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EVERY ISSUE

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FROM THE EDITOR

Kaishan USA was established, in 2019, with a $20 million investment. I was able to visit their 65,000 square-foot plant, in Loxley, Alabama, and Mike Grennier penned our lead article titled, "Kaishan USA – All In with Global Manufacturing and Engineering Center."

I did not know Carrier invented the centrifugal chiller in 1922. I hope you'll find the article commemorating the centennial of this invention interesting. Thanks go to Carrier's Tom Franaszek, "Making the Modern World Possible: The Centrifugal Chiller Turns 100."

The electrification of heating may be one of the profound changes we experience in the future. Danfoss is leading the way for those investing in decarbonization goals. We thank Jose Alvares for his article, "Heat Recovery in Chillers and Their Link to Decarbonization Goals."

The Centrifugal Compressor Section of the Compressed Air and Gas Institute (CAGI) has sent us an excellent article titled, "Lubricants for Centrifugal Air Compressors." This piece does an excellent job dispelling the myth that all lubricant is the same regardless of formulation.

A highlight for me this Issue was getting to know expert chilled water system auditor, Clayton Penhallegon, Jr., from Integrated Services Group. We were connected together by a subscriber, from a major carpet manufacturer, who has long valued his work. Enjoy his article titled, "Plastics Processor Saves Big on Chilled Water Energy and Maintenance."

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

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COMPRESSED AIR TECHNOLOGY & INDUSTRY NEWS

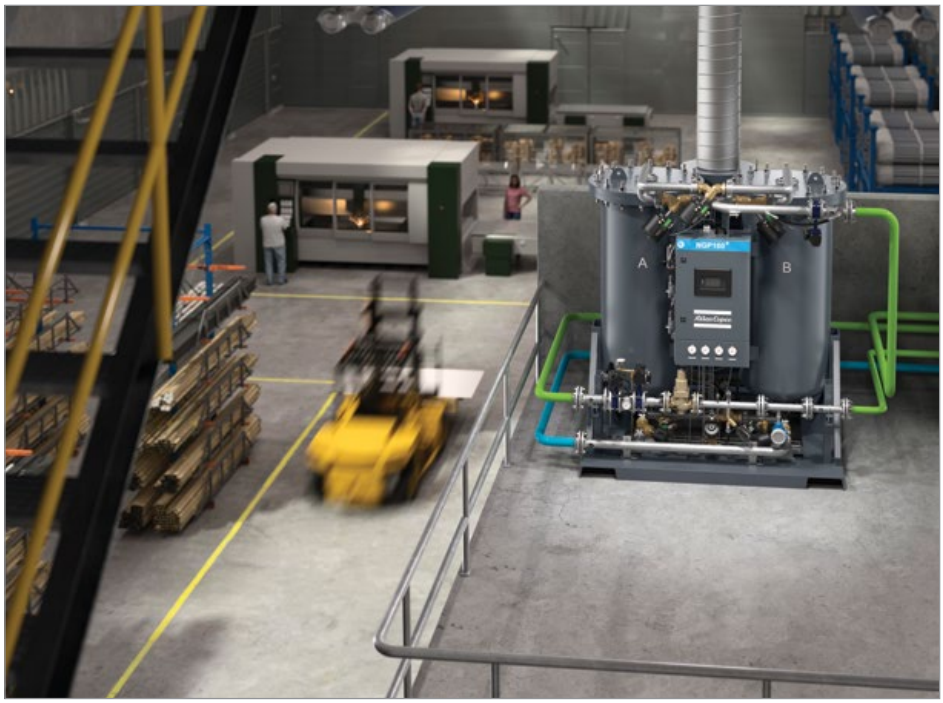
Atlas Copco Expands PSA Nitrogen Generation Offer

Atlas Copco's NGP+ nitrogen generator range is getting bigger and even better. Building on the success of its premium PSA nitrogen solution, Atlas Copco is introducing two new models to its NGP+ line-up. Along with launching the NGP 160+ and NGP 200+, Atlas Copco has also added advanced features to the entire midsize NGP+ range to give customers more flexibility, reliability, and low cost of ownership.

The NGP+ is Atlas Copco's premium Pressure Swing Adsorption (PSA) nitrogen generation solution. Offering a guaranteed gas purity from 95% to 99.9995%, it is available in flow sizes up to 4,802 SCFM (for a single unit). Over the years, the NGP+ has built a reputation of superior performance and low cost of ownership. Its expanded and enhanced midsize range (27–482 SCFM) continues this tradition with even more customer flexibility and reliability.

With floor space being such a scarce commodity in many production facilities the option of covered outdoor installation an important one for many of our customers. The low ambient temperature setting allows customers to install the NGP+ outside (in a covered area) in temperatures down to -10°C/14°F.

Today's midsize NGP+ models feature the state-of-the-art Elektronikon® Touch controller with easy gas purity selection and advanced connectivity options. The Elektronikon Touch optimizes the NGP+'s performance and continuously measures gas purity to protect customers' production. It also monitors the feed air to safeguard the integrity of the adsorbent.



Atlas Copco's Premium NGP+ range introduces new midsize models and advanced features.

Other newly available options include a room oxygen alarm and the ability to produce ultra-dry nitrogen.

What has not changed is the NGP+'s industry-leading low total cost of ownership. The generator and its software are designed to utilize the premium Carbon Molecular Sieve adsorbent with maximum efficiency to ensure minimal air consumption per unit of nitrogen generated. In addition, the NGP+ comes with a number of unique features, such as the Variable Cycle Saver algorithm. VCS optimizes the PSA cycle during lower demand and in colder temperatures, giving customers up to 40% additional energy savings. The stand-by mode also avoids energy waste.

"For customers who need high-quality nitrogen, there is no better solution than the NGP+," said Ben Christianen, Product Manager Industrial Gases with Atlas Copco's Industrial Air Division. "It offers a guaranteed nitrogen purity at the lowest energy cost and with superior reliability and flexibility. It's a true best-in-class product."

About Atlas Copco Compressors

Atlas Copco Compressors LLC is part of the Compressor Technique Business Area, headquartered in Rock Hill, South Carolina. Atlas Copco Compressors provides innovative solutions, including world-class compressors, air blowers, industrial coolers, vacuum pumps, quality air products, and gas generation systems, all backed with full service, remote monitoring, and auditing services. With a nationwide service and distribution network, Atlas Copco Compressors is your local, national, and global partner for all your compressed air needs. Learn more at www.atlascopco.com/air-usa.

Sullair Announces Climate Change Action Strategy

Sullair, a Hitachi Group Company, announced its long-term climate action strategy and goal to globally reach carbon neutrality. It will be achieved by undertaking capital expenditure projects to further facilitate CO_2 reduction, transitioning to 100% renewable electricity through a voluntary green power program, and implementing a voluntary carbon offset program.

Compressed Air Technology & Industry News

The Sullair Michigan City campus achieved carbon neutral status in fiscal 2021 ahead of plan.

This strategy comes in line with Hitachi, Ltd.'s long-term environmental targets, titled "Hitachi Environmental Innovation 2050." The Hitachi Group has set a target of becoming carbon neutral in all its global factories and offices by fiscal 2030 and achieving carbon neutrality throughout its entire value chain by fiscal 2050. The Sullair Michigan City campus achieved carbon neutral status in fiscal 2021 (ending March 31, 2022) ahead of plan, and the rest of its global operations aim to achieve carbon neutrality by the end of fiscal 2022 (March 31, 2023).

"Sustainability is both at the core of our strategy and a driver of our business," said John Randall, president and CEO of Sullair. "Customers and businesses are increasingly making a conscious effort to buy products and services that help promote sustainability, assist the environment, and reduce the impact of climate change. By establishing this long-term climate roadmap and taking immediate action, we aim to fully play our part in the fight against climate change."

The company's long-term climate action strategy includes three focus areas:

1. Undertaking capital expenditure projects over the next 12 months to facilitate CO_2 reduction including:
   - Upgrade nearly 1,100 fluorescent lights in its Michigan City, Ind. factories to high-efficiency LED lighting, reducing its annual CO_2 by 350 tons.
   - Upgrade its nearly 40-year-old HVAC equipment to a variable refrigerant flow (VRF) HVAC system, reducing CO_2 by 605 tons each year.

- Install 80 pace node devices throughout its Michigan City campus to monitor energy usage on each piece of equipment.
- In its global facilities, install a variable speed drive compressor to power its China manufacturing facility, along with installing solar panels and upgrading air conditioning units.
- In Australia, transition its service fleet to hybrid vehicles and, later, fully electric vehicles.

2. Transitioning to 100% renewable electricity by joining a voluntary green power program to run a portion of its Michigan City campus which purchases Renewable Energy Credits (RECs) on the company's behalf and allows Sullair to designate a portion of its monthly electric usage to come from power generated by renewable energy sources, such as wind power.

3. Implementing a voluntary carbon offset program allowing Sullair to offset CO_2 emissions while developing and implementing future additional measures for fossil fuel use reduction over the next 4 years.

Voluntary Carbon Offset Program

As part of its long-term climate action strategy, Sullair has launched a voluntary carbon offset program in conjunction with World Kinect Energy Services, the sustainability division of World Fuel Services Corporation. Sullair has committed to voluntarily offset at least 28,000 $mtCO_2e$ through 2025. This is the equivalent of 69,501,756 miles driven by an average gasoline-powered passenger car or the amount of carbon sequestered in 189 acres of forests per year. This initiative allows Sullair to act immediately and further demonstrates its commitment to addressing climate change.

A carbon offset represents one ton of greenhouse gas emissions that has been avoided or reduced in the atmosphere. Purchasing carbon offsets allows companies to compensate for their residual carbon footprint by supporting projects worldwide that reduce carbon emissions. Carbon credits purchased by Sullair will help with the Guanaré Forest Plantations on Degraded Grasslands Under Extensive Grazing project. The land targeted by this project is under extensive grazing by beef cattle ranching, and the project will reforest 21,298 hectares in the eastern part of Uruguay, creating new job opportunities and reducing CO_2 by 127,000 tons per year.

Through World Kinect, Sullair is investing in high-quality, trusted carbon offsets that have been independently verified and meet the highest international standards such as the Gold Standard or the Verified Carbon Standard (VCS).

"Each company has a unique approach to sustainability, and we applaud Sullair for its thoughtful approach and leadership," said Michael Kasbar, chairman and chief executive officer of World Fuel Services Corporation.

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"Our experts at World Kinect developed a tailored carbon offset solution that enables Sullair to make immediate progress towards their long-term sustainability goals."

About Sullair

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

Air Compressor Solutions Expands to New Mexico

Air Compressor Solutions, West Texas' top provider of heavy-duty air compressors, portable generators, and light towers, has expanded to New Mexico and opened a new location in Albuquerque at 6721 Edith Blvd NE, just five miles north of downtown.

To celebrate the grand opening, Air Compressor Solutions – in partnership with the Greater Albuquerque Chamber of Commerce and the Albuquerque Hispano Chamber of Commerce – hosted a ribbon-cutting ceremony and open house celebration on April 19, where representatives from the City of Albuquerque, Chambers of Commerce, media members, employees, and more enjoyed refreshments and tours of the new space.

Air Compressor Solutions' new 2,500-square-foot Albuquerque location offers equipment rentals, sales, parts, and service to keep commercial and industrial businesses running strong and powered up, including:

- Rentals – air compressors, generators, light towers, air hoses, and more
- Sales – natural gas & diesel generators, portable light towers, and portable, reciprocating, and rotary screw air compressors
- Parts – inventory of over two million essential parts to maintain air compressors, including oil filters, lubricants, hoses, belts, intake vents, and more
- Service – equipment repair, preventative maintenance, air pipe installation, and more

Air Compressor Solutions' new Albuquerque location is open-to-the-public from 7:30 a.m.-5:30 p.m. Monday through Friday, for individuals looking to rent equipment for home improvement projects, such as pressure washing, spray painting, landscaping, sanding, and more.

Also, as one of the region's only distributors of Ingersoll-Rand and Doosan Portable Power equipment, Air Compressor Solutions employs factory-trained, certified technicians ensuring best-in-class quality and maintenance. In 2021, Air Compressor Solutions was honored with the "Top Distributor" award by the Association of Ingersoll Rand Distributors.

Founded in 1984 in Odessa, Texas, Air Compressor Solutions has grown to become the top equipment solutions company in the compressed air industry, with over $30 million in annual sales across four locations in Odessa, Amarillo, El Paso, and now Albuquerque. Its diverse customer base includes businesses in

Air Compressor Solutions' new 2,500-square-foot Albuquerque location offers equipment rentals, sales, parts, and service.

industries such as heavy commercial, oil & gas, manufacturing, automobile & tire, agricultural, greeneries, farming & food processing, military, concrete, construction, drilling and more.

"Establishing a full-service office in Albuquerque has always been in our long-term growth plan, as we have dozens of existing New Mexico-based customers who rely on us for their compressed air, generator, light tower, and air tool needs," said Brian Stubbs, president and owner of Air Compressor Solutions. "We look forward to becoming an integral part of the Albuquerque community, creating new job opportunities, and helping keep local industrial and commercial businesses powered up and operating at maximum capacity and productivity."

About Air Compressor Solutions

Founded in 1984 in Odessa, Texas, Air Compressor Solutions has grown to become the top equipment solutions company in the compressed air industry, offering rentals, sales, parts, and service of heavy-duty air compressors, portable generators, and light towers. With locations in Odessa, Amarillo, El Paso, and Albuquerque, Air Compressor Solutions is known for keeping industrial businesses running strong and powered up. For more information, visit Air Compressor Solutions online at https://acsir.com/.

Sauer Compressors Appoints Dirk Slottke to Management Board

Dirk Slottke has become part of the management team of the Kiel-based compressor manufacturer. Slottke takes over responsibility for the sales section and succeeds Harald Schulz, who is retiring after 37 years of meritorious service and almost 20 years on the management board.

The new management of Sauer Compressors thus consists of Hendrik Murmann as Chief Executive Officer (CEO), Franck Lallart as Chief Operating Officer (COO), Thomas Heumesser as Chief Technical Officer (CTO) and Dirk Slottke as Chief Sales Officer (CSO). Dirk Slottke is responsible for the departments of business

Compressed Air Technology & Industry News

development, marketing, product management, after sales and service, and leads the sales of all companies within the worldwide Sauer Compressors Group. The graduate industrial engineer has been with the company since 2005 and most recently successfully served as director of marketing & sales.

Dirk Slottke was appointed to the management board of Sauer Compressors and is responsible for the sales section.

About Sauer Compressors

Sauer Compressors is a medium-sized German group of companies with 14 international subsidiaries. The company looks back on more than 135 years of history and over 85 years of experience in compressed air and gas technology. These days, the focus is on the development, manufacture and sale of oil-lubricated and oil-free medium- and high-pressure compressors for applications in commercial shipping, industry, petro industry and the defense sector. The four product lines SAUER, HAUG, GIRODIN and EK focus on specific fields of application. The SAUER line comprises oil-lubricated high-pressure compressors for a wide variety of applications, while HAUG stands for oil-free and hermetically gas-tight compressors. The GIRODIN and EK lines offer special compressors for the naval market. The modern reciprocating compressors for compressing air as well as a variety of gases reach pressures of 20 to 500 bar.g. In addition to standard products, customized solutions are offered for every type of application for individual customers, OEMs and globally active companies. With a worldwide network of representatives and partners, Sauer is always close to its customers. By supplementing the compressor range with high-quality accessories, engineering services, assembly and service concepts, Sauer provides complete system solutions right up to complete turnkey installations. Further information can be found at https://www.sauercompressors.com.

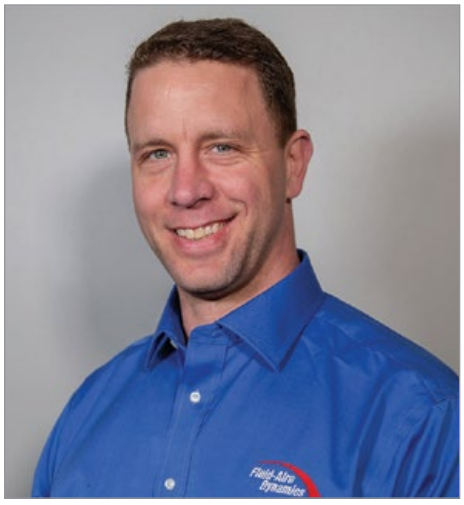
Fluid-Aire Dynamics Welcomes New Sales Director

Fluid-Aire Dynamics, a leader in the compressed air industry, is pleased to welcome a new sales powerhouse to their team. Jeremy Gaitsch has been named National Sales Director. In this newly created role, he will lead a team of Sales Engineers and Business Development specialists and oversee the company's growth strategy in their primary markets of Chicago, Milwaukee, Minneapolis and Detroit.

Fluid-Aire Dynamics specializes in design, sales, installation, maintenance, repair and parts for rotary screw air compressors, serving manufacturers and other industrial compressed air users in their core markets. Named to the Inc. 5000 Fastest Growing Companies for four years in a row, the company is currently opening a new service facility near Detroit in Wixom, Michigan. They are also moving forward with growth in other parts of the Midwest. The new role of National Sales

Director was created to help them meet their growth targets and expand into new market areas. Kevin Taylor, co-owner and Director of Fluid-Aire Dynamics, says, "We're excited to welcome an industry veteran and proven sales performer to our team. With Jeremy's leadership and experience, Fluid-Aire Dynamics is poised for another year of 30% growth."

Gaitsch has been in the compressed air industry since discharging from the Marines in 2004. Starting at a local distributor Cochrane Compressor of Chicago, he began his career as a service technician before moving into inside sales, then outside sales and eventually managing the business. After leaving Cochrane, he worked in a holdings company, managing industrial sales and e-commerce in North America. He identified companies for joint ventures and worked on acquisitions overseas. This experience enabled him to understand retail markets and vertical integration through four company-owned factories. Most recently, he was with Atlas Copco, where he led the specialty rental operation and managed sales and operations for a seven-state region.



Jeremy Gaitsch, National Sales Director, Fluid-Aire Dynamics

"There are not many jobs in this field I haven't done; I enjoyed learning the different facets of the industry very much. Closing a deal and watching a team grow are where my work passions lie," said Gaitsch.

Kevin Taylor and co-owners (and brothers) Brad and Derrick Taylor are pleased to welcome Gaitsch into a prominent role in the business, which has been owned and managed by the Taylor family since 1983. Brad Taylor, the Sales Engineering Manager, says, "Our growth over the last decades has been driven by our commitment to our customers and service excellence. Jeremy is the right person to help lead our next phase of growth as we expand into new markets and continue to build on our past successes."

About Fluid-Aire Dynamics

Fluid-Aire Dynamics is a leader in the industrial compressed air industry, specializing in design, sales, installation, maintenance, repair and parts for rotary screw air compressors. Founded in 1983 in Schaumburg, IL, by Garth Taylor, they remain family-owned and operated. They now serve manufacturers and industrial compressed air users in Chicago, Milwaukee, Minneapolis, San Antonio, Detroit and Northern Illinois/Southern Wisconsin. Over the last 30 years, they have built a large and loyal customer base thanks to outstanding customer support backed by their four-hour emergency response guarantee. For more information, visit www.fluidairedynamics.com.

Kaishan USA – All In with Global Manufacturing and Engineering Center

By Mike Grennier, Compressed Air Best Practices® Magazine

The Kaishan USA manufacturing and engineering center in Loxley, Alabama.

When deciding how best to deliver high-quality rotary screw air compressors and components to companies throughout the Americas and beyond, Kaishan decided to go all in.

And go all in it did with the creation of Kaishan USA, which today operates its global manufacturing and engineering center in Loxley, Alabama. The goal of the company, said compressed air industry veteran and Kaishan USA CEO Keith Schumacher, was to put the right pieces in place from the very beginning.

"To that end, we've invested $20 million in our facility and created a team allowing us to develop technologies and manufacture products not only for the Americas, but also for export globally," Schumacher said.

Operations in Full Swing

Opened in 2019, the 65,000-square-foot plant in Loxley serves as Kaishan USA headquarters, as well as its manufacturing operation and engineering and design center. The operation now in full swing boasts an experienced and skilled workforce dedicated to the design and complete manufacture, assembly, modification, and testing of single- and two-stage rotary screw air compressors from five to 500 horsepower.

Schumacher said Kaishan USA's goal is to do much more than ensure products get from Point A to Point B. Its commitment to designing, engineering, and manufacturing highly efficient air compressors is a prime example, he said.

"We spent $3 million alone in research and development within the first couple of years," Schumacher said, noting how forty percent

(40%) of salaried employees at the company work in engineering positions. What's more, he said, team leaders of every area of the company have a minimum of 25 years of experience in rotary screw air compressor manufacturing.

In addition to a heavy engineering focus and experienced leadership, Kaishan USA is fully committed to state-of-the-art manufacturing technologies and the implementation of streamlined processes to efficiently produce air compressors and components that exceed customers' expectations. The commitment is seen throughout all areas of the operation such as in the precision manufacturing of airends by highly skilled CNC machine operators.

"The investment in technology and equipment we've made to produce rotors (airends) is upwards of $8 million," Schumacher said.

State-of-the-art machining systems, such as a Kapp Niles rotor grinding machine, are used in the production of precision components including the air compressor rotors. A flexible machining center with an automated pallet system allowing for operation 24 hours per day, seven days a week by one operator is also used. These precision components all pass under a Zeiss coordinate measuring machine, measuring the components for accuracy within .0012 mm. The entire facility itself is also air conditioned as an added measure of manufacturing excellence.

"When you're talking about the kind of tolerances involved, ambient temperature will have an effect on it," Schumacher said.

Equally crucial as R&D and manufacturing, Schumacher said, is the need to ensure products shipped meet stringent quality standards, which explains the company's significant investment in automated testing equipment. As an example, he points to technology used to measure tolerances of rotors to within eight microns.

"The measuring capability of the technology is one-50th of the thickness of a piece of paper," he said. In addition to extensive internal testing

The Kaishan USA engineering team reviews the latest design of an oil-free rotary screw air compressor airend.

Kaishan USA – All In with Global Manufacturing and Engineering Center

and quality control measures, he said the company also participates in the Compressed Air & Gas Institute's Performance Verification Program. The long-standing CAGI program validates manufacturers' claims of rotary air compressor performance. Every machine is tested prior to shipment to ensure they comply to the stated CAGI performance sheet.

Seamless and Efficient Online Experience

Kaishan USA also places significant emphasis on creating a seamless experience for those who quote, purchase, install, and maintain its air compressors and components that make up a complete solution.

As an example, Kaishan USA Customer Experience Manager Henry Phillips references the company's online system featuring a host of tools designed to make doing business easy and efficient. The system allows users to select a product based on specific requirements and determine whether the product is in stock, as well as its purchase price and delivery date. Users can also easily track shipments and be automatically notified in advance of any delays, eliminating guesswork, Phillips said.

"Even though these purchases are typically large capital investments, we still provide an experience that is as close as possible to that of any leading e-commerce company," Phillips said. "When you make it easy for distributors, they can confidently say, 'I'll buy the product from Kaishan USA because they'll deliver.' "

The system also tracks every nuance associated with an order, such as the pressure requirements for a given application and the air compressor settings to meet it.

"We want to know exact pressure requirements because we're going to make sure that modulation valve is set just perfectly. We'll then test it at that pressure before it's shipped," Phillips said. "We capture all data like that and put into to a 'digital birth certificate' to

Kaishan USA engineers check bearing journals on a coordinate measuring machine.

track the critical information about our units, including service history and fluid samples, in case it's ever needed in the field."

Maintaining and servicing equipment long after the sale is also a major advantage of the system, as is the team effort behind customer support, Phillips said.

"The system provides visibility into all of our equipment in the field. It really makes aftermarket administration extremely efficient," he said, noting the value of starting a company with a fresh perspective. "We decided early on we wanted an operation that would be lean and mean."

A Kaishan USA KRSP-75 fixed-speed air compressor in the process of assembly.

Kaishan USA – All In with Global Manufacturing and Engineering Center

Focused on Customer Satisfaction

A number of other initiatives also contribute to a high level of customer satisfaction.

Among them is Kaishan USA's commitment to the availability of all products – even if the product isn't a top seller, Schumacher said.

"We have over $7.5 million worth of products in our inventory," he said. "This includes not only our finished units, but all of the aftermarket components as well. Honestly, we know some of the products might not be needed anytime soon, but we still have them in stock."

Schumacher said the company's manufacturing processes are 85% vertically integrated, which contributes to readily available products in addition to manufacturing agility and quality assurances. He said an emphasis on vertical integration, combined with advanced manufacturing capabilities, also elevates the breadth of unique products available. It includes the production of airends unique to each single-stage air compressor.

Adding to customer satisfaction is Kaishan USA's philosophy of employee engagement at every level of the company, Schumacher said.

"We want to make sure we're creating a good working environment and a motivated workforce," he said. "One of the things we do to be an employer of choice is to offer a gain-sharing program where 30% of company profits are shared with employees. Our belief is that the business will prosper if you reward people for doing the right thing as stakeholders."

The approach impacts everyday decisions in all areas, said Phillips, pointing to the on-time delivery of products as an example of numerous metrics closely tracked by team members since it impacts profitability.

"The team understands that going above and beyond to achieve delivery dates is what it takes to win over customers," he said. "That's something that happens everywhere whether it's manufacturing, quality control and testing, shipping, or aftermarket support."

Both Schumacher and Phillips said the gain-sharing program is one of many examples of how Kaishan USA's goal is to attract and retain quality employees. Those interested in joining the company are invited to learn more at https://kaishanusa.com/careers/.

Helping Those Most in Need

But for Kaishan USA, being a people-focused company extends beyond its operation. This core belief drives a passion for giving back to the community, which is seen in its partnership with the Gary Sinise Foundation, whose mission is to serve the nation by honoring its defenders, veterans, first responders, their families and those most in need.

A topline corporate sponsor, Kaishan USA supports the foundation's R.I.S.E. program, which enables the country's most severely wounded heroes to receive 100% mortgage-free, specifically adapted smart homes. Support for the program also extends to the foundation's Relief & Resiliency program, which aims to ensure defenders and their families stay strong through hardships by offering complete support in times of need.

In addition to its role as a major sponsor, Kaishan USA has recently introduced a program that gives distributor partners ample opportunity to contribute to the foundation. For more, visit http://kaishancares.com

"We are an American manufacturer with military veterans comprising more than 20% of our staff," Schumacher said. "All of us are very proud to support this important organization."

Doors Continue to Open

Proud also defines how Schumacher feels about the progress Kaishan USA has made in the relatively short time since it formally started business as a U.S. manufacturer.

Since 2018, sales at the company have grown 100 percent year over year with significant gains in market share. Schumacher said things have changed considerably since the early goings when the leadership team sat on folding chairs in a small facility to map out the company's future.

"We're getting a lot of knocks on our door these days," he said. "That's a lot different than the days when we did most of the knocking." BP

For more information about Kaishan USA, visit https://kaishanusa.com/

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Making the Modern World Possible: The Centrifugal Chiller Turns 100

By Tom Franaszek, Global Product Management Director, Water-Cooled Chillers, Carrier

In June 1920, Willis Haviland Carrier prepared a memo that described a novel machine and refrigerant that might significantly advance the art and science of air conditioning.

Already celebrated for his 1911 "Rational Psychrometric Formulae," Carrier imagined a "centrifugal chiller" and new refrigerant that would not only enhance process cooling in factories around the world, but reliably and affordably deliver "comfort air" to the public in theaters, stores, restaurants, sports venues, ships, hospitals and office buildings.

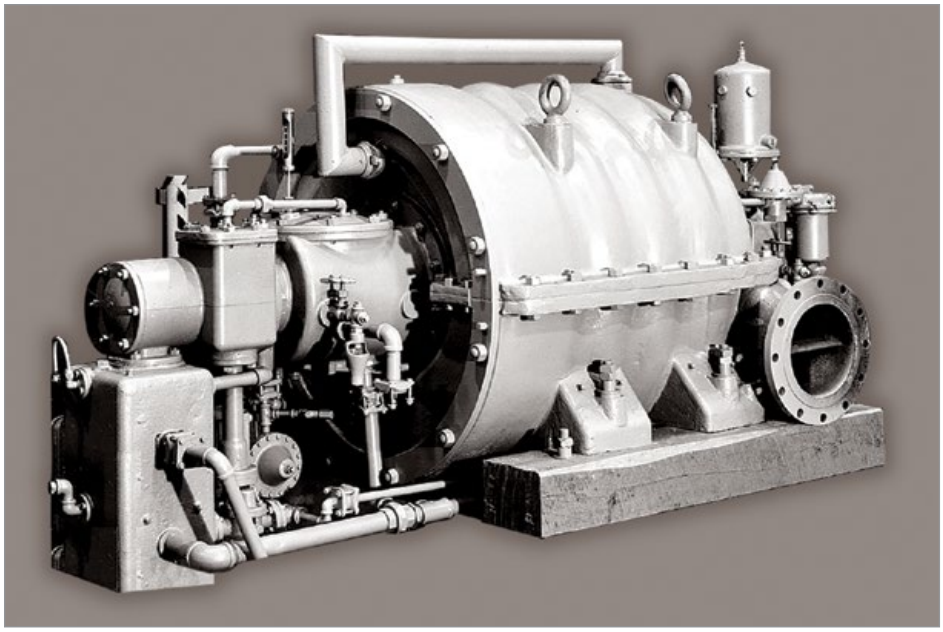
Unveiled in 1922, the centrifugal chiller would become the first significant advance since the invention of modern air conditioning in 1902. Now celebrating its 100th anniversary, Carrier's breakthrough invention introduced a grateful world to comfort air while writing a new chapter in the effectiveness of process cooling, making the modern world possible.

From Process to Comfort

Carrier's first customer, the Stephen F. Whitman & Sons Candy Company in Philadelphia, installed three centrifugal chillers in 1923 for its chocolate factory. The following year, the Onondaga Pottery Company in Syracuse, New York, installed Carrier's original prototype machine. Forty years later, this iconic chiller would be added to the permanent collections of the Smithsonian Institution in Washington, D.C.

In 1924, Carrier realized his dream of true comfort cooling when the owners of Detroit's J.L. Hudson Department store added centrifugal chillers. Once installed, people no longer fainted from the heat during the store's popular basement bargain sales. A few years later, R.H. Macy placed a humorous ad forbidding its customers to remain overnight in the store, even if it meant a comfortable night's sleep in Carrier's modern air conditioning.

Carrier dazzled the sporting world when his centrifugal chiller froze the ice at Madison Square Garden for the opening game of the 1925 professional hockey season. Later that year on Memorial Day, moviegoers were delighted to find comfort air cooling New York's



The first Carrier Centrifugal Chiller – 1922. Photo courtesy of Carrier.

Rivoli Theater, a combination of hot weather and Hollywood that would one day result in the summer blockbuster.

Comfort air arrived in the office In 1926 when the T.W. Patterson Building in Fresno, California, installed a centrifugal chilling system throughout six of its floors. Eighteen months later, the 21-story Milam Building in San Antonio, Texas, became the first high-rise office building to have central air conditioning installed during construction.

Carrier's remarkable innovation soon became a global phenomenon, providing process cooling to rayon manufacturers in India and cracker factories in Mexico, and comfort air to Buenos Aires apartments, Egypt's Hall of Parliament, and Oslo, Norway's City Hall.

By the end of 1940, after thousands of guests experienced air conditioning for the first time in Carrier's famous igloo at the 1939/40 New York World's Fair, the company had sold its 1,000th centrifugal chiller. By 1980, that total had soared to 40,000 – and was climbing rapidly. Today, centrifugal chilling is a multi- billion dollar global industry and still growing.

Willis Haviland Carrier in 1915. Photo Courtesy of Carrier.

Making the Modern World Possible: The Centrifugal Chiller Turns 100

Photo Courtesy of Carrier.

In so many ways, the history of air conditioning is a history of Carrier, with the centrifugal chiller at its heart, making the world we live in today possible.

The New York Times dubbed the 1970 U.S. Census "The Air-Conditioned Census," noting that the humble air conditioner had made it possible for Americans to live and work year-round in the semitropical heat of Florida and Texas. "By the end of the decade," one historian noted, America's "'sunbelt era was in full swing." Likewise, centrifugal chilling had helped to create a global sunbelt, making life more comfortable and productive from the arid lands of the Middle East to the tropical urban centers of Asia.

In the last century, few venues have been untouched by Carrier's centrifugal chiller, from skyscrapers to apartment buildings, hotels to hospitals, airports and cruise lines to subway stations, and sporting venues to museums. All have benefited from centrifugal chiller technology.

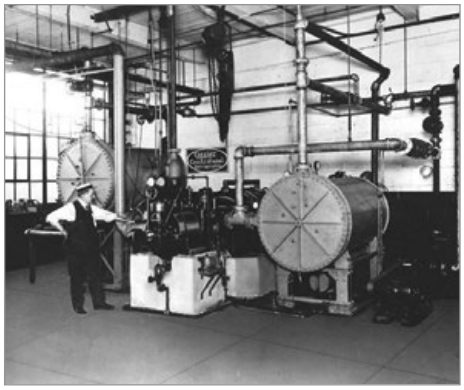


Photo Courtesy of Carrier.

By delivering precise temperature and humidity, centrifugal chillers have also made possible countless manufacturing processes which improve all facets of our lives, from medicines, automotive products, plastics, chemicals, textiles and mining applications, to many aspects of our modern digital age, including electronics, semiconductor chips and data centers.

In 1998, Willis Carrier was named one of the "100 most influential business geniuses of the century" by TIME magazine. The following year, U.S. News & World Report named Carrier one of 25 Americans who shaped the modern era and "the coolest American of the century."

Today, we celebrate the Father of Air Conditioning and the 100th anniversary of his centrifugal chiller, the man and machine that made the modern world possible. BP

For more information about the history of Carrier and the impact of centrifugal chilling on today's world, visit https://www.carrier.com/commercial/en/us/centrifugal-100

End Notes

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Heat Recovery in Chillers and Their Link to Decarbonization Goals

By Jose Alvares, Vice-President of Sales & Marketing, Danfoss Turbocor Compressors

Electric-operating heat pumps at the Ringsted District Heating facility in Denmark.

The electrification of heating presents a significant opportunity to achieve decarbonization goals by reducing or eliminating the use of fossil fuels in traditional building systems such as boilers. The current geopolitical scenario has caused commodity prices to quickly rise and forced businesses, cities and countries to rethink their future dependence on fossil fuels and accelerate the conversion to sustainable alternatives.

Most commercial and industrial facilities have separate cooling and heating systems. Chillers and heat pumps are electric-operated machines designed to transfer heat from one point to another. Chillers are used for cooling applications to remove the heat from a process (process cooling) or occupied space (comfort cooling) and usually reject the unwanted heat to the outside via an air-cooled condenser, cooling tower or fluid cooler, while heat pumps are used in heating applications to transfer heat from outside into occupied space or process.

Reversible heat pump systems, which combine cooling and heating in the same equipment, are commonly available in small systems such as residential or light commercial and their application is also climate-dependent (usually warmer or mild climates). Large commercial and industrial systems as well as smaller systems installed in colder climates usually rely on boilers to provide heating.

The Challenges of Implementation

Heat recovery consists of utilizing the unwanted heat from one system and applying it to another system. Combining cooling and heating systems together in one system is a clever approach to electrify and decarbonize the site, so the unwanted heat from the cooling system can be transferred to the heat system or vice-versa. It sounds simple in theory, but in practice it is more complicated.

It is important to first understand how the cooling and heating systems operate, including variation in load sizes, operating temperatures and operating hours during the year. In existing installations, the first step is to understand the design operating temperatures for both cooling and heating systems and evaluate if the temperature of the heat rejection of one system can meet the design operating temperature of the other system.

In general, boilers can generate very high hot water and steam temperatures that are difficult to achieve solely by utilizing the heat rejection of cooling systems. In newer systems, a detailed

evaluation of the operating temperatures of each system is strongly recommended during the design phase, so the difference between the design cooling and heating operating temperatures could be reduced without compromising each system and, consequently, increasing the possibility of transfer heat from one system to another.

Another key challenge is to match both cooling and heating loads during the same period, so the combined cooling-heating system can operate seamlessly. In most facilities, during the summer months, the demand for cooling will be higher than the demand for heating, and the opposite will occur during the winter months. Other facilities may have a very high demand of only one type of load, cooling or heating. Data centers, for example, have a high demand for cooling during the whole year and very limited need for heating during the same period. Most of the unwanted heat from the cooling systems in data centers cannot be used in the site and it is usually rejected to the atmosphere.

In most existing data center installations, finding a heating consumer close to the site to utilize the unwanted heat from the cooling system may be difficult or unfeasible depending on the required district heating or cooling infrastructure to transfer heat to the consumer. The latest trends in some European countries show that some data center facilities are now being installed close to high-demand heating consumers (residential, commercial or industrial), so the unwanted heat from their cooling systems can be economically transferred and utilized by those potential consumers.

In most of the United States, there is limited district heating and cooling infrastructure already installed which further reduces the feasibility of heat recovery solutions. The exceptions are some universities and colleges, where the district heating and cooling infrastructure is already available and heat recovery solutions should be evaluated and considered.

The Potential of Hybrid Solutions

Even though it is very difficult to completely match all the design requirements and synchronize the loads for both cooling and heating systems, there are several benefits of a hybrid solution approach where the heat recovery is implemented to partially address the need of the cooling and/or heating systems. Hybrid solutions can significantly improve the overall combined system performance and reduce both greenhouse gas (GHG) emissions and operating costs at a short implementation time.

In a hybrid solution, the heat rejection of the electric-operated cooling system could preheat the entering water in the boiler, and consequently, increase the efficiency of the boiler and the overall combined system efficiency. A reduction in fossil fuel consumption at the boiler will be realized since the amount of energy required to achieve the desired water or steam temperature is reduced due to the higher entering water temperature. The reduction of fossil fuel consumption will directly reduce the operating costs and, consequently, reduce the site's greenhouse gas (GHG) emissions.

A practical example of utilizing electric-operating heat pumps is the successful case of Ringsted District Heating in Denmark. The district heat plant was redesigned in a collaboration between Ringsted, Geoclima and Danfoss with a focus on high-efficiency electric heat pumps that utilized the innovative technology of highly efficient oil-free centrifugal Danfoss Turbocor® compressors. In this project, the unwanted heat that was originally rejected to the atmosphere was used to generate hot water and re-introduced into the district heating network. Three heat pumps with dedicated heat exchangers were designed to maximize the efficiency. The result of this innovative solution was a very high energy

The oil-free centrifugal Danfoss Turbocor® compressor.

Heat Recovery in Chillers and Their Link to Decarbonization Goals

A cut-away image of the oil-free centrifugal Danfoss Turbocor® compressor.

savings with an improvement in the overall heat plant coefficient of performance (COP) of up to +21% and a reduction of approximately 97% in the SO_2 emissions.[1]

Utilizing heat pump technologies in new building design and retrofits will go a long way toward achieving the site's decarbonization goals. In addition to reducing emissions, using electricity as a power source creates more energy-efficient cooling and heating systems, often resulting in significant savings for the facilities and increased comfort for its occupants. Further reduction in greenhouse gas (GHG) emissions can be achieved when the site utilizes renewable sources of electricity such as solar or wind. BP

About the Author

Jose Alvares is currently the vice president of sales and marketing for Danfoss Turbocor. He has an MBA degree with a focus on international business and strategic marketing from Mercer University (USA), an M.S. in industrial business from Londrina State University (Brazil), and a B.S. in mechanical engineering from Itajuba Federal University (Brazil). He has over 25 years of global experience in the HVAC-R industry and has held multiple positions in global sales, product management and marketing, application engineering, design engineering and R&D while living and working in the United States, Brazil and China.

About Danfoss

Danfoss engineers advanced technologies that enable us to build a better, smarter, and more efficient tomorrow. In the world's growing cities, we ensure the supply of fresh food and optimal comfort in our homes and offices, while meeting the need for energy-efficient infrastructure, connected systems, and integrated renewable energy. Our solutions are used in areas such as refrigeration, air conditioning, heating, motor control, and mobile machinery. Our innovative engineering dates back to 1933 and today Danfoss holds market-leading positions, employing more than 27,000 employees and serving customers in more than 100 countries. We are still privately held by the founding family. Read more about us at www.danfoss.com.

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Lubricants for Centrifugal Air Compressors

By the Compressed Air & Gas Institute

➤ One of the common misconceptions of people that own air compressors is that all lubricant is the same regardless of the formulation. Often facilities use whatever lubricant they have on hand to replace fluid that has an expired life. In this article we are going to investigate recommendations for lubricant typical for centrifugal compressors and how to tell if your lubricant is expired. The article will also cover lubricant sampling, testing and proper storage.

Centrifugal Air Compressors and Oil Systems

Centrifugal air compressors, also known as dynamic compressors, efficiently convert energy utilizing a series of stages to compress and cool the air as it continuously flows through the unit. A centrifugal compressor imparts kinetic energy into the airstream by increasing the velocity of the air using a rotating element and then converts this kinetic energy into potential energy in the form of pressure. In between each stage of compression, the air is cooled, and excess moisture is removed to further increase the efficiency and air quality. This design results in the ability to produce large quantities of air efficiently in a relatively small package.

A centrifugal compressor has a fairly simplistic lube oil system that supplies oil to the compressor and driver bearings as well as the gears and couplings. The lube oil is drawn from the reservoir by the pumps and is fed

under pressure through coolers and filters to the bearings. Upon leaving the bearings, the oil drains back to the reservoir. The reservoir is designed to permit circulation of its entire fluid volume between 8 to 12 times per hour. Oil reservoirs often have thermal sensors for monitoring temperature levels during start-up and constant operations. The main oil pump circulates the lubricant with an auxiliary pump acting as a stand-by.

The lubricant system in a centrifugal compressor is very unique in that at no time does the lubricant come in contact with the air-path. Instead the lubricant serves as a high-speed hydrodynamic gear lubricant. The system itself is very simplistic which often causes many operators to choose a standard hydrocarbon-based lubricant rather than a lubricant formulated for the specific conditions a centrifugal compressor operates under such a high-speed rotation and heat.

Choosing the best Lubricant for Your Centrifugal Compressor

The two main points for a lubricant in a centrifugal compressor is preventing varnish formation as well as preventing gear and bearing wear. Because friction causes more heat and demands more energy consumption to cool the unit sufficiently for safe operation, reducing friction means less power usage and lower energy costs.

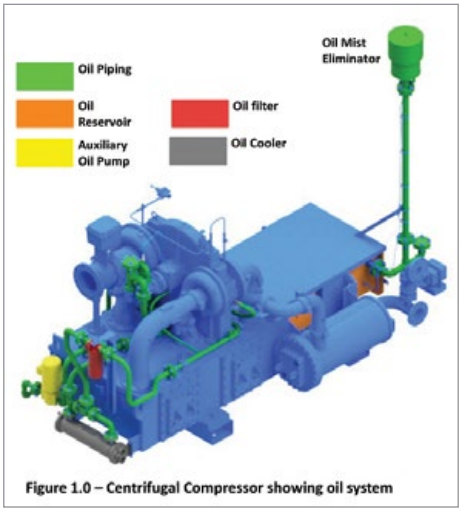

Figure 1.0 – Centrifugal Compressor showing oil system

Desirable Lubricant Properties

Lubricants used for centrifugal compressors will have the following chemical and physical properties which will maximize the life of the lubricant and improve the operation of the machine.

- Wear protection
- Low oil carryover
- Water separation
- Resistance to foaming and air entrapment
- Rust and corrosion protection
- High thermal and oxidative stability
- Varnish protection
- High Viscosity index (VI)

Because air compressors often are subject to extreme operating temperatures, a high VI is essential. The higher a lubricant's VI, the more stable its viscosity is over a wide range of temperatures. Oxidation happens in all lubricants which makes it detrimental to a compressor lubricant. Oxidation also promotes the formation of sludge and varnish that impede or even interrupt compressor operations, leading to more frequent maintenance.

Many air compressor applications, particularly those in humid environments, are prone to producing significant amounts of water via condensation. Good immiscibility, or water separation, makes water removal easier, reducing the risk of water-related problems.

Lubricants for Centrifugal Air Compressors

If the water and oil do not separate well, the water can:

- Reduce the lubricant's viscosity and load-carrying capabilities
- Increase oxidation, foaming and air entrainment, shortening the lubricant's service life
- Promote rust and corrosion of compressor parts, resulting in greater maintenance costs and downtime

Corrosion and rust damage components and may lead to failure. They also contaminate the lubricant and may promote faster oxidation, increased wear, sludge formation, filter blockage and other problems. Rust and corrosion inhibitors help protect the lubricant and the compressor components from these issues. Foaming, a persistent layer of bubbles on the surface of a lubricant, may promote excessive lubricant consumption.

One prominent issue is varnish on the surfaces of both axial and thrust bearings. This is most devastating in a compressor which has fixed tilt pad journal bearings like a centrifugal compressor. Centrifugal compressors have a clearance of about 0.001". If even 0.0002" (two-ten-thousandths) of an inch of varnish forms on this surface, it will change the rotor dynamics, resulting in an increase of vibrations. Ultimately, there is a thermal rise at the bearing, and babbitt on the bearings begins to deform. On a pinion/impeller assembly turning as much as 50,000 RPM, high vibration shutdown, failure, and a costly rebuild could follow.

Most centrifugal compressors operate well using a full-synthetic hydrocarbon-based turbine oil with an ISO viscosity grade of 32 or 46. These products exhibit good oxidative stability and prevention of acidity, sludge and varnish formation in stable environments with controlled temperatures.

Base Stocks

There are several base stocks that can be selected for use in centrifugal compressors. It is important to know the strengths and weakness of each base stock.

Synthetic Hydrocarbons (PAO's)

This is the most common type of lubricant used in industrial applications. Sometimes referred to as a synthetic lubricant, PAO's are engineered to be extremely stable and provide uniform flow at a wide temperature range. They also mix well with mineral oils and have a low volatility.

Polyol Esters (POE's)

These esters are formed by the process of esterification of a multifunctional alcohol with a carboxylic acid and therefore not derived from crude. Polyol esters offer outstanding thermal stability and have dispersant properties to keep parts clean. POE's mix easily with other additives and base stocks making them ideal for mixing or when replacing other lubricants.

Polyglycols (PAG's)

Polyglycols are the safest bet for keeping your compressor deposit-free and varnish-free.

The drawback to using PAG's is that they mix easily with water and often have a hard time separating out water. The increasing amount of water can harm bearings due to the heavier viscosity. Often an additive is mixed with the PAG's to allow them to separate out the water, however this breaks down over time. Finally, some PAG's do not mix well with PAO's if they are mistakenly added to a compressor when the other is in the reservoir.

Make sure when choosing your lubricant, you choose based on which will provide the most appropriate for your specific environment and compressor application.

Lubricant Sampling and Testing

Scheduled maintenance through fluid analysis is key to maintaining the health of your compressor. Lubricant sampling and testing should be part of every turbomachinery user's scheduled maintenance practices. A minimum of two samples each year should be collected, however each quarter is optimum. Your compressor manufacturer will recommend the best number of samples to collect. Over time, analyzing the lubricants used in your compressor provides valuable insight into the overall health of your machine, allowing proper preventive maintenance that leads to significant cost savings.

Where to take the Sample

Getting a representative sample of the lubricant in the compressor is key to having an accurate representation of the quality of the lubricant and what may be going on in the gearbox. Some centrifugal compressors come with a lubricant sampling port already installed. If your compressor does not have a sample port try and pick a location that will be representative. Samples should not be collected at the bottom of a lubricant reservoir as this lubricant will not be representative of what is flowing in the machine. Also, lubricant samples should not be collected downstream of the oil filter. This is because the filter will pull out wear particles that will be critical for health analysis.

Lubricants for Centrifugal Air Compressors

Laboratory Testing

Once your sample is collected, a laboratory should be chosen based on the certifications and qualifications they maintain. Many compressor manufacturers have a recommended lab that they use. The key is to make sure the same laboratory is used every time. This will assure the results will be trended properly and offer meaningful answers.

There are numerous laboratory tests that can be done to gauge the health of a centrifugal compressor, some more critical than others. The testing can also give an indication on how the compressor is being impacted by surrounding environmental conditions.

Wear Metals

The presence of wear metals could be indicative of shavings from mechanical components of the compressor package. Most centrifugal compressors are designed such that the rotating shafts operate on a lubricant film rather than contact with the bearings. Anti-wear additives in the lubricant coat the lubricated surfaces.

A number of conditions can cause wear of the components inside the air compressor. Certain conditions, such as low lubricant pressure, extreme lubricant temperatures, contaminants or overload can result in minor or significant wear. Rubbing between the parts creates friction, resulting in metal wear (scuffing and scoring). Metal particles, in addition to other contaminants in the lubricant, can cause progressively higher wear (abrasion or cutting) of the components inside the air compressor. The following are wear metals:

- Iron
- Chromium
- Nickel
- Aluminum
- Copper
- Lead
- Tin
- Cadmium
- Silver
- Vanadium

Additive and Contaminant Metals

In this section we will review additive metals (good) and contaminant metals (bad). Every lubricant has a different formulation so it is important to talk to your manufacturer of the compressor to know which ones have been added to their lubricant. These will often be found at higher quantities and should not be cause for concern unless the lubricant manufacturer has not used them as additives. Additives help to prevent things such as rust or oxidation.

Metals that are not wear or additives in the lubricant should be considered contaminant metals. Contaminants may migrate into the compressor lube system from a few sources. During shut down of the air compressor, airborne dirt may migrate into the lube system via the oil mist eliminator. Contaminants may also migrate into the lube system from the seal air system. During shutdown, the customer's air supply provides buffer air to the pinion seals inside the air compressor. Any contaminants in the customer's air supply may migrate past the seals and enter the lube system. During compressor operation, air pressure at the discharge of the compressor provides buffer air to the pinion seals. Any contaminants in the compressor discharge air may migrate past

the seals and enter the lube system. Possible contaminants in the compressor discharge air are: dirt that bypassed the inlet air filter; rust (iron or steel particles) from the air piping and intercooler shells; the coating from the intercooler shell; and aluminum from the intercooler fins.

Again, it is important to understand the formulation of your lubricant to know which are from additives and others that could be contaminants. These could be:

Silicon	Contaminant
Sodium	Contaminant
Potassium	Contaminant
Magnesium	Additive
Calcium	Additive
Barium	Additive
Phosphorus	Additive
Zinc	Additive
Boron	Additive

Water

Water can be another contaminant that can cause harm to a compressor. Atmospheric air naturally contains water. During an extended shutdown of the air compressor, atmospheric air will naturally seep into the air compressor via the oil mist eliminator or inlet air filter. Heating and cooling of the atmospheric air during the day can result in a slight build-up of condensate in the lubrication system. During compressor operation, any condensate in the oil likely will evaporate in a short period of time since the temperature of the oil in the oil reservoir is about 170˚F (77˚C). Therefore, no water content in the lubricant is expected unless the compressor has been shut down for a period of time or there is a water leak in the oil cooler.

Viscosity

Viscosity is critical to proper operation of the compressor to ensure that proper bearing film thickness is maintained. Not all oils respond in the same way to a given change in temperature. Many oils contain an ability to resist changes in viscosity due to a change in temperature. This property is referred to as the oil's viscosity index or VI. The higher the VI of an oil, the less its viscosity is altered by temperature changes.

Typically measured at 104˚F or 40˚C. Viscosity is measured and reported in centistokes (cSt). Every lubricant has a standard viscosity and can typically be found on the material safety data sheet (MSDS). The viscosity of a lubricant changes due to various environmental conditions. Increase in viscosity can indicate oxidation, over-heating, water contamination or the wrong lubricant. While the viscosity of the lubricant is typically reported at the standard method temperature as mentioned above, a truer representation of the current viscosity of the lubricant would be at the operating temperature inside the gearbox. Depending on the temperature, a laboratory could do this testing; however, it should be noted that the standard temperatures is what the method states to use and all labs use, so caution should be taken if comparing results.

Total Acid Number (TAN)

The chemicals and additives used in the lubricant are slightly acidic and contribute

Lubricants for Centrifugal Air Compressors

to the TAN (Total Acid Number) of the lubricant. Increases in the TAN from the base value usually indicate lubricant oxidation or corrosive acid contamination. A sudden increase in TAN can also indicate mechanical problems. TAN numbers above 1.0 should be considered a red flag. Trending is important when monitoring TAN numbers as it could give an indication of what is going on in the lubricant including oxidation.

Oxidation

Oxidation naturally occurs in all lubricants and is often the source of end of life for a lubricant. Lubricant oxidation is accelerated by heat and pressure in the compressor. Oxidation can be responsible for:

- Viscosity increase
- Varnish formation
- Sludge and sediment formation
- Additive depletion
- Base oil breakdown
- Loss in anti-foam properties
- Acid number increase
- Rust
- Corrosion

Oxidation rate of a lubricant will often dictate the life expectancy of a lubricant. It is often unclear how the life of a lubricant is determined by the manufacturer but it is most often done by estimating rate of oxidation. The rotating pressure vessel oxidation test (RPVOT) is often a way to predict performance and lifetime of a lubricant. RPVOT is often used as an analytical method to determine the long-term stability of a lubricant. The test mimics conditions a lubricant would expect to be exposed to in a compressor.

Particle Count (ISO 4406)

Particle count determines the degree of abrasive wear and whether the lubricant is clean enough for reliable operation. The most common method of reporting fluid cleanliness is the ISO standard 4406. In this standard, the number of particles in 1 ml of lubricant are counted and separated into three different size categories: >4 mm, >6 mm and >14 mm. ISO 4406 then categorizes the number of particles in each size and counted. This count in each of the three categories are then converted to an ISO code. Trending on particle counts can indicate an increasing risk of many of the above issues.

Choosing the Best

In order to make the most of the lubricant you choose for your centrifugal compressor, you should do your homework. Many compressor manufacturers will give you guidance on the right lubricant for your machine. Consistency is the key to a long-lasting lubricant:

- Consistently the same lubricant
- Consistent sampling at the same location
- Consistent bi-annual or quarterly samples
- Consistent usage of the same laboratory
- Consistent levels of the test results

The use of a good quality lubricant for your specific application and the routine testing of that lubricant is key to successful predictive maintenance of your centrifugal compressor. BP

CAGI Compressed Air & Gas Institute
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- Hanwha Power Systems
- Ingersoll Rand
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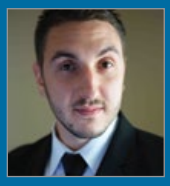

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MAY 19
ASME PTC 13 Wire-to-Air Performance Test Code for Blower Systems Part 1
Presenters Julie Gass, Lead Mechanical Process Engineer, Black & Veatch, Fred Constantino, S&C Project Engineering Advisor, ASME and Andrew Balberg, President, Lone Star Blower and Compressor – *Sponsored by Lone Star Blower & Compressor*
Thursday, May 19, 2022 – 2:00PM EST

JUN 09
Sizing and Maintaining Compressed Air Systems
Presenter Loran Circle, Senior Consultant, Circle Training & Consulting – *Sponsored by Kaishan*
Thursday, June 9, 2022 – 2:00PM EST

JUN 23
Compressed Air System Design for Lowest kW/100scfm
Presenter Tom Taranto, Owner, Data Power Services – *Sponsored by VPInstruments and BEKO Technologies*
Thursday, June 23, 2022 – 2:00PM EST

JUL 21
Applications for Adiabatic Cooling Technology
Presenter Bert J. Wesley, Sr. Principal Industrial Plant Engineering Practice Leader, Woodard & Curran – *Sponsored by Evapco*
Thursday, July 21, 2022 – 2:00PM EST

JUL 28
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Presenters Hiran de Mel, Senior Project Manager and Principal Technologist, Jacobs and Lloyd Slezak, Consulting Engineer (ret), Brown and Caldwell – *Sponsored by Howden*
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AUG 18
VFD Vacuum Pumps Do's and Don'ts
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AUG 25
Avoiding Production Downtime: Realtime Compressed Air Quality Monitoring and Audits
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OCT 20
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Presenter Nick McCall, P.E., Technical Manager, Woodard & Curran – *Sponsored by SPX Cooling Technologies, Inc.*
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Compressed Air: What You Don't Know Can Hurt You
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Presenters John Conover, Consultant, Mark Addison, Senior Engineer, Artesian Water Company, and Fred Constantino, S&C Project Engineering Advisor, ASME – *Sponsored by APG-Neuros*
Thursday, November 10, 2022 – 2:00PM EST

DEC 08
Compressed Air: Reliable Source for Nitrogen Generation
Presenter Loran Circle, Senior Consultant, Circle Training & Consulting – *Sponsored by Rogers Machinery and Parker*
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Plastics Processor Saves Big on Chilled Water Energy and Maintenance

By Clayton Penhallegon, Jr., P.E., Integrated Services Group

The new chilled water system equipment: free-cooling heat exchanger in foreground and two chillers in back.

➤ An Illinois protective packaging manufacturer was able to reduce their cooling costs by over 60% while also saving around $100,000 each year on system maintenance by replacing their old system with high-efficiency equipment and a streamlined hydronic design. Helped by ComEd efficiency incentives, the plant captured these benefits through an under 2.4 year payback system upgrade project.

In addition to the energy savings, the plant has improved their process stability and reliability while simultaneously greatly reducing their maintenance labor and their equipment capital replacement costs. This article will describe the changes made and highlight lessons learned from the project.

Initial Conditions

Like many plants, the manufacturer had a fragmented cooling system that had grown up over the years in steps as more cooling was needed for additional lines. Efforts to tie the four chillers and associated pumps into shared loops resulted in a hodgepodge of tanks, pumps, and chillers that were difficult to operate, maintain, and expand.

The system had a total chilled water (CHW) capacity of 210 tons from four air-cooled chillers with sixteen hermetic scroll compressors (four per chiller). Ten CHW pumps were installed along with three separate CHW tanks – a main collector tank and two hot well / cold well tanks. Four pumps ran when the chillers were on even when the plant load was zero, with resulting efficiency and maintenance impacts one would expect.

The chillers alone averaged over 1.0 kW per ton efficiency year round, with summer peak design efficiency nearer 1.2 kW per ton. The multiple pump loops resulted in pump power of nearly 0.5 kW per ton for the typical running loads such that the overall system efficiency was just under 1.5 kW per ton (note lower is better with kW per ton metrics).

In addition to the poor overall efficiency, the system was subject to variations in CHW supply temperatures and, even more inconsistent, significant swings in pressure to the floor depending on which lines were running and which pumps were on. To satisfy the process

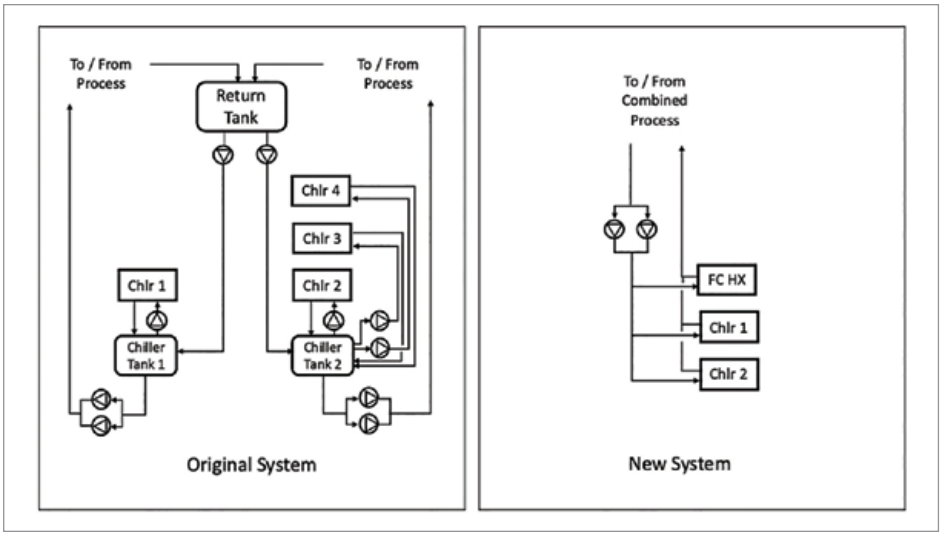
requirements, the system had to run with cooler water temperatures and higher pressures than would otherwise be necessary, contributing to the poor overall cooling efficiency.

There was also a small one-cell cooling tower system providing tower water (TW) cooling to process and machine loads not requiring CHW temperatures. This system, comprised of a 135 tower-ton cooling tower with 7.5 HP fan, a 10 HP tower recirc pump, and a 20 HP TW pump with a dedicated hot well / cold well tank, ran as constant speed, always-on equipment with the tower running to a single, year-round set point.

Making matters worse, the cooling system equipment itself was old and inefficient, prone to frequent failures, and costly to repair. Remote air-cooled refrigerant condensers were installed on the roof of the plant, leading to long refrigerant lines, frequent leaks, and difficult access for repairs. The multiple small scroll compressors were not designed for 24 hours / six days per week operation under real plant circumstances (e.g., refrigerant charge conditions, oil levels, power quality, etc.) so the plant was replacing three to four compressors every year.

Chilled Water System Evaluation

Integrated Services Group (ISG) was contracted to review the systems for potential efficiency and operational improvements. A detailed site study was conducted that catalogued the system equipment and design along with collecting extensive system operating data. This included one minute interval trends of key operating data (e.g., loop flows, pressures, temperatures) for 24 hour-plus periods on each subsystem and loop, and month-long amp logging to support an efficiency incentive application through the local power supplier.



A range of options for improvements emerged from the study, from modest changes like adding VFDs and making minor control changes to major renovation of the systems.

Due to the (unfortunately) very poor efficiency of the incumbent system, all the prospective approaches offered savings to the plant, many of which would meet the corporate threshold for funding (≈2.5 years simple payback or less). Fortunately, corporate management was willing to fund more extensive improvements if the cost could be justified through a combination of energy savings, efficiency rebates, and maintenance savings.

After evaluation and review with corporate management, the client decided to completely replace the existing air-cooled CHW system with a new water-cooled system that would also incorporate comprehensive efficiency and reliability measures beyond just the chiller changes.

Replacement System Design & Operation Features

Once the decision was made to install a completely new cooling system, detailed choices were needed for the specific design principles, component sizing and features, location in the plant, etc. The replacement system includes the following:

- Simplified CHW flow design utilizing single loop, variable flow with no tanks
- Two water-cooled, screw compressor industrial chillers each with dual compressors
- Seasonal tower water economizer "free cooling" plate heat exchanger
- A gear-drive, all stainless cooling tower sized for the free cooling requirements
- Redundant components (e.g. dual pumps) and other high reliability design features
- Automatic controls performing cooling mode transitions, efficient operation control, fault handling, normal lead / lag rotations, and historical data trending

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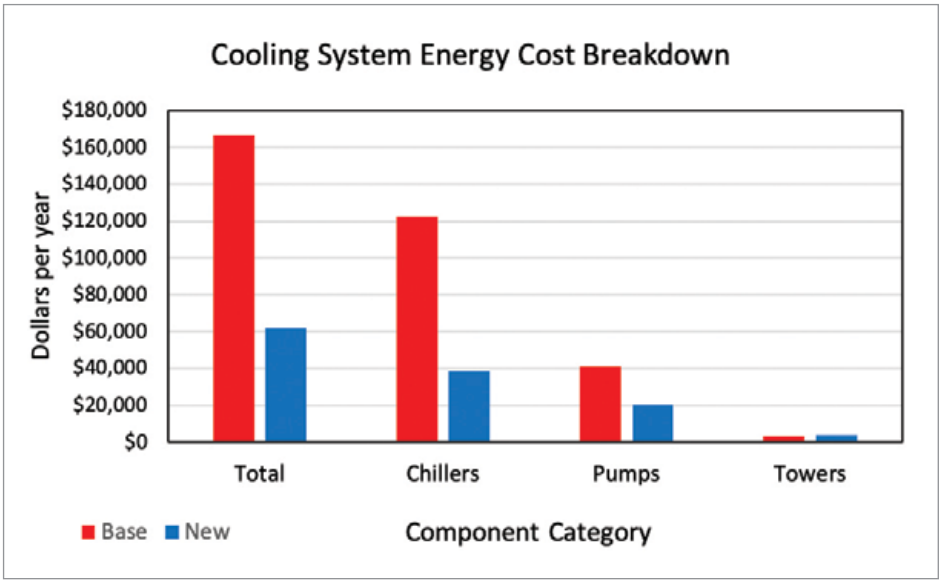
When considered as a whole, the cooling system upgrades can be viewed as three broad improvement strategies. First, there are piping design changes to eliminate excess & unproductive flows in the mechanical plant and improve the opportunity for efficient operation. Second, the cooling technology was changed to dramatically lower operating costs and maintenance requirements. Finally, the implementation details (e.g., equipment layout, component sizing & count, control functions) were tailored to maximize the effectiveness in the context of the particular plant. Each of these elements is discussed separately below.

Piping System Design Changes

The as-found system included multiple recirculation and balancing flow loops, in addition to split plant floor process cooling piping loops, and was difficult to operate and maintain (even more so to fully understand). Specific problems included:

- Sequential open tanks made level control challenging to avoid overflows or dry suctions
- Fixed chillers recirc loops required multiple small, relatively inefficient pumps to run
- High flow rates relative to designed flows made tanks function as blenders and aerators, with air venting and accelerated corrosion issues from air in the system
- Contaminants from an open, direct contact cooling operation were in the system
- In-tank blending of process and chiller return water and high recirc flow loops narrowed the effective chiller delta Ts and required lower than otherwise necessary CHW set points, both of which further reduced the chillers' efficiencies

ISG recommended changing to a single-loop, variable flow design that dramatically reduced the complexity of the flows and component count required while also needing less floor space. By combining the flows, fewer larger pumps could be used that also had notably higher efficiencies than the multiple small pumps originally used (eight pumps before, three after [including tower water pump] under normal conditions).



The design change eliminated fixed chiller recirc flow loops and allowed the chillers to see the full CHW return temperature from the process, thus not requiring artificial lowering of the CHW set point to achieve the desired process supply temperature. Conversion to a closed, pressurized suction CHW system eliminated the need for tanks as well as potential pump suction cavitation issues, and the direct contact cooling operation was isolated behind cleanable plate heat exchangers with dedicated VFD controlled loop pumps.

Note that caution was required to ensure the system included minimum flow applications. Furthermore, the newly installed chillers (discussed below) were equipped with on-board controls able to handle variable CHW flows as well as automatic isolation valves to disable their respective flows when not needed during light load conditions.

The overall impact of the system redesign on the pumping power has been dramatic. System pumping power has been reduced significantly, with the efficiency improving from nearly 0.5 kW per ton to under 0.2 kW per ton including the tower pumping.

The consolidated CHW process piping system further supported the implementation of differential pressure (DP) control which, with the improved temperature control, greatly improved the process cooling consistency. These combined benefits are harder to quantify than the energy savings but are actually more meaningful to the plant operations staff as it supports more

consistent quality and productivity from the production lines.

Cooling Technology Choices

The original system was characterized by standard cooling technology and system design concepts with scroll compressors operating in an air-cooled system defining the nominal best efficiency and the actual operating conditions making the realized efficiency even worse. The system had limited ability to leverage potentially beneficial outdoor conditions (i.e., better heat rejection conditions in cooler seasons). Brazed plate heat exchanger evaporators on the chillers offered good design heat transfer but were uncleanable. While reasonable technology for commercial air handler applications and very small industrial systems, the incumbent cooling technology made little sense in a year-round process cooling system.

The new system cooling sources consists of appropriate industrial grade equipment implemented in a manner designed to leverage the relatively consistent process cooling requirements and available seasonal conditions through the plant's high annual operating hours:

- Two dual screw compressor, water-cooled 110 ton chillers
- A 200 ton plate heat exchanger for seasonal free cooling
- A gear-drive, all stainless cooling tower rated at 300 tower tons for chiller cooling and 220 refrigerant tons for free cooling

Changing to water-cooled chillers required increasing the plant's cooling tower capacity.

Old chilled water system equipment after removal.

The existing system was appropriately sized for its specific process cooling function so a new tower was added for the condenser cooling and free cooling heat rejection. Having a separate unit also allows the new tower to run at the much cooler temperatures needed for free cooling while leaving the original tower cooling conditions undisturbed.

The northern Illinois climate combined with the 55°F CHW supply temperature mean that cooling can be provided through the free cooling (FC) system around 2500 – 2800 hours per year, depending on the actual loads at any given time and the wet bulb ambient condition. When in FC mode, only the tower fan and lead tower and CHW pumps are required (i.e., no mechanical refrigeration cooling). Not only is this highly efficient, it also significantly lowers the annual operating hours of the chillers which in turn reduces their maintenance requirements and extends their useful lives.

The two 110 ton chillers have modulating condenser flow valves controlled from their internal head pressure differential. This control has ensured smooth startups of the chillers with no issues from cold condenser water when starting from FC operation.

The chillers also have two compressors each, providing redundancy as each chiller can run with one compressor off or out of service and they were sized so that 3 of 4 compressors covers the peak loads. With compressor rotation by the chiller controls and the thousands of yearly hours the chillers don't run due to the FC, the compressors should be trouble free for many years.

The free cooling operation reduces the cooling portion of the kW per ton to around 0.125 including tower fans and pumping. The chillers cooling efficiency (not including tower or pumping) ranges from around 0.5 to 0.65 kW per ton, while the total chiller mode cooling efficiency averages ≈0.776 kW per ton, under 55% of the original air cooled system efficiency.

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When viewed as a whole, the total annual average system efficiency, including both chiller and FC cooling with all tower and pumping loads, is around 0.475 kW per ton, a stunning 36% of the initial system efficiency.

Implementation Decisions

Once the system design and cooling technology were determined, the implementation details had to be confirmed. Key goals were to minimize the transition impacts, facilitate the staff's ability to use the new system, and automate as much operation as could be reasonably accomplished to maximize the system's realized benefits. These were accomplished through multiple measures including the following:

- The new system equipment (with smaller footprint) was installed adjacent to the maintenance area while keeping the original systems operating
- Plant loop piping was revised on Sundays with interties and new supply / return connections installed to allow the new system to be tied in without disruption
- New system controls and pump and tower fan VFDs were networked to a control panel HMI by the system, reducing the operators' needs to walk to individual components
- The new controls provide critical functional capabilities streamlining the operators' work
  - Single switch Off / Circulate / Cool system control for complete system operation
  - Tower fan control for chiller and FC modes with set point reset based on wet bulb
  - Tower and CHW pump control by pressure inputs and respective algorithms
  - Cooling mode selection and chiller staging based on load and CHW temperatures
  - Lead / lag rotation and fault handling on redundant pumps and chillers
  - Enhanced sensor suite to facilitate remote system diagnosis and troubleshooting
  - Alarm console and data trending for system support and operations analysis
- HX flow separation, filtration and water treatment maintains the water conditions and system performance
- Oversized expansion tank sized for mold water loss make-up pressure swing considerations instead of conventional system water expansion design basis

As a result of the changes, the system operation manpower requirement has been reduced by over 80%. The system now requires less than a full man-day each week for start / stop operation and routine maintenance, down from requiring essentially one full time technician with periodic help. Contractor support requirements have been reduced by over 90% and are now largely scheduled maintenance.

New cooling tower and tower auxiliary equipment.

Non-Energy Project Benefits

The plant has realized dramatic energy and maintenance cost savings as described above. In addition to qualifying the plant for an efficiency rebate of nearly $85,000 the plant also realized the following broad scope benefits:

1. More stable cooling from improved CHW temperature stability and pressure control
2. Reduced process disruption from cooling component failures
3. Reduced routine maintenance needs from industrial design equipment selection and load calibrated operation by VFDs
4. Lower system management and diagnostic time with remote support assistance from ISG
5. Improved water quality from closed loop treatment and air elimination
6. Space savings from more compact systems in plant space.

Around a year after the new system began operation, the plant engineer was extremely complimentary, saying, "The system is working as designed without any issues – it has been a blessing." To ISG, this is the ultimate indicator of the project success. BP

For more information about Integrated Services Group visit https://www.isg-energy.com, email: info@isg-energy.com, tel: 770.823.8235

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CHILLER & COOLING SYSTEM TECHNOLOGY & INDUSTRY NEWS

CTI Announces Thermal Performance Certification for Dry Coolers

The Cooling Technology Institute is proud to announce the inclusion of dry fluid coolers as part of its existing Thermal Performance Certification Program based on CTI Standard 201. Both forced and induced draft dry coolers are covered by the Program, cooling either water or aqueous glycol solutions. By purchasing a CTI Certified model, an Owner / Operator has the assurance that the heat rejection device will perform thermally as specified.

Currently, there are 79 Manufacturers along with 17 private brand affiliates participating in the Thermal Certification Program from all regions of the globe with 192 certified open and closed-circuit cooling tower product lines available to the market, comprising a total of over 53,000 individual models. All Manufacturers who are interested in certifying their dry fluid cooler product lines are invited to do so by filling out the Thermal Certification Inquiry form that can be found at www.coolingtechnology.org/certification-information.

The deadline for applications for the initial round of dry cooler certification is April 29, 2022. Implementation of the certification program will begin effective June 30, 2022.

The current versions of STD 201 OM (Operations Manual) and STD 201 RS Dry (Ratings Standard) are available for a nominal charge on the CTI Marketplace, along with the companion Acceptance Test Code (ATC) 105 DS for dry coolers.

For more information, visit www.coolingtechnology.org

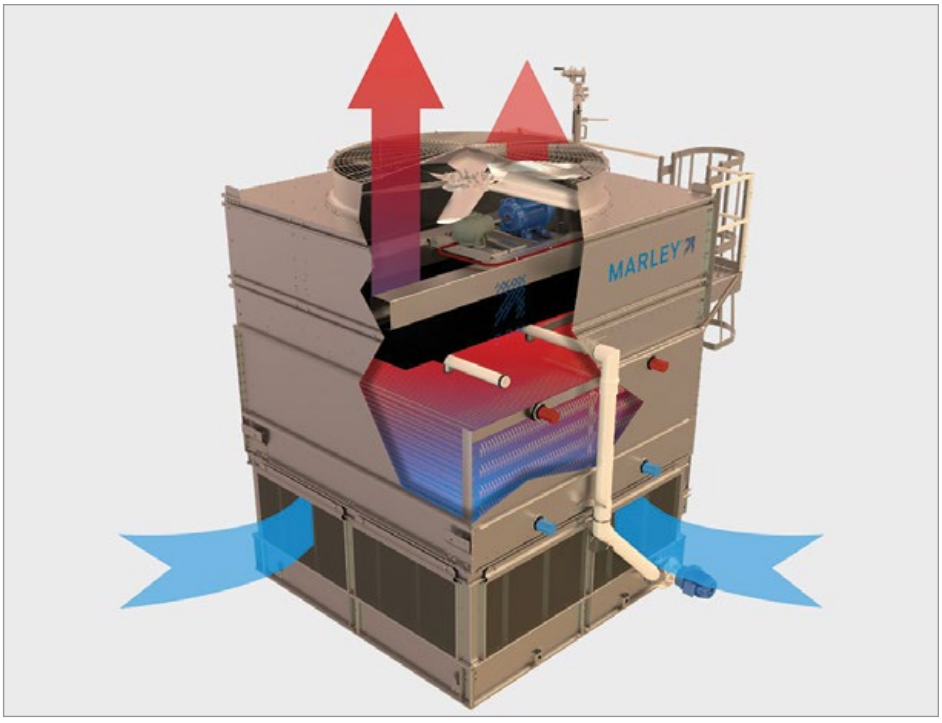
New Aero-X Coil Technology Enhances Marley DT Fluid Cooler

SPX Cooling Technologies, Inc., a full-line, full-service industry leader in the design and manufacture of evaporative cooling towers, fluid coolers and related equipment, has incorporated new proprietary Aero-X coil technology into its induced-draft, closed-circuit DT Fluid Coolers. The Aero-X tube profile maximizes thermal capacity per coil row thanks to the lowest air-side pressure drop (up to 10% more airflow at the same fan HP) and maximum heat transfer surface area.

Dry operation is extended for longer periods with switch point temperatures up to 10°F + higher than other similar closed-circuit cooling towers. Depending on climate, operators can gain up to 15-20% more incremental annual hours in dry mode, with 3,000 gallons/ton and $40/ton annual water savings per ton of cooling achievable in many areas. Optional finned coils further enhance dry operation capability at higher ambient temperatures.

Reduced fluid pressure drop, up to 30% lower than previous generation, positively impacts system operating cost by lowering pump energy demand. DT models are available in a wide range of sizes and layouts to meet specific requirements and offer options for reducing equipment size.

Standard equipment includes the low-maintenance Marley Geareducer gear drive,



The Marley DT Fluid Cooler with Aero-X coil technology.

clog-resistant water distribution system, triple-pass air inlet louvers to reduce splash out, and low-sound fan for quiet operation. Heavy-duty construction with galvanized and stainless-steel material options and five-year mechanical warranty ensure reliable cooling over a wide range of closed loop applications.

About SPX Cooling Technologies, Inc.

SPX Cooling Technologies, Inc. is a leading global manufacturer of cooling towers, evaporative fluid coolers, evaporative condensers, industrial evaporators and engineered air quality systems. Since 1922, the company's cooling and air handling systems, components, and technical services have supported applications in heating, ventilation and air conditioning (HVAC), refrigeration, and industrial process cooling. SPX Cooling Technologies and its product brands are part of SPX Corporation. For more information, visit www.spxcooling.com.

Danfoss North America Leadership Transition

John Galyen, president of Danfoss North America since 2011, has announced his retirement from Danfoss later this summer. Rick Sporrer, VP Sales America for Danfoss Power Solutions, has been appointed to succeed Galyen. Over the next several months, Galyen and Sporrer will work together to ensure a successful transition, with Sporrer fully assuming the role on July 1.

Galyen joined Danfoss in 2001 and held various management-level positions prior to his appointment to his current role. During his 21+ year career with Danfoss, he has been very instrumental in leading the company's continued regional growth in North America – from $100 million in annual sales to $3 billion – and made significant contributions to the success of the business.

With more than 40 years of overall industry experience, Galyen has been active in leadership capacities of various industry associations. In 2020, he was chairman of the Board of Directors of the Air Conditioning, Heating and Refrigeration Institute (AHRI) and he holds a seat on the Board of Governors at the National Electrical Manufacturers Association (NEMA). In addition, he has been an active thought leader and speaker on various influential panels addressing efficiency and sustainability topics.

"The past 21 years at Danfoss have been the most rewarding of my career," said Galyen. "I'm proud of the strides we have made in growing our business and footprint in North America, which is now Danfoss' largest region, and I'm especially proud of the industry leadership position we've taken – together with our customers – to meet the changing market requirements. Rick is well-positioned to help Danfoss North America continue its growth journey and innovation in sustainable solutions."

Sporrer brings more than 30 years of customer and regional expertise and leadership to his new role. Prior to his current role, he was director Global Sales – Motors Business Unit. His strong leadership of the sales workstream activities proved invaluable in preparing for Danfoss' successful merger with Eaton Hydraulics last year.

Rick Sporrer, VP Sales America, incoming Regional President, Danfoss North America.

"John has provided exceptional leadership to Danfoss North America for the past 15 years," said Sporrer. "I'm looking forward to working with our business units to continue our commitment to innovation and customer service as we engineer solutions for a more sustainable world."

About Danfoss

Danfoss engineers advanced technologies that enable us to build a better, smarter and more efficient tomorrow. In the world's growing cities, we ensure the supply of fresh food and optimal comfort in our homes and offices, while meeting the need for energy-efficient infrastructure, connected systems and integrated renewable energy. Our solutions are used in areas such as refrigeration, air conditioning, heating, motor control and mobile machinery. Our innovative engineering dates back to 1933 and today Danfoss holds market-leading positions, employing 37,000 and serving customers in more than 100 countries. We are privately held by the founding family. Read more about us at www.danfoss.com.

Chiller & Cooling System Technology & Industry News

Nidec/U.S. MOTORS New SynRA Motor

As energy costs climb, the need for the highest level of energy-efficient pumping equipment has never been more critical. Nidec Motor Corp. has responded to that demand by introducing SynRA, an innovative, patent-pending synchronous motor. When paired with the ID300 Perfectspeed integrated drive, the new motor offers one of the highest efficiencies available for today's industrial and commercial pumping and HVAC equipment – with ratings at IE 4 and IE 5.

Nidec U.S. MOTORS SynRA with Perfectspeed – Integrated Motor and Drive.

In addition to significant energy savings, this new technology from Nidec's U.S. MOTORS brand offers the advantage of easy motor replacement, without having to install an entirely new system and controls, saving time and money.

SynRA provides the operating benefit of a pure synchronous reluctance motor, and suitability benefit from a simple volts/hz drive. The unique design gives the freedom to replace components individually instead of the entire system, leading to a lower cost of maintenance. The product's Smart Technology results in less wear and tear on blower or pump systems by matching application demands with variable speed.

The design of the SynRA motor itself is made with ease in mind. The synchronous reluctance rotor with an aluminum cage design is magnet-free, allowing for easy programming and compatibility with existing Variable Frequency Drives (VFDs). The SynRA motor is also available already fully-integrated with Nidec's ID300 PerfectSpeed.

Applications include:

- Inverter Driven Variable Torque (VT) Loads (Pumps, Fans, Blowers, etc.)
- OEM Constant Pressure Booster Pump Systems
- OEM Variable Speed Hydronic Pump Systems
- Super Premium replacement VFD motors

About Nidec Motor Corporation

With headquarters in St. Louis, Mo., Nidec Motor Corporation (NMC) is the leading manufacturer of commercial, industrial, and appliance motors and controls. The NMC product line features a full line of high efficiency motors, large and small, that serve industrial, residential, and commercial markets in applications ranging from agriculture, water treatment, mining, oil and gas, and power generation to pool and spa motors, air conditioning condensers, rooftop cooling towers, and commercial refrigeration. NMC also makes motors, controls, and switches for automotive and commercial markets. For more information, visit www.acim.nidec.com/motors.

Johnson Controls Enhances YORK YVAA VSD Screw Chiller

Johnson Controls, the global leader for smart, healthy and sustainable buildings, has announced the latest evolution to the YORK YVAA Variable Speed Drive Screw Chiller for the entire global product line. The award-winning chiller now features increased operating efficiency, a reduced footprint and integration with low-GWP refrigerants.

The chiller also now offers more flexibility with expanded configuration options at each cooling capacity along with a reduction in sound levels.

Installed widely around the globe, the YORK YVAA Variable Speed Drive Screw Chiller features a patented, liquid-cooled variable speed drive that is designed to improve reliability and performance with a customizable, highly optimized design. The YVAA chiller is highlighted by advanced technologies including series flow evaporators, microchannel condenser coils and EC fans to create higher levels of full and part load efficiency.

The YORK YVAA Variable Speed Drive Screw Chiller from Johnson Controls.

With optional Quick Start technology and lower requirements for maintenance (with glycol replacement only required every five years), the YVAA air-cooled screw chiller offers solutions for mission critical applications in harsh environments.

About Johnson Controls

At Johnson Controls we transform the environments where people live, work, learn and play. As the global leader in smart, healthy and sustainable buildings, our mission is to reimagine the performance of buildings to serve people, places and the planet.

With a history of more than 135 years of innovation, Johnson Controls delivers the blueprint of the future for industries such as healthcare, schools, data centers, airports, stadiums, manufacturing and beyond through its comprehensive digital offering OpenBlue. With a global team of 100,000 experts in more than 150 countries, Johnson Controls offers the world's largest portfolio of building technology, software as well as service solutions with some of the most trusted names in the industry. For more information, visit www.johnsoncontrols.com.

Automated Logic Introduces OptiFlex Advanced VAV Controllers

To help facility professionals manage indoor air quality, workplace comfort, operational efficiencies, and meet their environmental, social, and governance goals, Automated Logic has added advanced variable air volume (VAV) controllers to its OptiFlex line of digital building controls. Automated Logic, a leading provider of innovative building management solutions, is a part of Carrier Global Corporation, the leading global provider of healthy, safe, sustainable and intelligent building and cold chain solutions.

The new OptiFlex VAV controllers, models OF342 and OF141, are ideal for zone-level temperature and air quality control applications. Designed to operate in a wide range of environmental conditions, the new controllers are ASHRAE Guideline 36 compliant with inherent algorithms that help reduce energy consumption and increase occupant comfort. To help maximize energy efficiency and performance, ASHRAE Guideline 36, High-Performance Sequences of Operation for HVAC Systems, includes uniform sequences of operation for HVAC systems, which help provide control stability and allow for real-time fault detection and diagnostics.

"These new OptiFlex controllers are well suited to satisfy the demands of variable air volume and temperature applications, giving customers peace of mind that their facilities will provide more comfortable and productive indoor environments," said Mead Rusert, President, Automated Logic.

The new OptiFlex VAV controllers are available in two models, OF342 and OF142, depending on your I/O needs.

The OptiFlex product line was built for connectivity. Multiple IP network topologies are supported including Daisy Chain, Ring, Home Run and Hybrid. Dual IP ports help ensure network redundancy using fail-safe and self-healing mechanisms. A simple software update will enable future communication protocols such as IPv6, BACnet Secure Connect and wireless, reinforcing Automated Logic's commitment to support the latest industry standards.

The new OptiFlex controllers have been tested and certified by BACnet Testing Laboratories (BTL). They meet the BACnet Advanced Application controllers (B-AAC) and BACnet Broadcast Management Device (B-BBMD) device profiles. They can be used on new projects and are also backwards compatible with legacy Automated Logic systems and its WebCTRL building automation system, making retrofits quick and easy.

About Automated Logic Corporation

Automated Logic Corporation provides innovative building-management solutions that maximize energy efficiency and sustainable building operation while ensuring comfort. Its intuitive products control and monitor building functions such as heating, air conditioning and lighting for commercial office, education, health care, government and data center markets through a global network of independent dealers and North American branch offices. Automated Logic is a part of Carrier Global Corporation, the leading global provider of healthy, safe, sustainable and intelligent building and cold chain solutions. For more information, visit www.automatedlogic.com.

Chiller & Cooling System Technology & Industry News

Thermalogic IoT Capable Controls and Transmitters

Thermalogic offers a multitude IoT capable temperature, humidity and other process controls, sensors and transmitters. Thermalogic's expertise can help you design a system to monitor and configure your device remotely, saving you overall time and labor.

Thermalogic offers IoT capable, internet-enabled temperature, humidity and other process controls, sensors and transmitters.

Communication options available with our controls, sensors and transmitters include Ethernet, WiFi, Bluetooth, USB, RS232, RS422, RS485, ModBus and many more.

Thermalogic specializes in built to order temperature, humidity and process controls and sensors for OEM's and Volume users. A plethora of inputs, outputs, power supplies and communication interfaces are available. Its sales engineers will work closely with you to design a device built to your application's exact specifications.

"When companies want something that is top notch, they come to Thermalogic," said Joe Grein, President of Thermalogic.

About Thermalogic

Since 1971, Thermalogic has provided design, engineering and manufacturing services of temperature controls and sensors for OEM and volume users. For more information, visit www.thermalogic.com.

Nostromo Partners with Smardt to Launch Energy Storage System

Nostromo Energy announced a technology collaboration with Smardt Chiller Group to introduce an energy storage system with the highest round trip efficiency (RTE) ever.

Nostromo developed a novel energy storage system based on the IceBrick, a modular, encapsulated ice cold-energy storage system featuring breakthrough engineering and materials and enabling rapid freezing at high temperature with unprecedented efficiency.

Smardt recently launched its High-lift Chiller, the newest model of the company's oil-free magnetic chiller line. Nostromo's IceBrick enables the ice-building charging unit to work at its highest available efficiency. (0.65 to 0.45 kW/RT).

In order to decarbonize buildings, we must embed safe and sustainable energy storage in the buildings themselves. Retrofitting the existing building stock will be the key to realizing this future. Nostromo IceBrick's compact size and modular design enables fitting the system into unused spaces or positioning it on the roof, parking lots, or any other commercially neglected spaces. Smardt's chillers have a compact design, so together the companies offer a solution that can be retrofitted into existing buildings.

"Combining the Nostromo system with the Smardt chiller will enable us to utilize the capabilities of our IceBrick to produce ice at unprecedented efficiencies," said Yaron Ben nun, Nostromo's Founder and CTO, "We

Nostromo and Smardt Lab in final stages of construction.

are aiming to achieve efficiency at ice-making mode which will be higher than the most customer's regular chiller efficiency for delivering thermal comfort. Cold energy storage is used to shift energy to provide relief to the grid at critical times of the day."

"Eventually, although we do have some losses through the full cycle, we still might show a total efficiency of 100%. This might become an important milestone in our quest to bring water to the heart of the discussion on the future of energy storage. We believe water must become a significant part of the energy storage landscape," said Yaron Ben nun.

The partnership involves the establishment of a state-of-the-art lab to develop operating protocols for both the Smardt chiller and Nostromo System to optimize the system's performance and to deliver the charging energy at the highest efficiency possible.

"We are excited about partnering with Smardt, as we share the passion for innovation and breaking new frontiers, together with a strong commitment to maximizing efficiencies and minimizing carbon emissions, for our customers and this planet," said Yoram Ashery, CEO, Nostromo.

About Nostromo Energy

Nostromo accelerates the renewable energy revolution, with its sustainable energy storage solution that enables commercial and industrial buildings to do their part in stopping climate change by becoming large-scale energy storage assets. Nostromo paves the way to a carbon free electric grid, while offering a safe, clean and financially beneficial system to building owners. Nostromo's revolutionary technology, the IceBrick, stores cold energy during off-peak or surplus solar hours and uses it to power commercial space cooling, which accounts for approximately 40% of power demand during peak hours. For more information, visit www.nostromo.energy.

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The Magazine for Safety, Quality & Reliability in Energy-Efficient Compressed Air Systems

Compressed Air Best Practices® is part of a family of magazines dedicated to **Safe, Quality and Reliable Systems Powering Automation.** The U.S. Department of Energy estimates compressed air represents 30% of industrial energy use. Each issue features expert articles on how to conduct **Best Practice System Assessments** to reduce energy consumption while enhancing **Quality, Safety and Reliability.**

"Some of our plants have created Air Strike Teams to focus on compressed air, particularly compressed air leaks. The teams have purchased ultrasonic leak detectors, and we expect these will help us with our Energy Treasure Hunts."

— Michael Jones, Director of Corporate Energy, Intertape Polymer Group

"We have had supply-side compressed air audits performed, within the last three years at around forty percent of our plants. Generally, we are looking for a ten to fifteen percent energy savings from most of the projects we identify and execute."

— Daniel K. Pemberton, Corporate Project Engineer, Berry Global

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