems in Canada since 1965. We congratulate them and hope you enjoy new Digital Content Editor Brooke Jones's article resulting from her interview with President Steve Sobczyk.

CAC Group specializes in compressed air systems throughout Latin America with 14 locations serving 21 countries. We are grateful for the expertise CAC's Daniel Mejia and Jim Hudson share in their article titled “Air Compressor Sizing at Higher Altitudes.”

Our new Senior Editor, Troy Dreier, recently visited the huge plastics show, NPE2024, to discover innovations with air compressors, chillers and cooling towers.

What do Saudi Aramco, Universal Creative, Gates, Jacobs and Ardagh Glass Packaging have in common? Their facility and energy management leaders are keynote speakers at the Best Practices 2024 EXPO & Conference! It takes place October 29 to 31 in Atlanta. Don't delay – sign up for discounted rates at <https://cabpexpo.com/registration/atlanta-2024/>!

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

**RODERICK M. SMITH**

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# Readers From Around the World

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



↑ To say we were bowled over when we got this group shot from CASCO USA would be an understatement. We're grateful they took time to pose with two company vehicles, an air compressor and several copies of their favorite magazine. CASCO USA installs and services Kaeser air compressors in Pennsylvania, Ohio, West Virginia and New York. Visit <https://cascousa.com>.



↑ Plastic packaging manufacturer Berry Global counts over 250 locations around the world, and we'd love to get pictures from each and every one of them. First up is the facility management team from the Lawrence, Kansas, manufacturing plant, led by Facility Engineering Manager Jim Munda (third from the right). Visit <https://www.berryglobal.com>.

## Submission Guidelines

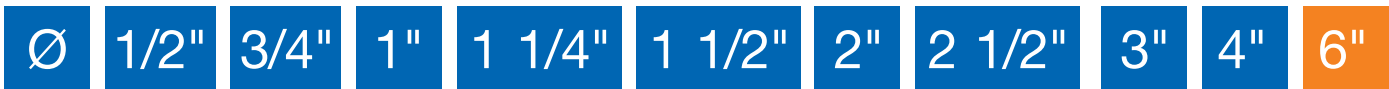
We invite our subscribers to send in pictures so we can see the people who read our Best Practices magazines! Those holding a recent magazine issue will receive first consideration. Please send a high-resolution picture as a JPG or PDF file and a note describing the team and company to Troy Dreier at [troy@airbestpractices.com](mailto:troy@airbestpractices.com). If we publish your submission, we'll thank you with a \$25 Amazon gift card.





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# Compressed Air Industry News

## Edmac Compressor Parts Celebrates 75th Anniversary

Edmac Compressor Parts is celebrating 75 years of success in the compressed air and gas industry. To mark the milestone occasion, Edmac held celebrations in Charlotte and Los Angeles with dinner, guests and special presentations. Guests included current and former employees, owners and GMs, along with Edmac US's current VP/GM, Deepak Vetal, and a congratulatory message from the GM of Edmac Global, Björn Paumen.

Edmac was originally founded by Edgar McKnight and began as an industrial welding and tool supply company. In 1955, the welding supply division was sold off and, since then, Edmac has focused exclusively on compressed

air service and repair parts. McKnight later went on to a successful political career, serving as a representative in the North Carolina State House of Representatives. In 1974, McKnight sold the company, but it has retained the Edmac name and commitment to selling the highest-quality compressed air parts.

In its 75 years of operation, Edmac has grown from a small store front in North Carolina to boasting offices and warehouses in Charlotte, North Carolina, Los Angeles, California, Portland, Oregon, and internationally in Europe, China, India and Australia. Edmac's key to success lies in its ability to operate as the premier one-stop shop for compressed air parts to its many distributors and customers around the world. From early to late model,



Edmac booth at the industrial trade show for the Annual High Point North Carolina Furniture Market in 1979.

piston to oil-free screw, receiver tanks to downstream air treatment, Edmac provides the full spectrum of compressed air maintenance





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and repair parts to keep its customers up and running.

Edmac's most valuable assets are its people. After 75 years of growth and developing a global presence, Edmac still maintains its family-owned feel and culture. The Edmac culture translates to strong and lasting relationships with its supplier partners and customers. Edmac's KPIs are not just monetary; the company measures its success based on customer satisfaction and ensuring it gets it right the first time, every time.

Edmac continues to grow and innovate. The company's mission is to make purchasing compressed air parts easy for its customers, and it's continually developing new tools and applications to simplify the buying experience.

Edmac remains committed to the highest levels of customer service, along with providing expert-tested and guaranteed high-quality compressed air parts. No matter what the last 75 years have thrown its way, Edmac has endured the test of time, and the company looks forward to seeing what is to come over the next 75.

#### *About Edmac Compressor Parts*

*Founded in 1948 by Edgar McKnight, Edmac has grown to become a premier specialist in compressor parts. The company is dedicated to providing its customers with top-quality components and outstanding service. It understands the importance of each part in maintaining energy-efficient and vital air flow to critical production processes. For more information, visit <https://www.edmac.com>.*

#### **FS-Curtis Celebrates Expansion of Platinum Program**

Since its establishment in 2015, the FS-Curtis Platinum Program has stood as a pillar of FS-Curtis's business, recognizing its most steadfast Channel Partners and propelling mutual growth. This year, the company is elated to commemorate the program's substantial expansion and to underscore the immense effort and dedication required for success.

FS-Curtis takes pride in honoring Platinum Channel Partners who have excelled in four pivotal areas: total sales, sales growth, product focus and connectivity to the installed base. Each of these areas serves as a crucial barometer of the company's present business vitality and a testament to its commitment to future expansion.

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## Compressed Air Industry News

For 2023, FS-Curtis is proud to announce the following winners for each key metric:

- Total sales: 3C Industrial, LLC
- Sales growth: Industrial Air Rental & Sales LLC
- Product focus: 3C Industrial, LLC
- Connectivity to installed base: Arizona Air Compressor

In addition to the winners, FS-Curtis congratulates the following companies for finishing in the top four in each of the categories: Air Power Equipment, Custom Energized Air Ltd, LBS Corporation and Vacuum Pump & Compressor.

“We truly appreciate the partnership we have built with our elite Platinum Channel Partners, are proud of their accomplishments and look forward to continued success in the years to come,” said Matt Smith, Vice President Channel Partner Sales.

Since its inception in 2015, the Platinum Program has experienced a remarkable growth of over 500%, a testament to the strength of the



FS-Curtis is celebrating the expansion of its Platinum Program, as well as honoring Platinum Channel Partners who have excelled in key areas.

company’s partnership and the effectiveness of its programs. The program has rewarded the Platinum group over \$2 million with rebates and co-op marketing to bolster their regional marketing and initiatives. These figures underscore the tangible benefits and substantial rewards that come with being a part of the exclusive Platinum Program.

These rebate-based benefits, coupled with exclusive shipping benefits, special discounts and stocking programs, have strengthened FS-Curtis’s partnership, and given the companies an advantage in their growth.

FS-Curtis extends its sincere gratitude to all its Platinum partners, especially to the award winners, who have played a pivotal role in shaping the program and laying a solid foundation for future growth.

### About FS-Curtis

*FS-Curtis is committed to offering a world-class portfolio of products. Through the dependability of its people and its quality-focused manufacturing, FS-Curtis will continue to be a trusted and dependable name in compressed air serving even more markets through its ever-growing global presence. For more information, visit <https://fscurtis.com>.*



## Ingersoll Rand Acquires Del Pumps, CAPS and Fruitland Manufacturing

Ingersoll Rand, a global provider of mission-critical flow creation and industrial solutions, has closed on the previously announced acquisition of ILC Dover and has acquired Complete Air and Power Solutions (CAPS), Del PD Pumps & Gear Pvt Ltd. (Del Pumps) and Fruvac Ltd. (Fruitland Manufacturing) for a combined purchase price of approximately \$150 million.

The acquisition of ILC, with an upfront cash purchase price of approximately \$2.325 billion, expands Ingersoll Rand’s addressable market to a total of approximately \$65 billion in highly fragmented market segments with significant and sustainable growth opportunities. It adds new technologies for life science applications including innovative powder and liquid single-use solutions for various end markets including biopharma, pharma, cell and gene therapy.

“We thank ILC’s leadership and employees for their partnership in creating a global leader across multiple high-growth, life critical markets over the last four years,” said Andre Moura, managing director at New Mountain Capital. “We look forward to seeing the business continue on its impressive trajectory with Ingersoll Rand.”

In addition, three additional acquisitions demonstrate the continued commitment and success of the company’s capital allocation strategy:

Del Pumps, based in India, manufactures rotary, twin and triple gear pumps for the loading, unloading, transfer and pressurization of liquids. The acquisition will complement Ingersoll Rand’s portfolio of mission critical,



*Ingersoll Rand extends its portfolio in sustainable end markets, including life sciences, food and beverage, medical and wastewater treatment.*

high margin pumping solutions across life science, food and beverage, medical, natural gas and wastewater treatment industries. Del Pumps will join the newly established Precision Technologies platform within the Precision and Science Technologies segment.

CAPS, based in Australia, has been providing compressed air and power generation services to a strong customer base for over 40 years.

The acquisition is expected to expand the CAPS portfolio to include additional Ingersoll Rand products, which will provide greater expertise and choice for customers. The business will join the Industrial Technologies and Services (IT&S) segment.

Fruitland Manufacturing is a leading manufacturer of mobile and truck mounted vacuum pumps, systems and peripheral parts. Based in Canada, Fruitland will expand Ingersoll Rand's capabilities to include low flow applications in the mobile vacuum market. Fruitland will join the IT&S segment.

"I remain energized by Ingersoll Rand's growth trajectory," said Vicente Reynal, chairman

and chief executive officer of Ingersoll Rand. "These acquisitions demonstrate our continued commitment to our inorganic growth strategy and ability to execute on our acquisition pipeline."

**About Ingersoll Rand**

*Ingersoll Rand, driven by an entrepreneurial spirit and ownership mindset, is dedicated to Making Life Better for its employees, customers, shareholders and planet. Customers lean on the company for exceptional performance and durability in mission-critical flow creation and industrial solutions. Its employees develop customers for life through their daily commitment to expertise, productivity and efficiency. For more information, visit <https://www.irco.com>.*

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**Jason Costigan**  
Director of Product  
Management,  
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# Selecting a Reliable and Efficient Nitrogen Generation System

Whether you're shopping for a pressure swing adsorption or membrane nitrogen generator, here are the points to consider

By Kevin Conley, MID, Arkansas Industrial Machinery

▶ As a refresher, there are two main types of nitrogen generators designed for use inside manufacturing facilities.

## Pressure Swing Adsorption (PSA) Nitrogen Generators

PSA nitrogen generators are fed compressed air which goes to two vessels alternately. One vessel fed by pre-treated air produces nitrogen, and the other undergoes regeneration by depressurization, purging the adsorbed gases, and then repressurization. This cyclic process ensures a continuous supply of nitrogen. The adsorbent materials selectively capture gases like oxygen, carbon dioxide and other trace gases within the compressed air stream while allowing nitrogen to pass through. Though testing of the outlet gas typically shows that the air composition is the same as the inlet minus the oxygen. The term inert nitrogen is sometimes used to refer to the nitrogen generator outlet gas because it has everything else the compressed air will contain. There are a few different types of adsorption media commonly used in PSA nitrogen generators. These include:

- ▶ Activated carbon is a highly porous material with a large surface area typically made from organic materials like coal, wood or coconut shells.
- ▶ The carbon molecular sieve is a type of activated carbon and can also be made from a plant resin. It's a porous carbon material with a narrow range of pore sizes engineered to have selective adsorption properties, favoring the adsorption of certain gases over others.

PSA nitrogen generators are primarily used in industrial applications needing high-purity nitrogen, typically 95% to 99.9995% purity. It is worth noting here that the savings from making onsite nitrogen over liquid nitrogen increases as the level of purity required decreases. This contrasts with bulk liquid nitrogen that is industry standard 99.998% pure regardless of the application's need.

PSA nitrogen generators are commonly used in industries such as food and beverage packaging, electronics manufacturing,

pharmaceuticals, chemical processing and laser cutting.

## Membrane Nitrogen Generators

Membrane nitrogen generators use selective permeation through semi-permeable membranes to separate nitrogen from other gases in the air. Compressed air is fed to the membrane which consists of a bundle of hollow polymer fibers. The membrane's fibers have a unique structure that is designed to allow oxygen to pass through (permeate) its walls and



Membrane Nitrogen Generator by Atlas Copco

vent out. Nitrogen is less permeable and doesn't pass through the walls. Nitrogen follows the path of the hollow tubes and flows out the end of the generator. Water vapor can be a big issue for membranes. Water and oil can both clog the fibers and stop the membrane from functioning.

Membrane nitrogen generators are simple in design and require minimal maintenance. They are usually used in lower purity applications with purity levels ranging from 90% to 99.5%. Higher purities can be achieved, but the air-to-nitrogen ratio increases dramatically, and the output purity is not stable.

Membranes become more productive at higher temperatures, meaning they can produce more nitrogen with less compressed air. This decrease in the air-to-nitrogen ratio potentially lowers the capital investment cost for companies that work in high temperature areas since they don't need as large an air compressor and air treatment equipment. Additionally, the energy cost for nitrogen generation will be less.

Membrane nitrogen generators are typically used in applications such as heat treatment, laser cutting, tire inflation and nitrogen blanketing in storage tanks.

Now that we know a little bit about nitrogen generators, what can you do to make them more reliable and energy efficient? We must look at the entire nitrogen system because the nitrogen generator is only one piece of equipment in a much larger system.

### Things to Consider When Choosing a Nitrogen Generation System

#### Nitrogen Generators

Nitrogen is not toxic but will cause asphyxia. Therefore, never directly inhale the produced gas and avoid working in the immediate vicinity of flowing nitrogen.



Custom pressure swing adsorption nitrogen generator fabrication project by Arkansas Industrial Machinery

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## Selecting a Reliable and Efficient Nitrogen Generation System

The placement of nitrogen generation equipment should be carefully considered because the discharge air from a nitrogen generator will be rich in oxygen, which causes an increased fire hazard. The oxygen concentration in the vicinity of the nitrogen

generator will normally not exceed 40% and will quickly go to normal concentration in the air a short distance from the generator, in a normally vented area. It's also possible to pipe the waste gas outside the facility. If the generator is in the same room as it's being used

and isn't being consumed by the process, the oxygen and nitrogen gases will mix together to get a net zero change in the room.

### Air Compressor

After the nitrogen system equipment is purchased and installed, the only costs associated with onsite nitrogen generation are the energy and maintenance costs of the equipment. The air compressor will be the largest energy user in the system, therefore take some care picking out a properly sized and energy efficient air compressor.

Air compressor maintenance costs are also important, and care should be taken to find an air compressor that has high quality parts. If a compressor manufacturer uses low quality parts or has oil that must be replaced every 2,000 hours compared to others that have an 8,000-hour periodicity, the maintenance costs will significantly lengthen the return on investment.

The air compressor will need to be capable of 100% duty cycle, therefore choose an oil-free or oil-injected rotary screw air compressor that is either fixed speed or includes a variable speed drive (VSD). A VSD air compressor is recommended because the pull from the nitrogen generator can vary with temperature and time in the cycle. Having an air compressor that stays loaded reduces energy costs significantly.

The compressor should be placed in a well-ventilated room where the air is as cool and clean as possible, or duct in clean air from a suitable place outside. Placing the air compressor outside is not recommended unless weather and temperature protections are taken.

If using compressed air from an existing plant air compressor, it is recommended to have a receiver tank dedicated for a PSA nitrogen generator and a check valve placed in between

### Arkansas Industrial Machinery

Founded in 1971, with a belief that a better company could serve the Arkansas industrial markets, engineers and salesmen Marvin Kee and Ralph Vandagriff opened the doors of Arkansas Industrial Machinery (AIM).



A half-century later, AIM's customer base is vast and relies on the knowledgeable and caring staff at AIM to keep their air, gas and fluid products flowing with optimum performance, premium efficiency and minimal downtime.

Today, AIM operates from its original North Little Rock, Arkansas, location and has added Memphis, Tennessee (1975), and Bossier City, Louisiana (1981), locations to help serve all or parts of Arkansas, Tennessee, Louisiana, Mississippi, Texas, Oklahoma and Missouri.

AIM helps its customers select and apply solutions for maintaining equipment used in the treatment of air, gas and fluids. AIM is a customer-centric partner, solving operational challenges and improving systems for maximum efficiency and profitability.

AIM employs a team of over 50 professionals vested in helping customers grow and prosper. AIM works with each customer to solve issues that impact workflow processes. AIM doesn't offer canned solutions; instead, the solutions provided are customized to each customer's individual needs. For more information, visit <https://www.aimcompanies.com>.



Arkansas Industrial Machinery was founded in 1971 and is the cornerstone of the AIM family of companies.

the tank and the nitrogen generator to prevent large plant demands pulling air from the nitrogen generator.

### Compressed Air Dryers

When picking out a compressed air dryer for a PSA nitrogen generator, be aware that heated desiccant dryers can have a high discharge temperature that needs to be taken into consideration. As the air temperature goes up, so does the air-to-nitrogen ratio. For example, the air-to-nitrogen ratio may be 3.6 to 1 at 86°F (30°C), but will go up to 4.2 to 1 at 140°F (60°C). Not taking this into account could lead to lower purity nitrogen than expected from the generator, under sizing the air compressor or an inline aftercooler may be needed to lower the temperature of the air going into the nitrogen generator.

Adsorption dryers may use a purge for regeneration. The amount of purge air needs to be taken into consideration when sizing the air compressor to prevent not having enough compressed air for the nitrogen generator.

### Compressed Air and Nitrogen Storage Tanks

For PSA generators, the dry compressed air supply tank should have a regulator downstream to provide steady pressure to the generator. You could also use a variable speed air compressor to get steady pressure. The pressure band of a fixed speed air compressor will cause air velocities to continuously change inside the nitrogen generator, which could degrade the adsorption material over time.

Having a properly sized wet compressed air tank in the system (a tank between the air compressor and the dryer) is recommended to help prevent short cycling of the air compressor and remove some moisture from the air stream and take some load off the dryer.

It's important to size the dry compressed air receiver correctly because the air requested by the nitrogen generator is not constant during the production cycle. Every time the vessel is pressurized, the air consumption can be three to four times the average consumption for a few seconds.

It's recommended to have a nitrogen storage tank after the nitrogen generator for handling varying demands. Whether you are feeding the nitrogen applications or supplying nitrogen

to a booster, having enough nitrogen storage will help with the overall efficiency and reliability of the system. Also, regulate the nitrogen leaving the tank to the lowest pressure needed.

Having more nitrogen storage capacity may allow the purchasing of smaller nitrogen system equipment if the nitrogen demand is not continuous 24/7. For example, if the nitrogen system operates 16 hours a day, the other eight hours could be used to fill a large capacity storage system. It could mean reducing the horsepower of the air compressor significantly, as well as lowering energy costs.



*Holtec pressure swing adsorption nitrogen generator*



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## Selecting a Reliable and Efficient Nitrogen Generation System

It may be a good idea to create extra nitrogen as a backup or have an oversized or extra nitrogen tank. Having a 12 or 16 pack of nitrogen bottles pressurized to 4,100 psig (283 bar) will provide hours or potentially days' worth of nitrogen in the event of a problem with the nitrogen system.

### Compressed Air Filtration

The number one cause of customers breaking their nitrogen generator is improper filtration. Also, every nitrogen generator manufacturer will void the warranty if the nitrogen generator is destroyed by inadequate filtration.

Adsorption material is expensive and must be protected. Therefore, high-quality filters are required to ensure the efficiency and reliability of a nitrogen generator. These filters remove particulate, liquids and oil vapors from the air stream.

Most, if not all, nitrogen generator manufacturers require the use of an activated carbon bed with oil-flooded air compressors. The activated carbon adsorbs the compressor oil and protects the expensive CMS from

degrading. This can be the difference between having to replace the CMS every two to four years to replacing it every 10 to 20 years.

Changing the filter elements periodically is crucial for continued protection of the nitrogen generator.

### Compressed Air Piping

Pay attention to good engineering practices when installing piping. There may be flow meters or other types of sensors on the nitrogen generator that can be affected by erratic air flow. Having 20 pipe diameters of straight pipe before the flow meter is a good rule of thumb. This varies depending on what the piping obstruction is; 15 pipe diameters may be good after a sweeping 90-degree elbow, while 20 pipe diameters may not be enough if there is something more disruptive in the line.

The general rule for the size of a nitrogen generator's inlet and outlet connections is to size them for a maximum pressure drop of 2 psi (.14 bar) over 100 feet of pipe. This assumes no bends, but adding some elbows shouldn't have much effect.

Some piping materials or designs may allow oxygen migration through the piping into the nitrogen system, so consider the piping style and material prior to installation.

### Pressure Swing Adsorption (PSA) Nitrogen Generators

A good nitrogen generator will use high quality adsorption material that needs to be protected because it's expensive to replace – typically 30 to 45% of the cost of a new generator.

Some nitrogen generator manufacturers take a more proactive approach than others to ensuring the reliability and efficiency of their products, therefore you should compare features offered by different manufacturers.



*Mikropor MNG-US-35 nitrogen generator fed by a Kaishan KR5B air compressor*

Built-in sensors, monitoring systems and automated flush mechanisms can be used to ensure required purity is met. If nitrogen demand requires a minimum purity level, find a generator that guarantees the required purity by stopping nitrogen flow and flushing until purity is met. This requires nitrogen being provided from a backup storage system.

If inlet compressed air quality drops below safe operating conditions, the nitrogen generator should have a way of protecting itself by flushing out the bad air, but not all nitrogen generators have this feature. Backup nitrogen will be required with this feature, also.

During startups of the nitrogen generator when there is no pressure in the tank, there is a risk of overflowing the adsorption material and damaging it. Therefore, only a small amount of high purity nitrogen should be allowed to flow through the nozzle until adequate pressure is achieved. Once enough pressure is in the tank, the minimum pressure valve can be opened to allow full flow through the nitrogen generator. Not all nitrogen generators have this feature.



*Mikropor pressure swing adsorption nitrogen generator*



PSA systems typically are not designed for use outside and perform poorly in direct sunlight. This is because PSAs operate more efficiently at lower temperatures.

It's rare, but there are applications that have a maximum purity requirement. This is usually for applications that limit the speed of a chemical reaction with oxygen. Make sure the nitrogen generator picked out can support this, if needed.

### Regular Maintenance

While the design and technology of a nitrogen generator plays a significant role in its efficiency and operation, following the manufacturer's recommendations for maintenance schedules and procedures will prolong the lifespan and reliability of the generator.

### Employee Training and Awareness

Providing training to personnel involved in operating, maintaining and troubleshooting the nitrogen system enhances their knowledge and skills, which could mean fewer problems and increased reliability.

By considering these factors and choosing a reputable manufacturer with a track record of building quality nitrogen generators, you can increase the chances of having a long-lasting dependable nitrogen generation system. **BP**

For more information, visit <https://www.aimcompanies.com>.

### About the Author

Kevin Conley is the Applications Engineer for Arkansas Industrial Machinery (AIM) and the head of its Industrial Gas Division. He has been at AIM for 16 years and has a Master's of Industrial Distribution Degree from Texas A&M.

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# The CABP Interview: Hitachi Global Air Power President and CEO John Randall on the Sullair TS Series

Roderick Smith, publisher of Compressed Air Best Practices® Magazine, sits down with John Randall to talk about the innovations that made the Sullair TS Series the most efficient Sullair ever

By Troy Dreier, Compressed Air Best Practices® Magazine

► In March 2024, Hitachi Global Air Power announced the launch of Sullair TS Series lubricated rotary screw air compressors, debuting an innovative two-stage airend with an over/under design, patent-pending interstage cooling, and a lighter, more compact form. The TS Series includes nine models ranging from 984 to 2033 cfm, 100 to 200 psi (7 to 13.8 bar), and 250 to 350-horsepower (190 to 260 kW).

To mark the occasion and explore what makes the TS Series the most efficient Sullair lineup ever, Roderick Smith, publisher of *Compressed Air Best Practices® Magazine*, sat down with Hitachi Global Air Power President and CEO John Randall for a one-on-one interview. Topics include air compressor advances, the need for water-efficient solutions and meeting needs for a variety of customers and industries.

**Smith:** What are the main points of interest about TS Series for customers? What are the advancements in the two-stage technology?

**Randall:** Two-and-a-half years ago we started looking at chartering a product to replace our legacy TS-32, which is the tandem air compressor we have today. We wanted to make sure the new product we designed did a couple different things.

One, it had to be best-in-class efficiency in every region. We wanted to ensure we were

doing things that were going to reduce energy consumption for our customers. We are focused on our customers' primary vision of conserving energy, eliminating carbon where we can, ensuring we're doing the right things. Not only for ourselves, but back through our supply chain, to help us reach the Hitachi goal of carbon neutrality in all our facilities by 2030 and throughout our value chain by 2050.

Another piece is the serviceability aspect and then the connectivity with our AirLinX® platform. Helping customers understand how the air compressor's performing, what it looks like, helping them lead to standard and scheduled maintenance to keep high levels of efficiency in place.



John Randall, Hitachi Global Air Power President and CEO

**Smith:** John, that's exciting. And when you say best-in-class efficiency, what class are you talking about? What's the product category?

**Randall:** 190 to 260 kW, air-cooled or water-cooled, lubricated, two-stage rotary screw air compressors for specific power. We are best-in-class for efficiency when you look at fixed speed for most nodes – particularly at the larger kW nodes. There are one or two nodes that were just a few cfm off versus some of the competition at the lower kW end, but our efficiency was still best-in-class.

The journey for this began in 2017. All the learning from the LS Series single-stage, lubricated, rotary screw air compressor launch – the easy-off panels, the touchscreen controller, the easy serviceability – all of those things, that's part of the DNA of this product. We didn't forget what we learned on the LS; we just took it to the next level.

**Smith:** I read that you have something like 30 unique parts between the LS and the TS Series using this whole LS Series design platform.

**Randall:** We tried to minimize the number of unique parts between the single-stage and the two-stage. When we go back to serviceability, that makes it easier for our distributors to have the right parts in stock, whether they're servicing somebody with

a single-stage, two-stage or combination of the two.

**Smith:** Hitachi Global Air Power is becoming a pretty unique company in our industry as a major air compressor airend designer. Can you talk about the depth of the investment there? What did you do in the R&D process to come out with a new two-stage airend that's groundbreaking?

**Randall:** This was a clean-sheet development for our engineering team, but we incorporated a lot of things from our original Sullair LS-90 and 110 launch many years ago.

Looking at the airend, we understand some of the challenges of space. This is a completely different configuration and build of an over/under first-stage, second-stage airend versus the long tandem airends that we build today.

We know weight is a big issue for some of our customers, and putting these larger air compressors up on second-story platforms, we wanted to be mindful of the space but not compromise performance, durability and reliability.

In designing that over/under, we looked at the modularity concept. How do we look at the castings, the stator housings, what could be common within that platform, whether it's a single-stage or a two-stage product? And then how could we potentially even expand into higher kilowatt ranges using some of those same components within a new or larger kilowatt air compressor?

We eliminated about 40 leak paths by bringing all of the oil galleries internal to casting, eliminating all the piping and valving on the exterior. We eliminated roughly 40% of the fasteners. And then went to standard fasteners,

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## The CABP Interview: Hitachi Global Air Power President and CEO John Randall on the Sullair TS Series

making it easier for maintenance if there needs to be any kind of change in the future.

**Smith:** The over/under design, what has that done besides reduce space? What is it about that design versus the tandem that caused improvements?

**Randall:** A part of that is we have some patent-pending interstage cooling between the first and second stage, which aids us with efficiency. The space claim is big. The way we set up flow between the stages gives us a more efficient way to compress the air.

We looked at the gearing from the old to the new. There are some things we did in there differently, which allowed us to

maintain durability without compromising improved performance.

Our proprietary electronic spiral valve is managed by a fractional horsepower electric motor, so there's no air loss. Our old two-stage used a pneumatic control, which was a detriment to some of the flow. It also didn't have quite the pressure control that we liked. The new is up to +/-1 psi, so we had the ability to develop the system to have much better control for the customer in managing their process where that pressure finite needs to be held very tightly.

**Smith:** What benefit do customers get when you can go to them and offer them the three models for every flow range? The base model, the spiral valve and the VSD options?

**Randall:** A lot of it is based on the customer's need. We try to dissuade customers from buying an air compressor that's too large for what they need because everybody knows, "Oh, I'm going to grow and I'm going to need a bigger compressor one day. Let me just get it now."

Where we do have customers that are trying to grow, if we know they have something a little bit bigger, we want to make sure we can efficiently unload it and meet that lower demand versus the peak demand.

That's where a spiral valve comes in. The upper range of an unloaded air compressor with a spiral valve is more efficient than a variable speed drive, but the spiral valve can't turn all the way down like a variable speed drive can. Now, you don't want to be all the way down in that cycle because then you have a much larger compressor than what you need.

**Smith:** Can you talk about the customer benefit of having spiral valve and VSD options for part-load conditions? Is there a fixed turn-down range for spiral valve and the VSD?

**Randall:** Our spiral valve will turn down 50% and a lot of VSDs will go down to 80%.

A cement plant – you know how that powdery stuff can get everywhere – they'll use that pressure differential and then also the flow differential to be more efficient in loading and moving powder with the cement. But the drives just will not last. If you've got to replace a large piece of equipment like that, it can cost tens of thousands of dollars. At some frequency, that is a maintenance repair no customer wants.

A spiral valve, being simple, being mechanical, being all within the airend itself, there's zero maintenance to it. It's a great way to improve efficiency when you don't need that peak demand for air.

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**Smith:** I just got back from Spain where we're starting preparations for our first European conference in June 2025. The only thing engineering firms are talking about are droughts, lack of water, high ambient temperatures.

**Randall:** Even here in the U.S., there are a lot of regions, specifically in the Southwest, where it's not humid but there are extremely high ambient temperatures. We have customers in the Middle East, we have customers in Southeast Asia, where it's also hot, but also humid. We see a lot of condensation that comes out of air compressors.

With our engineering systems, we mathematically model temperature simulation, what we can see in high ambients, what we

can see in high humidities. Then, we can go in and size components and coolers and fans to ensure we're meeting peak performance at high ambients.

**Smith:** Are you finding customers and engineering firms using your products for high ambient temperatures so they don't have to use a water-cooled air compressor?



*To create some excitement around its latest innovation, Hitachi literally rolled out the red carpet for the debut event. Employees were treated to a "Taco Twos-day" lunch.*

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*Inside the cabinet, the Sullair TS Series' two-stage design is clearly visible.*

**Randall:** It depends. We have some customers in remote locations that don't have good access to water. In the Middle East, they like the air-cooled just because water is a scarcity. They may not have the cooling towers, they may not have the industrial water to be able to run through a system to be able to cool. We know it's important. We know there's also some performance differences between water- and air-cooled, but we think that is a valuable feature.

We also have remote cooling. We have remote cooler packs that can be pulled away from the air compressor and put into a different location to provide more optimal cooling than an air compressor has. We try to make sure we have the features and functionality that our customers need for their unique applications.

**Smith:** Can you talk about reducing imbalanced temperature loads? I have to think there's a real benefit to that.

**Randall:** If you look at cooling plots and diagrams, there are hot spots, there are cold spots. If you look at a traditional radial versus axial fan, radial would be just like a ceiling fan. There's always that cool spot in the center because all the blades are on the outside.

That's where we go back and try to make sure we use modeling to help us understand cooling

flow all the way through the coolers themselves. By separating out both air and oil, we have the ability to have different fin types and densities. That way, air can flow through each cooler at its own optimal rate to either cool air or oil, as the oil will come back into the airend for cooling as well as sealing and lubrication. But then air can then go out and cool from an aftercool perspective.

It's really a science of how you want to balance the two coolers to meet different needs. Not too hot, not too cold. We have a standard delta, but we also want to manage oil because it is a critical efficiency component of how the airend operates.

**Smith:** I see you're still a slow-running 1,800 rpm design. There are other machines out there running a lot faster.

**Randall:** It's a balance. Do you want to spin a smaller airend faster or a big airend slower? A lot of it depends on what you want for pressure. We sometimes use a smaller air end to get a higher pressure. We won't get the same level of flow.

Think about a garden hose. If you put your thumb over a garden hose, you get pressure. You take your thumb off, you get a lot more flow.

Sometimes you'll see folks go with smaller airends. They'll try to get spin-up faster, but then you can spin too fast and have tip speed issues. We'll look for the optimal size of airend for the displacement of flow we expect to see, then manage pressure up and down with some gearing.

**Smith:** Creating the TS Series was certainly a collaborative effort. What can you tell us about the team behind it?

**Randall:** There were thousands of hours of development put into this by the engineering team, but it wasn't just the engineering team. It was also the operations team; how are we going to build this? What does it look like? How do we make sure we have great repeatable processes and control plans in place through sourcing and selecting strategic partners for supply?

**Smith:** What's the latest with Hitachi Air Global Power? You're an employment powerhouse in Michigan City, right?



*The engineering team responsible for the Sullair TS Series. Standing left to right: Alan Barth, Senior Engineer; Don Weinkauff, Senior Designer; Mike Graves, Engineering Manager; Comlan Fandohan, Engineer; Constantin Oproiu, Senior Designer; Ben Oudhuis, Engineer; Nate Heiermann, Senior Designer; Zhenbi Su, Senior Engineer; Don Low, Principal Engineer; Jon Batdorff, Senior Engineer; Eric Noble, Senior Designer. Seated, Abram Valencic, Senior Engineering Manager.*


**Randall:** We're the second- or third-largest employer in the county. Sullair was founded here. Sullair was acquired by Hitachi in 2017. We changed our name last year to Hitachi Global Air Power because we represent the Sullair brand, the Hitachi brand, a joint venture brand in China and the Champion brand in Australia.

We've added over 80,000 square feet since the acquisition. We've done some things from a workflow integration strategy allowing us to have better control of cost, quality and delivery. We've hired over 100 incremental people in the ops area to be able to build our products.

Michigan City is the hub. Most all of our machining for rotors is done here. We're working more with our sister facilities in Japan and China

on how we can distribute some things differently, exercising our global footprint to better serve customers in those regions.

**Smith:** So the TS is almost like your second giant step after the LS, Sullair's line of lubricated single-stage rotary screw air compressors that debuted a redesigned air end and used fewer parts.

**Randall:** Yes, and I think we have more steps to come. 

*Images courtesy of Hitachi Global Air Power.*

**About Hitachi Global Air Power US**

Headquartered in Michigan City, Indiana, Hitachi Global Air Power drives manufacturing operations all around the globe. Its global network of engineering and quality experts build next generation, highly efficient and environment-forward compressed air solutions in response to customer needs. For more information, visit <https://www.hitachiglobalairpower.com>.

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# CFM Air Equipment Empowers Customers Through Education

Canadian compressed air distributor shares key elements to an efficient system

By Brooke Jones, Compressed Air Best Practices® Magazine

► Since opening its doors in 1965 in Calgary, Alberta, CFM Air Equipment has provided businesses with air compressors, compressed air dryers, compressed air filtration, blowers, vacuum solutions, compressed air piping and parts. Over the course of its history, the business changed hands a few times,

ultimately being purchased in 2002 by Stan Sobczyk, an oil and gas consultant. His son, Steve Sobczyk, was finishing college and searching for the right career. Together, the father and son duo committed to learning the ins and outs of the industry, growing the company and offering customers the service they'd grown to expect.

Winnipeg. The company has 21 employees, including one who was there at the start.

“Our motto is ‘Any make, any time,’ because of the experience we have across our service department. A key focus of ours is maintaining our team members and service techs. They have the knowledge and experience, so we’re able to service multiple brands and not be surprised by what we come across,” said Sobczyk.

## Compressed Air Across Canadian Provinces

CFM Air Equipment is a Kaeser Compressors Canada distributor for Southern Alberta and Southern Saskatchewan, and a distributor for Chicago Pneumatic at its Manitoba branch. It works with clients of all sizes, and serves oil and gas, mining, hydro, agriculture, building maintenance, government, fertilizer and power industries. In addition to providing products,

Steve Sobczyk started his career at CFM Air Equipment as a Shipper/Receiver and worked his way up to Inside Sales Service Manager. As his father begins his retirement, Sobczyk is at last taking the reins and serving as President.

Nearly 60 years since its inception, CFM Air Equipment has grown beyond its first location in Calgary. Today, the company has four branches providing parts and service coverage across Central and Western Canada, with locations in Calgary, Lethbridge, Regina and



Steve Sobczyk, President of CFM Air Equipment

*Above: CFM Air Equipment helped Calgary Italian Bakery upgrade its compressed air system with two 40-hp air compressors, saving \$3,500 per year compared to the previous design.*





Calgary branch

the company offers 24/7 service on all makes and models of compressed air equipment. Because compressed air needs differ from province to province, each branch has a unique clientele with distinct demands.

In Calgary, CFM Air Equipment serves many small- to medium-sized businesses that need equipment anywhere in the 5 to 50-horsepower (hp) range. While the company works with a variety of “mom and pop shops” from kitchen cabinet factories to granite companies, the mainstay at this branch are businesses that support the oil and gas industry such as metal fabrication shops. The diversity in Calgary allows CFM Air Equipment to not only focus on the compressed air business, but also provide alternative products and solutions such as vacuum systems, oxygen generation systems and low-pressure blowers.



Regina branch

At the Regina location, agriculture is a top industry. Clean compressed air is key when it comes to agriculture. CFM Air Equipment must be sure of each site’s requirements and what level of compressed air is needed. This leads to a big involvement of its service team to ensure continuous air quality. It needs to look at the breakdown of food grade oil and how external factors such as room temperature and condition can shorten life span. It’s also important to maintain compressed air filtration to ensure air quality.

Agriculture and food production are important industries for the Lethbridge branch. There are several large food processing and producing businesses in the area. The food industry in Lethbridge is growing quickly with

many new plants in the works. This allows CFM Air Equipment to get in at the ground level with the engineers to determine plant requirements. The company can provide input on the design and focus on efficiencies including pressure requirements (low vs. high



Lethbridge branch



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## CFM Air Equipment Empowers Customers Through Education

pressure), compressed air pipe design, as well as optimal storage.

Manitoba's economy is extremely diverse, not relying on any one sector. Within Manitoba there's a varied, longstanding aerospace industry. Its large factories need larger systems. However, there are also many midsize to smaller companies, making this sector more unique. The industry is comprised of specialty parts manufacturing, aircraft maintenance and engine overhauling and testing. A training college prepares the workforce for this industry. Each of these locations uses compressed air – either low-



Manitoba branch

pressure or high-pressure applications for the molding sector, general shop air use for the equipment and shop tools throughout the

maintenance sector, and high-pressure storage for the engine testing sector. Vacuum molding and vacuum tables are used throughout the manufacturing process. Supply of equipment, maintenance and parts is critical to keep these units running.

### Conducting Compressed Air Energy Demand Audits

CFM Air Equipment's business is comprised of 80% retrofit projects and 20% new projects. In both cases, the company takes a customer-centric approach. Team members take the time to learn what customers' applications are and what kind of equipment they use.

### Case study: Calgary Italian Bakery's Compressed Air System Improves Performance and Saves Money

In July 2023, Calgary Italian Bakery asked CFM Air Equipment for assistance with its compressed air system, due to the inconsistent and generally poor performance it had been experiencing with its existing 50-hp air compressor. The bakery had seen significant downtime and expensive repairs (overheating and oil leaks) for quite some time with no resolution in sight.

Past upgrades to the compressed air components had been made without determining the bakery's real-time compressed air needs, so CFM Air Equipment recommended a Kaeser Air Demand Analysis. After running the sensing equipment on the system for two weeks, the company submitted the data for a Kaeser Energy-Saving System (KESS) report which provided recommendations for cost-effective improvements.

To replace the single 50-hp baseload air compressor and seldom-used 30-hp backup air compressor, Kaeser presented three fixed-speed air compressor scenarios: one 50-hp machine and one 30-hp, one 40-hp and one 30-hp, or two 40-hp air compressors.

According to the data, the bakery's operational requirements could be met at the 85 percentile with one 40-hp air compressor active and another 40-hp on standby in lag mode. The calculated specific

power consumption of this solution was in the middle of the three options at 19.91 kW/100 cfm with a maximum free air delivery (FAD) of 324 cfm. The KESS report detailed that the power savings realized with the installation of two 40-hp air compressors would amount to \$3,500 per year. With this and service parts' commonality in mind, the bakery chose to upgrade to two 40-hp air compressors.

The compressor room was cleared in preparation for the installation and the Calgary Italian Bakery team did an excellent job of planning for the plumbing and ventilation of the two new air compressors. CFM Air Equipment installed and commissioned the new system components in January and February 2024, and the bakery has experienced satisfactory compressed air system performance ever since.

"We were very happy we decided to go with the CFM Air Equipment team for this project. They came in first with the presentation of an air demand analysis, which would allow us to physically see our system demands and inefficiencies. Once this was completed, we sat down and reviewed which solution would provide us with the most energy savings, while also allowing for possible future expansion," said Louis Bontorin, owner of Calgary Italian Bakery. "Overall, the peace of mind we now have with the new compressed air system allows us to focus on other projects and not worry that our compressor is going to shut down."

“Often times, we get specs that say a customer needs X amount of air compressor horsepower, which leads us to ask, ‘Well, what kind of equipment are you using? What size of piping?’ All of these questions can lead us to determine a customer might not need that size of air compressor. Or maybe the variable speed drive air compressor they’re asking for isn’t the right type of application because they don’t have varying demands in the system,” said Sobczyk.

“With our holistic approach, it’s almost always like a new installation for us – whether it’s a retrofit or new project – because if it’s a customer we’ve never been involved with, we’re trying to narrow down what they have, what they use, what their demands are, what their needs are and just listen to them, as well.”

When beginning a new project, especially if it’s a retrofit, CFM Air Equipment conducts a compressed air system energy analysis or demand audit. This consists of:

1. Installing compressed air monitoring equipment on the air compressors at the site, as well as pressure transducers, to determine the customer’s demand profile.
2. Reviewing the options currently available for the customer.
3. Examining pressure settings to determine how efficient the system is. Determining the lowest pressure settings to run the equipment.
4. Checking the compressed air piping for rust buildup, black pipe or anything else that might cause flow restrictions or leaks within the system. This is done by completing a flow profile.
5. Looking at the compressed air treatment to ensure there’s no differential across compressed air filters or inefficiencies such as stuck open auto drains to cause artificial air losses or incorrectly sized and located air receivers.

“We take an educational approach to help our customers learn about the efficiencies and inefficiencies with compressed air. A lot of times we aren’t just selling equipment. We might be only selling a filter element or a more-efficient auto drain. For us, that’s part of the process. It’s key for our development that we continue to help educate our customers,” said Sobczyk.

### The Cost of Compressed Air Leaks

Education is a large part of the company’s process. CFM Air Equipment believes in the importance of educating customers, so the team’s work goes well beyond sales calls. Common topics are the cost of compressed air leaks and the importance of monitoring, especially for larger systems.

“As soon as you mention the cost of compressed air leaks to customers, their eyes get wide – they don’t realize the cost of it,” Sobczyk said.

“For larger systems, continuous system monitoring is key. Kaeser has the Sigma Air Manager [SAM], which monitors the compressed air system and always works to

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## CFM Air Equipment Empowers Customers Through Education

### Questions to Ask for an Efficient Compressed Air System

When discussing compressed air systems, CFM Air Equipment asks these questions on system efficiency.

- Is the equipment properly sized?
- Is it running at a higher pressure than needed? If so, why?
- Is the appropriate air treatment equipment being used for the application? Is there any compressed air waste within that?
- Is it running efficiently for system demands?
- Is the compressed air piping properly sized?
- Are tanks placed in correct locations across the plant where they can be used to support high-demand operations?
- What are the load/unload hours?
- Is there any rust buildup or black piping that's causing flow restrictions?
- How much is it running?
- Are there air leaks that create artificial demand?
- What's the downtime?
- Are air compressors correctly placed to balance demand across the system?
- What are the pressure settings?

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balance the system to increase efficiency. It looks at which air compressors are running at what time, which ones shouldn't run and continuously learns. As we lean into those large systems, we encourage customers to invest in larger compressed air monitoring systems that can help them look at how things are running and almost give them a live price of what their compressed air costs."

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# Air Compressor Sizing at Higher Altitudes

Calculating air compressor requirements for mile-high cities means taking a whole new set of measurements into account

By Daniel Mejia and Jim Hudson, CAC Group



► Air compressor selection for higher altitude installations introduces some unique considerations that are often overlooked. A simple oversight will not only lead to disappointment, but a far less than satisfactory compressed air system – if it even operates! Higher altitude means less dense inlet and ambient air for both compression and cooling. Considerations must include a larger air compressor inlet capacity and footprint; high altitude rated motors, VFDs and even starters, all requiring greater cooling capacity; and larger cooling fans and air flows for air-cooled units or auxiliary components such as compressed air dryers.

Let's look at a few significant factors when considering air compressor selection for higher altitude installations. First, there are the physics of pressure, temperature and relative humidity. Second, there is the physical size and capacity of the compressor unit being

considered, whether positive displacement rotary screw type or dynamic centrifugal type. We will address and breakdown each of these factors.

## Formulas and Foundations

$pV = nRT$  Ideal Gas Law

For atmospheric air,  $n$  and  $R$  can be assumed to be constant as air is as close to an ideal gas as there is.

This reduces to the Combined Gas Law (including Charles's Law and Boyle's Law) which then allows:

$$\frac{P1V1}{T1} = \frac{(P2V2)}{(T2)} \quad (or) \quad V1 = \frac{(V2T1P2)}{(T2P1)}$$

In practical terms comparing inlet conditions to standard conditions:

$$ICFM = SCFM \times \frac{(T1)}{(Ts)} \times \frac{Ps}{(P1 - \Delta p) - (Pv)(RH)}$$

ICFM = Inlet cubic feet/minute  
(Volumetric Flow)

SCFM = Standard cubic feet/minute  
(defined at 14.7 psia, 60°F, 0% RH,  
which = Mass Flow)

T1 = Ambient temperature at site °R  
(°F + 460)

Ts = Standard Temperature °R  
(60°F + 460, in our case)

P1 = P ambient at site psia

Ps = 14.7 psia at sea level (in our case)

$\Delta P$  = Nominal air inlet filter/piping pressure  
drop psia

Pv = Partial vapor pressure of water psia at T1

RH = Ambient site relative humidity %

## High Altitude Factors to Consider

The primary ambient factors for air compressor capacity definition and selection include atmospheric pressure (P1) or altitude, inlet air temperature (T1) and the relative

*Above: The staff at CAC Group's main office in Medellin, Colombia*

humidity (RH) for any given set of operating conditions. Let's look at each factor.

**Pressure:** Atmospheric pressure decreases with altitude as the air density decreases. There are less molecules or moles in the same given volume of air. Molecules and moles or mass are the energy workhorse for compressed air. This means the inlet pressure to the air compressor at some elevation is measurably less than at sea level. To achieve the same desired discharge pressure the air compressor has to work harder to overcome the increased pressure ratio. The air density decrease is linear as the elevation goes up. This is the  $P_s/(P_1 - \Delta P)$  factor above and can be up to a 40% capacity correction factor above sea level. Site atmospheric pressure is the most significant factor to understand. It is assumed constant at the installation site but must be identified correctly.

**Temperature:** As ambient air temperature increases, the molecules expand and the density goes down. As with altitude there are also fewer molecules or moles in the same given volume of air. The air density decrease is linear as temperature increases and gives us an absolute temperature ratio factor in degrees R. This the  $T_1/T_s$  factor above and can be up to a 7% capacity correction factor above standard conditions.

**Relative Humidity:** As ambient air temperature increases, the partial vapor pressure of the air also increases. That is, warmer air is able to hold more moisture in the first place. This vapor content increase is exponential. This is the  $(P_v)(RH)$  factor above and can be a 6% or more capacity correction factor above standard conditions.

The relative humidity is the percent of water vapor in the air at a given ambient temperature. Water is generally incompressible

| Altitude above Sea Level, ft | Atmospheric Pressure, Psi | Barometer Reading, In. Hg | Altitude above Sea Level, ft | Atmospheric Pressure, Psi | Barometer Reading, In. Hg |
|------------------------------|---------------------------|---------------------------|------------------------------|---------------------------|---------------------------|
| 0                            | 14.69                     | 29.92                     | 7,500                        | 11.12                     | 22.65                     |
| 500                          | 14.42                     | 29.38                     | 8,000                        | 10.91                     | 22.22                     |
| 1,000                        | 14.16                     | 28.86                     | 8,500                        | 10.70                     | 21.80                     |
| 1,500                        | 13.91                     | 28.33                     | 9,000                        | 10.50                     | 21.38                     |
| 2,000                        | 13.66                     | 27.82                     | 9,500                        | 10.30                     | 20.98                     |
| 2,500                        | 13.41                     | 27.31                     | 10,000                       | 10.10                     | 20.58                     |
| 3,000                        | 13.16                     | 26.81                     | 10,500                       | 9.90                      | 20.18                     |
| 3,500                        | 12.92                     | 26.32                     | 11,000                       | 9.71                      | 19.75                     |
| 4,000                        | 12.68                     | 25.84                     | 11,500                       | 9.52                      | 19.40                     |
| 4,500                        | 12.45                     | 25.36                     | 12,000                       | 9.34                      | 19.03                     |
| 5,000                        | 12.22                     | 24.89                     | 12,500                       | 9.15                      | 18.65                     |
| 5,500                        | 11.99                     | 24.43                     | 13,000                       | 8.97                      | 18.29                     |
| 6,000                        | 11.77                     | 23.98                     | 13,500                       | 8.80                      | 17.93                     |
| 6,500                        | 11.55                     | 23.53                     | 14,000                       | 8.62                      | 17.57                     |
| 7,000                        | 11.33                     | 23.09                     | 14,500                       | 8.45                      | 17.22                     |
|                              |                           |                           | 15,000                       | 8.28                      | 16.88                     |

*Atmospheric pressure and barometer readings at different altitudes (table courtesy of CAGI, from CAGI Handbook, 6th Ed.)*



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## Air Compressor Sizing at Higher Altitudes

and serves no useful energy contribution to a compressed air system. Get rid of it. Generally, compressor interstage cooling, aftercooling and later downstream air drying will collect most of the condensed water vapor that entered the

compressor inlet before it enters the compressed air system.

After compression, single or multistage, and final aftercooling the compressed air is still

100% saturated now at system design pressure. The remaining water vapor or moisture content is about 30% of the initial ambient moisture volume. Water will continue to condense with any further temperature drop and needs to be removed or drained to maintain a dry air system. This water volume is also a capacity loss from the initial volume of humid air going into the air compressor inlet and must be accounted for.

Compressed air drying will further reduce the water vapor content helping to avoid condensation in air piping and instruments, as well as related system problems. Compressed air dryers are designed to reduce the final discharge pressure dew point such that there will be no further condensation if the compressed air temperature stays above the system designed compressed air dew point. These pressure dew point values are typically 35 to 50°F (2 to 10°C) for refrigerated dryer systems (at 35°F around 4% water vapor content remains) and -40°F (-40°C) for desiccant dryer systems (roughly 0.1% water vapor content remains).

We all know the main sizing selection considerations when comparing a nominal manufacturer's capacity rating and your actual jobsite conditions.

An air compressor is sized based on physical inlet volume. A compressed air system is designed based on the amount of useable energy which is delivered in compressed mass flow. The relative comparison is most often evident by looking at the volume or inlet cubic feet per minute (icfm) vs. the delivered mass flow expressed as standard cubic feet per minute (scfm). There are at least a half dozen common and acceptable standard definitions for scfm used in different industries and different parts of the world. Be sure you

| Initial Temperatures |         |                   | Initial Temperatures |         |                   |
|----------------------|---------|-------------------|----------------------|---------|-------------------|
| °F                   | °F abs. | Relative Delivery | °F                   | °F abs. | Relative Delivery |
| -20                  | 440     | 1.18              | 70                   | 530     | 0.980             |
| -10                  | 450     | 1.155             | 80                   | 540     | 0.961             |
| 0                    | 460     | 1.13              | 90                   | 550     | .0944             |
| 10                   | 470     | 1.104             | 100                  | 560     | 0.928             |
| 20                   | 480     | 1.083             | 110                  | 570     | 0.912             |
| 30                   | 490     | 1.061             | 120                  | 580     | 0.896             |
| 32                   | 492     | 1.058             | 130                  | 590     | 0.880             |
| 40                   | 500     | 1.040             | 140                  | 600     | 0.866             |
| 50                   | 510     | 1.020             | 150                  | 610     | 0.852             |
| 60                   | 520     | 1.00              | 160                  | 620     | 0.838             |

Effect of initial or intake temperature on delivery of air compressors based on a normal intake temperature of 60°F (table courtesy of CAGI, from CAGI Handbook, 7th Ed.)

| Temperature (°F) | Pressure (psia) | Temperature (°F) | Pressure (psia) | Temperature (°F) | Pressure (psia) |
|------------------|-----------------|------------------|-----------------|------------------|-----------------|
| 32               | 0.08854         | 60               | 0.2563          | 86               | 0.6152          |
| 34               | 0.09603         | 62               | 0.2751          | 88               | 0.6556          |
| 36               | 0.10401         | 64               | 0.2951          | 90               | 0.6982          |
| 38               | 0.11256         | 66               | 0.3164          | 92               | 0.7432          |
| 40               | 0.12170         | 68               | 0.3390          | 94               | 0.7906          |
| 42               | 0.13150         | 70               | 0.3631          | 95               | 0.8153          |
| 44               | 0.14199         | 72               | 0.3886          | 96               | 0.8407          |
| 46               | 0.15323         | 74               | 0.4156          | 98               | 0.8935          |
| 48               | 0.16525         | 76               | 0.4443          | 100              | 0.9492          |
| 50               | 0.17811         | 78               | 0.4747          | 102              | 1.0078          |
| 52               | 0.19182         | 80               | 0.5069          | 104              | 1.0695          |
| 54               | 0.20642         | 82               | 0.5410          | 106              | 1.1345          |
| 56               | 0.2220          | 84               | 0.5771          | 108              | 1.2029          |
| 58               | 0.2386          | 85               | 0.5961          | 110              | 1.2748          |

Pressure of water vapor at separation (table courtesy of CAGI, from CAGI Handbook, 7th Ed.)



are consistent in your evaluation. For this discussion we will define scfm at the conditions of 14.7 psia, 60°F and dry.

Let's look at an example that displays all factors:

A customer in Denver, Colorado, needs a 1,000 scfm air compressor designed for a summer day, 95°F, 80% RH, 5,280-foot elevation which equals 12.1 psia. We need to calculate the icfm required to deliver 1000 scfm.

Using the previous equation, we have:

$$ICFM = 1,000 \times \frac{(95 + 460)}{(60 + 460)} \times \frac{14.7}{(12.1 - 0.2) - (0.8153)(0.80)}$$

$$ICFM = 1,000 \times 1.067 \times 1.307$$

$$ICFM = 1,395$$

In total, our compressor selection needs to be about 40% larger than at sea level to do the same work.

Another way to see the effect of water vapor and relative humidity is to look at the volume of condensate to be removed. For our case of 100 psig, 95°F, 1,000 scfm, we see there are roughly 2.25 lbs. condensate per 1,000 cubic feet of air, or 0.27 GPM (about a quart), or 16.2 GPH (about a keg), at the air compressor inlet.

Ambient air weight at 14.7 PSIA, 95°F is about 70 lbs. per 1000 cubic feet. Ambient air weight at 5,280 feet altitude is about 58 lbs.

At 80% relative humidity (RH), this same 58 lbs. of air also includes 2.25 lbs. of water vapor. Therefore, nearly 4% of the total weight of the inlet air is water weight which is useless to the compressed air system and needs to be removed in the quantities above.

Conclusion: do not budget shop for a nominal 1,000 cfm compressor, with maybe a 250-horsepower (hp) motor. We need to look at a nominal 1,500 icfm size air compressor with 350 to 400-hp to get the desired 1,000

| %RH | Temperature, °F |       |       |       |       |       |       |       |       |       |
|-----|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     | 35              | 40    | 50    | 60    | 70    | 80    | 90    | 100   | 110   | 120   |
| 5   | .0019           | .0024 | .0035 | .0050 | .0071 | .0099 | .0136 | .0186 | .0250 | .0332 |
| 10  | .0039           | .0047 | .0069 | .0100 | .0142 | .0198 | .0273 | .0372 | .0501 | .0668 |
| 15  | .0058           | .0071 | .0104 | .0150 | .0213 | .0298 | .0411 | .0561 | .0755 | .1007 |
| 20  | .0078           | .0095 | .0139 | .0200 | .0284 | .0398 | .0549 | .0750 | .1012 | .1351 |
| 25  | .0098           | .0119 | .0174 | .0251 | .0356 | .0498 | .0689 | .0940 | .1270 | .1699 |
| 30  | .0117           | .0143 | .0209 | .0301 | .0427 | .0599 | .0828 | .1132 | .1531 | .2051 |
| 35  | .0137           | .0166 | .0244 | .0351 | .0499 | .0700 | .0969 | .1325 | .1794 | .2407 |
| 40  | .0156           | .0190 | .0279 | .0402 | .0571 | .0801 | .1110 | .1519 | .2060 | .2768 |
| 45  | .0176           | .0214 | .0314 | .0453 | .0644 | .0903 | .1251 | .1715 | .2328 | .3133 |
| 50  | .0195           | .0238 | .0349 | .0503 | .0716 | .1005 | .1394 | .1912 | .2598 | .3502 |
| 55  | .0215           | .0262 | .0384 | .0554 | .0789 | .1107 | .1537 | .2110 | .2871 | .3876 |
| 60  | .0235           | .0286 | .0419 | .0605 | .0861 | .1210 | .1681 | .2310 | .3146 | .4254 |
| 65  | .0254           | .0310 | .0454 | .0656 | .0934 | .1313 | .1825 | .2511 | .3424 | .4637 |
| 70  | .0274           | .0334 | .0490 | .0707 | .1007 | .1417 | .1970 | .2713 | .3705 | .5025 |
| 75  | .0294           | .0358 | .0525 | .0758 | .1081 | .1521 | .2116 | .2917 | .3988 | .5418 |
| 80  | .0313           | .0382 | .0560 | .0810 | .1154 | .1625 | .2263 | .3122 | .4273 | .5816 |
| 85  | .0333           | .0406 | .0596 | .0861 | .1228 | .1730 | .2410 | .3328 | .4562 | .6219 |
| 90  | .0353           | .0430 | .0631 | .0913 | .1302 | .1835 | .2559 | .3536 | .4853 | .6627 |
| 95  | .0372           | .0454 | .0666 | .0964 | .1376 | .1940 | .2707 | .3745 | .5147 | .7041 |
| 100 | .0392           | .0478 | .0702 | .1016 | .1450 | .2046 | .2857 | .3956 | .5443 | .7460 |

Moisture content of air in gallons per 1,000 cubic feet (table courtesy of CAGI, from CAGI Handbook, 7th Ed.)

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## Air Compressor Sizing at Higher Altitudes

scfm mass flow delivered to the compressed air system.

While the effect of altitude is notable in the U.S., particularly in Denver, Salt Lake City and snowmaking system locations, it is critical in Latin America. There are many more

higher altitude metropolitan areas, industrial operations and populations in the Latin America region including Mexico City, Mexico (7,300-feet, 22 million), Bogota (8,600-feet, 11 million) and Medellin, Colombia (5,000-feet, 4 million), Quito, Ecuador (9,300-feet, 2.1 million) and La Paz, Bolivia (11,900-feet,

3 million). These five areas alone have more population and related industry than 12% of the entire United States population.

For comparison reference, using the above calculation on a standard 60°F, dry day at 10,000-foot elevation, a 1,000 scfm demand will

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CAC was created as an independent, fully-authorized service compressed air house and rotating machinery distributor based in Miami by Bruno Rebessi, formerly Regional Manager for Elliott Turbomachinery. CAC celebrated its 20th anniversary this May and is now a sales and service organization of over 50 people including 40 engineers.

The company has sales, service and support engineers in 14 locations spanning 5,000 miles and 21 countries and the Caribbean, representing 650 million people. CAC has local branch operations in eight countries based on market needs. With a commitment to excellence and more than 20 years of expertise in the air compression industry, CAC is a premier partner for harnessing the power of compressed air to optimize operations.

CAC understands the unique challenges of the Latin American market. It provides local comprehensive engineering and authorized service support for tailored solutions to meet the diverse needs of its clients and the whole range of difficult environmental and operating conditions. Its engineered solutions deliver efficiency, reliability and productivity with the least downtime in the most demanding industrial applications.

In this a large geographical area, all markets and industries are represented. In Latin America, the petroleum industry is nationalized and controlled by local governments. CAC has installations in most oil refineries and petrochemical companies in the region. It



*Jim Hudson, Vice President, Daniel Mejia, Manager, and Bruno Rebessi, Owner and President, CAC Group*

has compressor installations in the extensive mining and smelter operations throughout the Andes mountains for copper, gold and silver for the traditional markets and now lithium, which is especially important today for the future of EV technologies. Glass, food and beverage, automotive, electronics, textile and air separation industry air compressor installations are also well represented with both local and international companies.

At CAC Group, products are just one piece of the puzzle. CAC provides authorized service, engineering support, turnkey project management, air over the fence, equipment leases and rentals for clients throughout every stage of their journey. Its team of experts stands ready to deliver innovative solutions that drive tangible results for business. From initial consultation to installation, maintenance and beyond, CAC is committed to being a trusted advisor and partner in achieving operational goals. For more information, visit <https://compaircorp.com>.

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## Air Compressor Sizing at Higher Altitudes



*Daniel Mejia examines the installation of an 800-hp FS-Elliott centrifugal compressor in a textile company in Mexico.*

require a 1,480 icfm sized air compressor. All air compressor sizing selections for the above noted areas are typically in the range of 150% icfm vs. icfm for equivalent mass flow (usable compressed air energy).

### Air Compressor Selection for High Altitude

When choosing between rotary screw air compressors and centrifugal air compressors for higher altitude installations, it is essential to account for the specific conditions of the customer's site. While centrifugal compressors are often selected based on customer-specific conditions, screw compressors are typically designed for operation at sea level. Therefore, when installing a screw compressor at high altitude, it is necessary to reselect the compressor to ensure optimal and correct performance under the atmospheric conditions.

Rotary screw air compressors, operate based on positive displacement, trapping air between two meshing helical screws, and reducing the volume to increase pressure. These compressors are recognized for their efficiency, reliability and relatively low maintenance

requirements. They are commonly used in various applications, but when operating at high altitudes, adjustments must be made to accommodate the reduced atmospheric pressure. Note in our example the nominal icfm increased by 40%.

Centrifugal air compressors operate by accelerating air radially outward from the impeller and converting kinetic energy into

pressure energy. When selecting centrifugal air compressors, factors such as altitude and specific site conditions are always considered to ensure optimal and correct performance.

At this glass manufacturer, three centrifugal compressors boasting a power output of 745 kW each supply operations at an elevation exceeding 8,200 feet. With an airflow capacity of 4,740 scfm or 7,000 icfm each, these compressors are crucial for sustaining production efficiency. Notably, the specific power rating of 10.64 kW/100 icfm ensures optimal performance in high-altitude environments.

When selecting between rotary screw air compressors and centrifugal air compressors for high altitude installations, several factors should be considered:

- **Altitude adjustment:** For rotary screw air compressors, adjustments must be made to accommodate reduced atmospheric pressure at higher altitudes to ensure correct optimal performance.



*Three centrifugal compressors at a glass manufacturer*

- **Customer-specific conditions:** Centrifugal air compressors are typically selected based on specific customer conditions, including altitude, air demand and other site-specific factors.
- **Energy efficiency:** Evaluate the energy efficiency of each compressor type under the customer's specific operating conditions to minimize energy consumption and operating costs.
- **Maintenance requirements:** Consider the maintenance needs and associated costs of each compressor type to ensure reliable operation over the lifecycle of the compressors.
- **The footprint, size and weight of a positive displacement rotary compressor increases greatly as the icfm rating goes up. The dynamic centrifugal also increases but at a more nominal rate. Model, frame and motor size increase directly relates to cost increase. Try to maximize the frame size capacity limit to get the flow you need.**
- **Operational factors at higher altitude include more cooling capacity for the motor requiring a high-altitude motor rating, more VFD cooling and certainly more cooling air flow for an air-cooled compressor. These larger package options and ratings must be included to get a reliable running unit.**

In conclusion, both screw air compressors and centrifugal air compressors offer unique advantages and are suitable for different applications. When selecting an air compressor for high altitude installations, it is essential to consider all the specific operating conditions

and requirements of the customer's site to ensure optimal and correct capacity, performance and efficiency for your location. **BP**

For more information about CAC Group, visit <https://compaircorp.com>.

#### About the Authors

Daniel Mejia is General Manager for Compressed Air Corp, with 22 years of experience in Latin American compressed air and general rotating equipment industries.

Jim Hudson is Vice President, Business Development for Compressed Air Corp, with 45 years of experience in the compressed air industry in worldwide sales and product marketing for a variety of compressed air components and systems. He's also a former CAGI Centrifugal Committee Chair and Board Member.

Images courtesy of CAC Group.

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# Air Compressor and Chiller Innovations at NPE2024

By Troy Dreier, Compressed Air Best Practices® Magazine

► NPE2024: The Plastics Show took place in Orlando, Florida, May 6-10, 2024, and *Compressed Air Best Practices® Magazine* and *Chiller & Cooling Best Practices Magazine* were there to cover the highlights. This year's conference drew over 50,000 registrants, including 15,000 from outside the United States. Filling both buildings of the Orlando Convention Center, the conference included zones dedicated to bottling, recycling and sustainability, material science, advanced manufacturing, mold-making and packaging.

We focused on covering announcements in air compressors, chillers (low-global warming potential refrigerants were a hot topic), cooling towers, nitrogen generators and industrial vacuum systems.

## Air Compressors

ABC Compressors displayed its Horizon Synchro range of high-pressure, three-stage, oil-free, reciprocating air compressors. The line is built with a synchronous permanent magnet motor construction where the motor

is directly attached to the compressor (no belts) to produce fewer vibrations with less wear on parts. "We're standardizing variable speed drives (VSDs) for all of our units, but we're not increasing the price because we've reduced the number of parts – the gear box and so on," said Nacho Urbistondo, Business Development Manager. The soft starter VSD regulates voltage to eliminate a voltage spike at startup. System packages include a refrigerated high-pressure compressed air dryer. The line is capable of 70% turndown. Models range from



Nacho Urbistondo and Gonzalo Gabarain of ABC Compressors (left to right)



Gareth Smith and Pascal Heyden of AF Compressors (left to right)

125 to 680-horsepower (hp) and up to 580 psi (40 bar). ABC claims a 5 to 7% efficiency gain over its own previous models, but 15 to 20% compared to the competition.

AF Compressors displayed its high-pressure PET range of three-stage, oil-free, reciprocating air compressors. At AF, the watchwords are “sober and efficient,” said Pascal Heyden, Sales and Marketing Manager. The phrase describes the company’s design philosophy of using only what’s needed and nothing more. Its three-stage design includes a vertical initial piston, and horizontal second- and third-stage pistons that require few valves. Its design philosophy translates into lower energy costs and maintenance costs. The low-speed PET range runs from 217 to 580 psi (15 to 40 bar). AF emphasizes the long life of its compressors,

noting that one Egyptian oil refinery has been running the same AF air compressor since the 1980s.

Alkin Compressors highlighted its ability to create custom air compressor solutions for bottling and injection molding customers. On display was a 527 series reciprocating air compressor in a cabinet that can be outfitted with sound insulation to decrease noise to 60 decibels. The display included a belt-driven, two-stage, air-cooled reciprocating air compressor with a booster able to output 175 cfm at 580 psi (40 bar). Alkin can multiplex compressors and boosters, with many customers running two compressors in parallel, but some running four in parallel for 700 cfm. “Our pumps are big. The form factor being bigger allows us to run a low RPMs,” said Nitin

Shanbhag, President. “When a lot of people run at 1,800, 2,200 RPMs, we run between 650 and 1,100 RPMs. Aside from sound, it keeps things cooler and they last longer.”

Atlas Copco Compressors discussed its air compressor options for a range of uses, emphasizing low-pressure rotary screw models for low-pressure installations and reciprocating models for high-pressure installations. When packaged with 300 to 400-hp compressed air boosters, the company can create solutions for even large bottling plants, optimizing different areas with different pressures. On display was a model from the company’s ZT line of oil-free rotary screw air compressors, capable of 51 to 189 psi (3.5 to 13 bar), 42 to 5,210 cfm, and running at 20 to 1,207-hp. A two-stage air compressor, it included two airends and two

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Compressors USA



**Bruce McFee**  
President,  
Sullivan-Palatek

## Air Compressor and Chiller Innovations at NPE2024

motors. The display was a Full Featured model that included an integrated compressed air dryer. “You have the flexibility of regulating two motors, so you have a lot of turndown,” said Alfonso Peschiera, Vice President for High Pressure Products.

Kaeser Compressors had multiple messages to communicate at its booth. Targeting small- to medium-sized specialty PET bottlers,

it promoted its compact rotary screw air compressors. It displayed a 10-hp model, but noted it has solutions up to 700-hp. Noting the trend for creating separate air compressor enclosures outside a plant – whether because of a lack of floor space or hot or dusty conditions – the company also promoted its custom skid option. Kaeser engineers will work with customers to create built-to-order custom compressor rooms that are installed on site, no

permits or architects needed. “We can basically create a compressor room that we build in Fredericksburg, put on the truck and deliver on site, and it has one power connection and one process connection,” said Michael Camber, Marketing Services Manager. Systems can be created at any size, from 5 to 450-hp. Kaeser has also created vacuum and blower enclosures, noting this is a popular option at wastewater treatment plants.



Aydin Dereci, Nitin Shanbhag and Emre Tujumet of Alkin Compressor (left to right)



Alfonso Peschiera and Tammy Maynard of Atlas Copco (left to right)



Michael Camber and Joe D’Orazio of Kaeser Compressors (left to right)



Rick Goralski of Bauer Compressors



### Nitrogen Generators

Bauer Compressors was having conversations with plastic injection molding companies about GIT, or gas injection technology. Rather than making parts out of solid resins, the company says, create a mold that injects inert nitrogen gas into the middle of the product. By doing so, manufacturers use less plastic material and the time to create each item is substantially reduced. Instead of cooling in the mold for two-and-a-half minutes, a gas-injected item might only take 40 seconds to cool. Nitrogen is an important component, as oxygen would burn and clog the injection molding machine's injectors and valves. The company supplies system skids with air compressors and nitrogen generators that use either pressure swing adsorption or membrane systems.

### Chillers and Cooling Towers

Advantage Engineering, like many chiller manufacturers in attendance, reported having continual conversations about low-GWP refrigerants with visitors at NPE. Rather than moving to R-454b directly, for its central and modular chillers, the company is "slow-stepping it," said President Jon Gunderson, transitioning customers to R-513a for the time being. Refrigerant compressors for chillers using R-454b are still in production, so this gives plants time to plan the safety requirements of the slightly flammable refrigerant. The company finds locating chillers outside is a growing trend for plastics manufacturers transitioning from hydraulic to electric-driven equipment, and have different cooling needs. Advantage Engineering provides outdoor chillers from 2 to 110-hp offering flow from 7.2 to 490 gpm.

AEC is helping customers move to low-GWP refrigerants with the release of two chiller lines using R-454b. The GPL series is on wheels so units can be moved around; they can be

networked to provide 360 tons of cooling. The LHE series can be grouped together in connected bays to provide up to 600 tons of cooling. Since AEC was redesigning its chiller internals to accommodate new refrigerants, it upgraded their designs to make them more useful. The condenser for the LHE is on its side, compared to the older design, bringing the overall height down to 88 inches. The chiller is easier to service, with the manifold now easier to access, and includes a color touchscreen interface. The company added a leak detector for safety, as R-454b is rated as slightly flammable. "For us, it's exciting because we fixed a lot of the problems we knew people complained about and now we have a better unit, and most importantly we have a product for customers who need R-454b," said Bill Bruhn, Senior Product Manager.

Chase Cooling Systems surprised attendees with a completely new product, the TGR Series of Thermochillers. Targeting injection-molding and other plastics processes, the TGR Series combines chilling and heating in one unit, with a water-cooled chiller, a three-way mixing valve and a heating resistor. It's able to mix heat transfer fluids from the plant's cooling hydronic system to achieve precise cooling control of  $\pm 0.4^{\circ}\text{F}$ . The series uses the low-GWP R-513a refrigerant. Eight models are available, from 8 to 60 kW, with cooling capacities from 2 to 17 tons. An integrated free-cooling mode lets the operator run directly from cooling tower output in the winter when temperatures are cold enough.

Frigel chillers were in abundance at NPE2024, used in many partners' booths. At Frigel's own booth, the company displayed two new pieces of hardware. First up, the Microgel Syncro chiller promises smarter and more energy efficient cooling of plastic molds. Rather than chilling molds continuously during the molding process, as other chillers do, the Syncro senses

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## Air Compressor and Chiller Innovations at NPE2024

when molds are open and closed, delivering super-chilled water during the closed portion only. When the mold is open, it passively heats up. “The big savings is the 30 to 40% improvement in cycle time,” said Al Fosco, Marketing Manager. The chiller also reduces failures that occur when plastic can’t fully form

in an over-chilled mold. The company suggests buyers will see a return on investment in six to eight months. An included Syncro Wizard lets operators set up the unit in an hour. Next up, Frigel debuted the Ecodry 4DK, a cooling tower alternative with a closed water loop. The 4DK cools water through three stages, first by dry

cooling, then with an adiabatic mode, finishing with a booster system that sprays water on cooling tubes. That sprayed water is collected and used in the adiabatic stage. The company cites a 20% energy efficiency improvement over the previous 3DK thanks to improved spray and fan designs.



Jon Gunderson of Advantage Engineering



Bill Bruhn of AEC/ACS Group



Chip Miller, Jim Miller, Spencer Miller, Phil Shaver and Massimiliano Parisi of Chase Cooling (left to right)



Al Fosco and Eric Thompson of Frigel (left to right)

Mokon was on hand to show its expanded IceMan LT Series of portable chillers, with LT standing for “low temperature.” The series now offers dual circuit capacities of 15 and 20 tons. It’s able to provide 300,200 BTU per hour at 20°F (-7°C) and 107,350 BTU per hour at -20°F (-29°C). The company offers both air-cooled and water-cooled options. Its unique design saves space and does away with the need for multiple electrical and mechanical connections. Most of the company’s orders are customized, with 90% of orders passing by the engineering team first to match process temperature control requirements, flow control requirement or other needs. “We don’t have a book,” said Key Account and Technical Sales Manager Scott Lombardo. “Everything’s its own unique animal.”

Process Cooling Systems stood out at NPE2024 not by wowing with new and improved hardware, but by selling its staff. No matter where in the U.S. a job is located, the company works exclusively with its own project management and installation crews, not third parties. Its employees are licensed in every state requiring a process piping license. While the company is listed as a manufacturer, it functions more as an engineering company, one devoted to never leaving customers unhappy.

Thermal Care was among the many talking low-GWP refrigerants at NPE2024. It reengineered its entire line in a major undertaking that took years, so now all chillers use R-454b or R-513a refrigerants. For plastics manufacturers, the company showed its new Mini-Aquatherm RMC Series of temperature control units for plastic molding. The device is roughly half the size of the company’s Aquatherm RQT Series, and heats or cools water from 40°F to 250°F (4°C to 121°C) and comes with 1/3 or 1/2-hp pumps. The company is positioning the Mini-Aquatherm

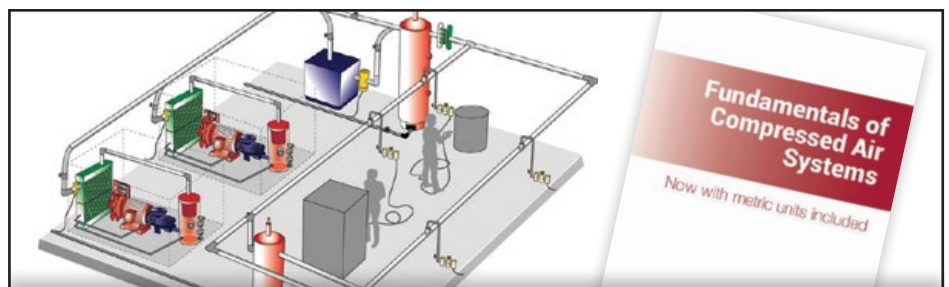
for small tonnage applications, below 100 tons. All equipment is constructed in the company’s 130,000-square-foot facility outside Chicago, Illinois.

### Industrial Vacuum Systems

Busch Vacuum Solutions was excited to bring its PLASTEX series of dry vacuum systems to the U.S. market. Developed in Europe, PLASTEX offers the plastics extrusion market, or anyone else degassing their product, a vacuum system that doesn’t require water, but instead uses oil injection for cleaning. The system’s pump and filtration elements are kept separate. The company notes that PLASTEX units typically use MINK claw vacuum pumps, which offer frequency-controlled motors and are energy efficient.

Conair was one of the few companies we saw discussing artificial intelligence. Its Conveying With Optimizer technology uses remote sensors to monitor conditions in plastic conveying, making adjustments automatically when needed. If a filter gets clogged or air leaks develop, the system adjusts on its own. Similarly, ResinWorks With Optimizer monitors how wet or dry materials are, saving energy by turning off heaters when they aren’t needed. “Taking the operator out of the equation, it’s doing all the adjustments,” said Stephen Szakelyhidi, Marketing Director.

Solberg Manufacturing made news at NPE2024 with its own line of vacuum system liquid/particulate separators, better known as knockout pots. With water conservation a



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## Air Compressor and Chiller Innovations at NPE2024



Dave Doucet, Ted Rudy, Shane Dandy and Derrek Davis of Process Cooling (left to right)



Peter Armbruster of Thermal Care



Mike Foster and Alex Hitsman of Busch Vacuum Solutions (left to right)



Andy Spicer of Solberg Manufacturing

necessity for many, these separators allow dry vacuum pumps to take the place of liquid rings. The company's dual-filter system uses baffles and filters to remove liquid and particulates. The TKO Series features 2 to 8-inch inlet connection sizes, with 4-inches being the strongest mover. Separators are sized by flow and pipe size. "The great thing is Solberg is making these canisters," said Andy Spicer, Regional Sales Manager. "We opened a fab shop

and are making these in three buildings in Itasca, Illinois." The plant employs 300 people, and new welders are always in demand.

The plastics industry will meet again in three years at NPE2027, again in Orlando, Florida. **BP**

To read similar articles on the **Plastics Industry** please visit <https://www.airbestpractices.com/industries/plastics>.



For expert presentations, visit our Webinar Archive Section dedicated to **Air Compressor Technology** at <https://www.airbestpractices.com/magazine/webinars>.

# Compressed Air Technology News

## Kaeser Enhances Oil-Free CSG Series

Kaeser's CSG boasts up to 16% more flow and as much as a 19% improvement in specific performance over the previous models, with a maximum operating pressure increased to 160 psig (11 bar). The CSG series is available in five fixed speed models from 50 to 125-horsepower (hp), delivering flows from 184 to 563 cfm as well as four frequency controlled (SFC) models with flows from 142 to 584 cfm. SFC models leverage the advantages of synchronous reluctance motors with class IE5 efficiency to ensure the highest levels of energy efficiency. On both fixed and variable speed units, a speed-controlled radial fan working in conjunction with the SIGMA CONTROL 2 regulates the fan speed, controlling the cooling air flow for additional energy savings.

The CSG series represents the latest generation of oil-free technology, combining Kaeser's industry leading SIGMA PROFILE rotor design with a new non-wearing coating that meets ISO 22000 requirements for superior peace of mind in food and beverage, pharmaceutical, chemical, laboratories and other applications requiring oil-free air.

"Kaeser has taken something great and made it better," said Joe D'Orazio, Kaeser's National Sales Manager. "At Kaeser, we value life-cycle cost and can't wait to share how the CSG.1 increases our customers' maintenance intervals and reduces their utility costs. From the automatic motor bearing lubrication, temperature and vibration monitoring to the new smaller footprint, our engineers painstakingly crafted the next generation of Kaeser oil-free compressors for the demands of 24/7 manufacturing."

"The patented triple-layer PEEK and nanoceramic coating represents a significant advancement in rotor coating for exceptional durability and long lasting performance," said Werner Rauer, Product Manager – Compressors.



*Kaeser announced the enhanced CSG series with up to 16% increase in flow and pressures to 160 psig (11 bar).*

"The food-safe coating represents a significant advancement in technology that will serve our customers well."

Other innovations include a superior water-jacket cooling design, more reliable condensate removal for better corrosion protection, automatic motor bearing regreasing, vibration monitoring and motor bearing temperature sensors. These and other features ensure top-notch reliability and reduced downtime for maintenance. Its improved service intervals also result in reduced maintenance costs. The new CSG models use 20% less floor space than the previous design, making it an ideal choice for businesses with limited space, providing users more flexibility in installation.

Kaeser's dedication to environmental stewardship is evident in the integration of innovative technology in the CSG series. The improved service intervals and reduced maintenance costs further underscore the company's commitment to delivering efficient and sustainable compressed air solutions.

### About Kaeser Compressors

*Kaeser Compressors is a leader in reliable, energy efficient compressed air equipment and system design. It offers a complete line of superior quality industrial air compressors as well as dryers, filters, SmartPipe™, master controls and other*

*system accessories. The company's 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>.*

## nano Introduces Oxygen Gas Generators

nano, a leader in innovative gas generation solutions, has announced the launch of its latest range of OGX oxygen gas generators. This new product line combines advanced technology with superior design to deliver unprecedented efficiency, reliability and sustainability for various industries including healthcare, manufacturing and environmental applications.

nano's new oxygen gas generators are designed to meet the growing demand for high-purity oxygen while emphasizing user convenience and operational efficiency. These generators use state-of-the-art Pressure Swing Adsorption (PSA) technology to ensure a consistent and reliable oxygen supply with purity levels up to 95%.



*nano has announced a new range of OGX oxygen gas generators.*

## Compressed Air Technology News

Key features and benefits include:

**High efficiency:** The advanced PSA technology optimizes oxygen production while minimizing energy consumption, offering significant cost savings over traditional methods.

**User-friendly interface:** The system's intuitive control panel makes it easy for users to monitor and manage it, ensuring seamless operation.

**Compact and modular design:** The space-saving design allows easy integration into existing systems and can be scaled to meet varying demand requirements.

**Sustainable solution:** By producing oxygen on-site, nano's generators eliminate the need for oxygen cylinder deliveries, reducing carbon footprint and enhancing supply chain sustainability.

**Enhanced reliability:** Built with high-quality components, these generators are designed for continuous operation, ensuring a steady oxygen supply even in critical applications.

nano's oxygen gas generators are ideal for a wide range of applications:

- **Manufacturing:** Supporting processes that require high-purity oxygen, such as welding, cutting and combustion.
- **Environmental:** Assisting in water treatment and waste management by supplying oxygen for biological processes.
- **Veterinary/laboratory:** For respiratory support and scientific research applications.
- **Pharmaceuticals:** Used in sterilization processes and support for bioreactors.

### About nano

*nano is a pioneering company in gas generation technology dedicated to delivering high-quality, efficient and sustainable solutions. With a focus on innovation and customer satisfaction, nano continues to lead the industry, setting new standards for performance and reliability. For more information, visit <https://www.nano-purification.com>.*

### ELGi Launches EQ Series in North America

ELGi Compressors USA has introduced the EQ Series, a new range of oil-lubricated, direct drive rotary screw air compressors. They're designed to provide superior performance and reliability to small and medium-sized operations that traditionally use belt-driven air compressors.

In line with ELGi's customer-centric approach, the EQ "ELGi Quest" Series is built for customers requiring reliable compressed air at improved flows at the right value. The EQ Series oil-lubricated, direct drive rotary screw air compressor is available from 25 to 30-horsepower (hp) with both fixed and variable speed drive configurations.

About the EQ Series of oil-lubricated, direct-drive rotary screw air compressors:

- Designed as an oil-lubricated, direct-driven air compressor available in multiple capacities from 25 to 30-hp
- Available with fixed or variable speed drives for all units in the series
- Equipped with a reliable TEFC motor
- Available in 100, 125, 150 and 175 psi (7, 9, 10 and 12 bar) discharge pressures
- Designed for operating in ambient temperatures of 122°F (50°C), ensuring superior cooling, reliability and durability

- Equipped with pre-filter enclosure cooling air inlets
- Long service interval of 4,000 hours (intake filter, oil, oil filter, air/oil separator element)
- Best in class warranty: six years on airend, five years on other main components, three years on VFD and one year on entire package
- Available as base-mounted, tank-mounted (120 or 200 gallons) or tank-mounted with dryer and filters for an easy-to-install complete air system

"Our new EQ line of air compressors is perfect for small and medium-sized operations that require a high degree of reliability for their equipment," said Robert Horneman, Product Manager, ELGi USA. "ELGi has always been known for leading the market from a reliability and warranty standpoint, and the EQ air compressors are no different. The direct-driven airend provides years of trouble-free service, and the optional variable speed drive delivers superior energy savings for applications with variable demand. Team that up with one of the country's most extensive service networks and our 48-hour uptime guarantee, and you have



The EQ "ELGi Quest" Series delivers reliability and performance gains to the 25 to 30-hp segment.

little risk of your operation shutting down due to compressed air failures.”

#### About ELGi North America

ELGi North America, headquartered in Charlotte, North Carolina, is a subsidiary of ELGi Equipments Limited, a leader in compressed air solutions for over 60 years. Established in 2012, ELGi North America, with its subsidiaries, Pattons, Pattons Medical and Michigan Air Solutions, offers a comprehensive range of compressed air products and services. Its product offering includes oil-lubricated and oil-free rotary screw and reciprocating air compressors, dryers, filters and ancillary accessories. For further information, please visit <https://www.elgi.com/us>.

#### INMATEC Offers Efficient Duo for Nitrogen Generation

With the ingenious combination of a nitrogen generator and hydrogen converter, INMATEC now offers an efficient duo for nitrogen generation. Users are able to save money on the investment as well as during operation.

Maximum-purity nitrogen is required as process and inert gas not only in the chemical industry, but also in other sectors such as food and beverages. Companies then have the choice whether to procure the gas from third parties or to generate it themselves. The benefits of generating it independently are obvious: the quantity, purity and pressure can be easily controlled and perfectly adapted to requirements. This also avoids costs for delivery and storage, and the gas is available when needed. Purity is monitored continuously – another advantage of onsite generation.

Combining a modified PN nitrogen generator (PNK) and an H<sub>2</sub>KAT hydrogen converter, INMATEC, which is part of the BOGE Group, offers a highly efficient and effective system for the independent generation of maximum-purity

nitrogen (0.001% O<sub>2</sub> [degree of purity 5.0]). A portfolio with suitable compressors and treatment components is available for the required compressed air.

The compressed air is filtered and dried before the nitrogen is separated from the ambient air using Pressure-Swing-Adsorption (PSA) technology and a high-quality carbon molecular sieve. The generated nitrogen, which has a purity of 0.1% O<sub>2</sub> (degree of purity 3.0), is first stored in a buffer receiver, then

enriched with tiny quantities of hydrogen in the H<sub>2</sub>KAT. Residual oxygen molecules are removed from the nitrogen and bound with hydrogen to produce water vapor. The nitrogen then has a purity of 0.001% O<sub>2</sub> (degree of purity 5.0).

The H<sub>2</sub>KAT is available in eight versions with free air delivery of up to 300 Nm<sup>3</sup>/h. To match these, there are eight PNK models with their technology being perfectly adapted to the relevant H<sub>2</sub>KAT.

The advantage of this two-stage process for nitrogen generation is a significant reduction in compressed air consumption by about 40 to 50% compared with the traditional generation of nitrogen with a purity of 0.001% O<sub>2</sub> (degree of purity 5.0). The generator has been designed for a fixed purity of 0.01% O<sub>2</sub> (degree of purity 3.0). The required quantity of compressed air can therefore be reduced by almost half. This has an impact on investment costs because compressed air stations, treatment components and the generator can be much smaller. By reducing the quantity of compressed air provided, energy costs can also be saved as well as CO<sub>2</sub> emissions lowered.



Combining a modified PN nitrogen generator and an H<sub>2</sub>KAT hydrogen converter, INMATEC offers a highly efficient and effective system for the independent generation of maximum-purity nitrogen.

Another advantage: Customers will receive the entire system consisting of compressor, compressed air treatment, nitrogen generator and hydrogen converter from one source. Thanks to the combination of INMATEC technology and BOGE compressors, customers are provided with a reliable complete system that guarantees a continuous and particularly efficient nitrogen supply.

#### About INMATEC

With its systems for the onsite generation of gases, INMATEC GaseTechnologie GmbH & Co.KG is a global market leader. The company has its headquarters in Herrsching and has been developing, manufacturing and delivering nitrogen and oxygen generators to the whole world since being established in 1993. Since August 2023, Inmatec has been part of the BOGE Group and can, in addition to its own team, fall back on BOGE's international sales and service organization. For more information, visit <https://www.inmatec.de>.

#### About BOGE Compressors

BOGE America is the USA based America's subsidiary of BOGE KOMPRESSOREN Otto Boge GmbH & Co. KG based in Bielefeld, Germany. Whether for centrifugal compressors, screw compressors, high-pressure piston compressors, scroll compressors, controls, air treatment equipment, complete systems or individual devices, BOGE meets the most diverse requirements and highest standards – in a precise and customer oriented manner. Compressed air systems are designed, sold and serviced through a dedicated network of over 50 distributors in North, Central and South America. For more information, visit <https://www.boge.com>.

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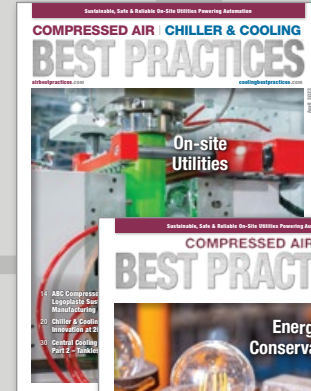
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A Publication of **Smith Onandia Communications LLC**  
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# "Crazy" Systems & Maintenance

Edited by Troy Dreier, Senior Editor, Compressed Air Best Practices<sup>®</sup> Magazine



Manufacturing plants perform admirably under "crazy" profit expectations to remain viable. Plants often experience "crazy" staffing and operational budget reductions. Our editorial staff salutes our subscribers who keep on-site utilities up and running reliably every day, with fewer resources at hand. These subscribers requested we publish some observed "crazy" system designs and maintenance practices, present due to budget reductions in plants. Our goal is to raise awareness, provide a learning opportunity and encourage increased investments in staffing and systems.

## Build Solid Compressed Air Pipe Support From the Ground Up

Eduardo Lopez is an engineer with Baja Design Engineering in Mexicali, Baja California, Mexico. Visit <https://bdefp.com>.

A client asked Lopez's team to lower compressed air pipes when there were no means to support them. The pipes simply dropped down in the middle of the air compressor room. To add a little stability, the team connected the pipes with a Unistrut channel.

An arrangement like this one raises safety issues. Something could easily hit and bend the pipes. Also, excess pressure could cause the pipes to move and even disconnect from their hose.

A better option, Lopez notes, is to install drops along walls or columns. If the room has a concrete floor, the company could also build a support mechanism from the floor up, then attach the Unistrut to it.



*To bring compressed air where it was needed, one plant operator dropped pipes in the middle of a room, with no fixed support.*

## Never Skip Proper Condensate Management

Dan Smayda is the owner of Advance Air Compressor in Oldsmar, Florida. Visit <https://advanceaircomp.com>.

Smayda found the oily discharge shown here at a Florida company that creates medical devices. The company has a 200-horsepower air compressor, a 1,060 gallon wet storage tank, proper filtration, and multiple drains, but no oil/water separator.

"Do you think this is a condensation issue? Do you think this company needs a condensate oil/water separator for its air compressor?" Smayda asks. "Check out the door with the mud on the bottom of it. Water shoots all the way to the bottom. Now, the door is rusted shut."

This is a good example of poor condensate management. Compressed air condensate should be channeled to an oil/water separator, then to proper water drainage points.



*The force of this oily discharge was great enough to rust shut the door on the opposite building.*



## Submission Guidelines

We invite our subscribers to send their observed "Crazy" Systems & Maintenance experiences to Troy Dreier at [troy@airbestpractices.com](mailto:troy@airbestpractices.com). Please send a high-resolution picture as a JPG or GIF file and a note describing the installation, what was wrong and what the solution should be. We will edit the text and remove equipment brand names and references from all materials. If we publish your submission, we'll thank you with a \$25 Amazon gift card.

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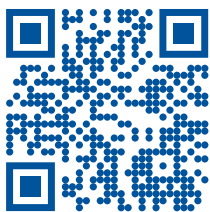
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