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May 2021

Food Packaging



FOOD & BEVERAGE PROCESSING
& PACKAGING MONTHLY FEATURE

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Leaves No Stone Unturned
with Compressed Air

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Compressed Air in Food Plants

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Maintenance

The Atlas Copco logo is positioned in the top right corner of the page. It consists of the brand name "Atlas Copco" in a white, serif font, centered between two horizontal white bars. The background of the entire page is a photograph of an industrial facility with large grey metal cabinets, blue protective sheeting, and various pipes and conduits. A large blue triangular graphic with white technical drawings is overlaid on the bottom right portion of the image.

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FROM THE EDITOR



Quality, Safety and Reliability

How does one achieve “oil-free” compressed air? How is that defined? David Swartz, from Sauer Compressors USA, has sent us a good fundamentals article reminding readers that air purification equipment is required, no matter what air compressor type is installed.

The Compressed Air & Gas Institute has sent us their second of two articles on reciprocating air compressor maintenance. This is a very practical article for all owners of this very common type of air compressor.

Microbiological testing in compressed air systems is still not widely understood within the compressed air industry. Industrial hygienists and other microbiology professionals, in the food industry, have historically provided clients with these testing services. One such individual is Charles Giambrone, from Rochester Midland Corporation, who has sent us an article titled, “Microbiological Testing Considerations for Compressed Air and High Risk Ambient Air Systems in Food Plants.”

Productivity, Sustainability & Energy Conservation

The monthly food industry feature article is on Wisconsin-based Schoeneck Containers. Our own Mike Grennier was able to interview SCI’s Facilities Engineering Manager, Bill Bushman, about the compressed air systems supporting the production of up to one million plastic containers per day. Thanks go to Zorn Compressor & Equipment for facilitating and participating in this article.

Did you know compressed air nozzles can impact worker safety, plant efficiency and production effectiveness? Jordan Shouse, from EXAIR, has provided a well-structured article outlining these three impacted areas within food industry blowoff applications such as cleaning, drying, cooling, conveying and overall processing.

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

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CORPORATE GHG-REDUCTION NEWS*

* Scope 1 and 2 GHG Emissions from Direct Operations

Titan Cement Group Accelerates Sustainability Efforts with Ambitious ESG Targets

Titan Cement Group (March 18, 2021) released its ESG targets for 2025 and beyond. “We are building on our strong track record on sustainability and aspire to increase our positive impact on people, society, and the environment. We are committing to ambitious targets that aim to generate more value for all our stakeholders and set the foundations for sustainable growth in a carbon-neutral and digitalized world”, said Leonidas Canellopoulos, Chief Sustainability Officer of TITAN Cement Group. Following are some highlights of the targets:

- **New CO₂ reduction target at -35% by 2030**, compared to 1990 levels, embracing the vision of the European Green Deal to achieve climate neutrality by 2050. Reduction of emissions across the supply chain by increasing the use of alternative fuels, accelerating efforts in energy efficiency, developing low-carbon products, and adopting innovative technologies and solutions.
- **Commitment to be among the global leaders in safety**, with zero fatalities and an employee LTIFR performance among the three best in the cement sector.
- **Emphasis on Diversity & Inclusion, employee training and wellbeing.** Further promotion of equal opportunities and increase of female participation in leadership. Upskilling and reskilling for all employees and implementation of wellbeing initiatives in all countries.
- **Increase of positive local impact with environmental, social**

and economic targets. Strong performance in air emissions. Quarry rehabilitation and diversity management plans. Community engagement plans aligned with stakeholder expectations and 2/3 of total spend directed to local suppliers and communities.

- **Integration of circular economy practices for a more sustainable supply chain**, ensuring that 70% of key suppliers meet TITAN ESG supplier standards. Emphasis on water conservation and recycling, energy efficiency, and diversion of waste from landfills.

All TITAN Cement Group ESG targets can be accessed at its website. <https://www.titan-cement.com/sustainability/our-approach/2025-targets/>

The J.R. Simplot Company Announces Sustainability Targets

The J.R. Simplot Company announced (October 29, 2020) a collection of global sustainability targets in four areas aimed at major reductions over a 10-year period. The Company’s global **4Sight 2030** goals are the latest effort in the global food and agriculture company’s ongoing commitment to environmental stewardship while planting seeds for the future.

Simplot’s **4Sight 2030** goals will:

1. Reduce energy use 15% per ton of product
2. Reduce freshwater intake 15% per ton of product
3. Achieve zero waste to landfill in our food processing plants, globally

4. Reduce carbon emissions 20% per ton of product through operational reductions and soil carbon sequestration, and invest in climate-smart innovations that will help farmers and ranchers adapt to climate change

“Sustainability is woven into the J.R. Simplot Company’s Purpose and Core Values and we view it as a vital responsibility across our Business Groups and international operations,” said Simplot President and CEO Garrett Lofto. “We believe that as a Company, and in our communities, our future relies on finding new, sustainable ways to produce more with less and doing it in ways that will meet the environmental and social needs of today and for generations to come.”

While Simplot employees have always focused on sustainability at their sites and in communities, this is the first time the Company has cultivated common sustainability goals across its global organization. The combined efforts will align those goals and the collective effort across the Company can have a tremendously positive impact.

“For Simplot, embracing our shared sustainability platform is to live our values with integrity; to put the data and numbers behind the work we do every day to be more efficient and support our communities,” said Brandy Wilson, Simplot’s Global Sustainability Director. “We want to create a better world tomorrow while driving toward smarter practices in the work we do today. These goals will help us contribute to feeding our world more sustainably.”

This work is not only aligned with Simplot’s core values and helping to build a more efficient, resilient business model, it’s

Tired of downtime and scrap as a result of poor compressed air quality?

Moisture is found in compressed air lines and exhausting from valves and actuators on equipment thereby reducing component life and machine efficiency. Tired of draining water and oil from your compressed air lines every spring? Tired of cleaning or replacing pneumatic components well before their lifespan?



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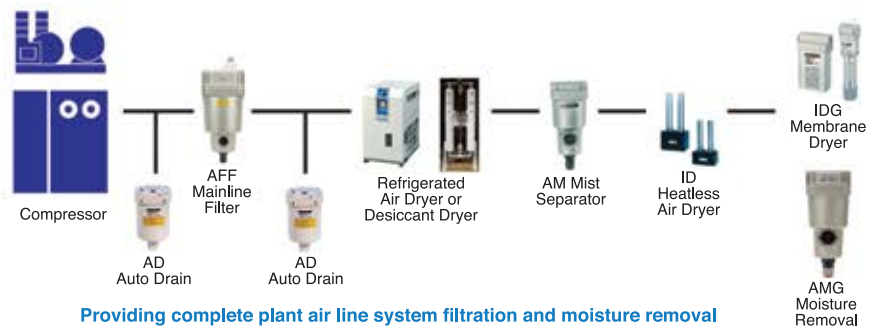
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Corporate GHG-Reduction News

important to the company's customers and the communities where it operates.

"The work we do in these sustainability goals builds trust and creates the opportunity for partnership throughout our value chain," Wilson said. "These targets let our customers know that we are laser-focused on making agriculture better at every step along the way, from mine to plate."

You can learn more about the 4Sight 2030 goals in the Company launch video <https://www.youtube.com/watch?v=fNVYid7PnUg>

TreeHouse Foods Publishes Inaugural Environmental, Social & Governance Report, Commits to 2025 Goals

TreeHouse Foods (NYSE: THS) announced

(Dec. 15, 2020) that it has published its 2020 Environmental, Social & Governance (ESG) Report, which builds on the Company's previous Sustainability reports, and highlights the Company's accomplishments and the ways in which it is enabling progress and sustainable growth in the communities it serves. The report also addresses TreeHouse's goals for the next four years around Environmental, Social & Governance issues. In conjunction, the Company also launched a dedicated section of its corporate website to inform stakeholders about its ESG efforts.

"The events of this year, from the COVID-19 pandemic to global protests against racial injustice to the growing threat of climate change, have all underscored the need for companies like TreeHouse Foods, Inc. to be an example of what is possible," said

Steve Oakland, Chief Executive Officer and President. "We must leverage our scale, capabilities, and influence to help address these complex social and environmental challenges. As one of the nation's leading private label food manufacturers, we approach this call-to-action with the same passion and commitment that we bring to exceeding customer expectations. To that end, I am pleased to share an update on our progress and our holistic ESG strategy."

In 2016, TreeHouse set environmental sustainability goals for its North America manufacturing operations focused on energy intensity, water intensity, and waste contribution to landfills. Despite facing challenges, TreeHouse reported meaningful progress related to the following:

- Carbon dioxide emissions decreased by 21% from 2016 to 2019
- Water intensity across all facilities, except one, decreased by 6% from 2016 to 2019
- Landfill diversion rate increased from 59% in 2016 to 78% in 2019

In addition, TreeHouse outlined Agenda 2025, developed through a more robust and holistic approach to environmental stewardship, stakeholder value creation and enterprise governance. Additional highlights from the 2025 vision include targeted achievement goals related to the reduction of greenhouses gas emissions and water intensity, expansion of its responsible sourcing policy and practices, and further development of its diversity, equality, and inclusion goals.

Visit <https://www.treehousefoods.com/esg/esg-overview/default.aspx>.



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Lamb Weston Publishes its First ESG Report

Lamb Weston Holdings, Inc. (NYSE: LW) announced (June 2, 2020) the publication of its first Environmental, Social, and Governance (ESG) Report, outlining the way sustainable business practices are built into the company's value chain.

"This report highlights work that Lamb Weston has always believed in – operating with integrity to support the long-term sustainability of our business," said Tom Werner, CEO of Lamb Weston. "I'm proud to share this overview, which tells the story of our efforts to be good stewards of the land and resources we need to make our products, and how we incorporate sustainability into every aspect of our business."

The report outlines sustainable practices through four distinct parts of the value chain: Protect, Plant, Produce and Provide. The report covers data and activities from Fiscal Year 2019, and includes information on the company's progress against goals set in 2016.

You can read the full report at <https://esg.lambweston.com>.

Georgia-Pacific Facilities Recognized by the EPA for Sustainable Efforts

March 10, 2021. Efforts to reduce water use, use energy efficiently and streamline resources used to ship products across the U.S. earned employees and GP facilities a variety of awards from the EPA.

Georgia-Pacific facilities received several awards and certifications, including the ENERGY STAR[®] Top Project for 2020, an ENERGY STAR[®] Certification, the SmartWay Excellence Award and a 2020 Energy Star Challenge Achiever for Industry by the EPA.



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The Leaf River cellulose mill in New Augusta, Mississippi, became the first U.S. pulp mill to earn the EPA's ENERGY STAR certification, signifying that the manufacturing facility performed in the top 25 percent of similar facilities nationwide for energy efficiency this year.

"The Leaf River team works hard to find and create new and more efficient ways to transform the way we operate the mill," said Chuck LaPorte, general manager of the Leaf River Cellulose mill. "I'm proud of the great work being done by our employees to advance the facility's efforts to consume fewer resources and achieving EPA's Energy Star certification underscores the team's dedication and commitment to this goal."

Georgia-Pacific's Brewton, Alabama, Containerboard mill has been named a 2020 Energy Star Challenge Achiever for Industry by the United States Environmental Protection Agency (EPA), a program developed by the agency to recognize individual facilities for volunteering to reduce energy intensity by 10% within five years.

To earn this recognition, the Brewton mill improved energy intensity by 11.2% in four years, resulting in an annual savings of approximately \$2.6 million. Brewton becomes the fourth paper mill in the U.S. to achieve this prestigious designation, joined by three other Georgia-Pacific paper mills located at Palatka, Florida; Green Bay (Broadway Mill), Wisconsin; and Muskogee, Oklahoma.

"As a company, we continually look for ways to advance environmental excellence, which includes working to consume fewer resources such as energy," said Tommy Blaylock, Brewton mill vice president and mill general manager. "As a business neighbor within the region, we have a vested interest doing the right things and I'm extremely proud of our team's focus around energy efficiency and reduction efforts."

Blaylock attributes much of the mill's success in energy reduction to the 2016 installation of the mill's recovery boiler and evaporator, a \$388 million project that burns residual material from the paper-making process to generate steam to power the mill. The project included a 75-megawatt turbine that can generate enough electricity to serve 60,000 homes, or the entire city of Auburn, Alabama.

The Brewton mill produces large rolls of paperboard products used to make corrugated boxes and paper plates. The facility employs more than 400, with an annual payroll and benefits of approximately \$36 million.

Georgia-Pacific's Palatka, Florida, consumer products mill and the kraft papermaking department team was awarded the EPA's ENERGY STAR® Top Project for 2020 for achieving a 40 percent water reduction in a 10-week period through investments in improved equipment and monitoring.

"As a company, we believe in being responsible stewards of our natural resources," said Mike Griffith, general manager of the Palatka mill. "Since 2018, we have placed considerable focus on how much water we use daily and how much we can save. This work exemplifies the type of collaboration and results we see across the Palatka team every day and I'm proud of the

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Ford Releases First-Ever Integrated Sustainability & Financial Report

Ford released (March 31, 2021) its first-ever integrated sustainability and financial report of accomplishments and aspirations, at the same time announcing new science-based targets toward the company’s ambition to be carbon neutral by 2050, in line with terms of the Paris Climate Agreement.

The targets – to reduce Scope 1 and 2 greenhouse gas emissions from operations 76% from 2017, and Scope 3 GHGs from use of the company’s products 50% from 2019, both by 2035 – were recently approved by the Science Based Targets initiative. SBTi is a collaboration between CDP, the World Resources Institute, the World Wide Fund for Nature and the United Nations Global Compact that helps companies set meaningful objectives for mitigating emissions.

Reducing emissions has favorable implications for a range of sustainability issues that Ford stakeholders have said matter most – all of which get attention in the newly issued report. Combining sustainability and financial performance in a single report, Ford said, is significant.

“Ford has always been about building a better world, where people have the freedom to move and pursue their dreams,” said John Lawler, the company’s chief financial officer. “Success in sustainability requires a financially healthy business, and financial health depends on effectiveness in sustainability areas.



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“Combining those topics in a single report reflects that, more than ever, investors and other stakeholders want to know not only what you plan to do, but what you’re accomplishing and how you’re managing risks along the way.”

Highlights in the integrated report include Ford’s large-scale social response to the COVID-19 pandemic; significant investment in and initial launches of high-volume, zero-emission electric vehicles; and actions to protect human rights and create greater diversity, equity and inclusion within the company.

Electrifying the Future, Clearing the Air

Through 2025, Ford plans to invest more than \$22 billion to engineer and introduce connected, electric vehicles – including EV versions of some of its most popular nameplates, in categories where millions of customers already rely on the company: pickup trucks, commercial vehicles and SUVs. Shipments of the highly anticipated Mustang Mach-E in North America began in 2020, followed by Europe in early 2021 and, later this year, in China. All-electric Transit commercial vans will be introduced toward the end of 2021; a battery-electric F-150 is scheduled for launch in 2022.

Ford last month announced that its entire commercial vehicle lineup in Europe will be zero-emissions capable by 2024. One-hundred percent of the company’s passenger vehicles in the region will be zero-emissions capable – all-electric or plug-in hybrid – by mid-2026, and entirely battery-electric by 2030.

To expand production capacity for EVs, Ford in 2020 started construction of the new Rouge Electric Vehicle Center in Dearborn, where the all-electric F-150 will be built. In February 2021, the company announced a \$1 billion investment to create the Ford Cologne Electrification Center in Germany.

Investments in Dearborn and Cologne manufacturing – together with another \$1 billion announced in February to transform operations in Pretoria, South Africa – will further help reduce Ford’s overall carbon footprint. Through improved energy efficiency and conservation initiatives, Ford today generates 40% less carbon from its facilities and manufacturing processes around the globe. An additional goal is to use 100% locally sourced, renewable electricity at all Ford plants by 2035.

“We will lead in achieving carbon neutrality because it’s the right thing for customers, the planet and Ford,” said Bob Holycross, vice president, Sustainability, Environment and Safety Engineering.

“Ninety-five percent of our carbon emissions today come from our vehicles, operations and suppliers, and we’re tackling all three of those sources with urgency and optimism.”

Visit sustainability.ford.com and shareholder.ford.com.

Nissan Sets Carbon Neutral Goal for 2050

Nissan Motor Co., Ltd. has set the goal (January 27, 2021) to achieve carbon neutrality across the company’s operations and the life cycle of its products by 2050.¹ As part of this effort, by the early 2030s every all-new Nissan vehicle offering in key markets will be electrified.

Nissan will pursue further innovations in electrification and manufacturing technology to make progress on the company’s carbon neutrality goal in the following strategic areas:

- Battery innovations including solid-state and related technologies to develop cost-competitive and more efficient electric vehicles;
- Further development of Nissan’s e-POWER electrified powertrains to achieve greater energy efficiency;
- Development of a battery ecosystem to support decentralized, onsite power generation for buildings with renewable energy sources. Nissan anticipates increased collaboration with the energy sector to support the decarbonization of power grids;
- Manufacturing process innovations to support higher productivity in vehicle assembly, starting with the Nissan Intelligent Factory initiative. The company will also strive for greater energy and material efficiencies to support longer-term carbon neutrality ambitions.



1. “Life cycle” includes raw material extraction, manufacturing, use, and the recycling or reuse of end-of-life vehicles.

“We’re determined to help create a carbon neutral society and accelerate the global effort against climate change,” said Nissan CEO Makoto Uchida. “Our offering in electrified vehicles will continue to expand around the world, and this will make a major contribution to Nissan becoming carbon neutral. We will continue to drive innovation that enriches people’s lives as we pursue a sustainable future for all.”

Nissan’s goal builds on its decades-long programs to reduce emissions and provide electric vehicle technologies that benefit the environment and society. The company’s electrification and emissions reduction efforts support the aims of the U.N. Paris Agreement on climate change and global progress toward carbon neutrality by 2050.

Nissan’s ambition also expands upon past initiatives under the Nissan Green Program and the company’s ongoing work to minimize the carbon footprint of its products and operations. The company introduced the world’s first mass-market electric car, the Nissan LEAF, and has sold more than 500,000 of the zero-emission vehicle to date.

Nissan also continues to work with industry coalitions and authorities to develop infrastructure and raise public awareness about the benefits of electric vehicles.

With 100% of all-new vehicle offerings to be electrified in the key markets of Japan, China, the U.S. and Europe by the early 2030s, Nissan will also be among the leaders in driving the adoption of electric vehicle technology.

Nissan believes the automotive industry can be a driving force in meeting global environmental and climate needs through a commitment to innovation and impact reduction by collaborating with authorities and partners worldwide. When combined with the expansion of renewable energy and charging infrastructure, vehicle electrification and sustainable operations can help accelerate the arrival of a carbon neutral future.

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FOOD & BEVERAGE PROCESSING
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Schoeneck Containers Leaves No Stone Unturned with Compressed Air

By Mike Grennier, Compressed Air Best Practices[®] Magazine

Schoeneck Containers, Inc.'s compressed air system in Delavan, Wisconsin, features ducting and louvers for heat recovery during the winter. The configuration also routes hot air out of the facility's mechanical room during warm months (Photo courtesy of Zorn Compressor & Equipment)

► When compressed air is essential to the production of up to one million plastic containers per day there's little room for error. That's why Schoeneck Containers, Inc. (SCI) leaves no stone unturned to ensure its compressed air systems run smoothly at all times and without fail at its bustling facilities in Wisconsin.

"As far as production, my focus is maintaining constant pressure and always having the availability of air," said Bill Bushman, Facilities Engineering Manager at SCI. "My other big focus is keeping an eye on misuse of compressed air. That's just a waste of air and the cost involved. Anytime we can save energy it helps us be more profitable."

All the while, SCI (www.schoeneck.com) pays close attention to customers' needs whether it's ensuring product quality or helping speed time to market – all of which explains its robust growth as a supplier of containers for use diverse applications, including food and

beverage, personal care, household, industrial, nutraceuticals, wipes and pet care products.

Tailored Compressed Air Systems

SCI's growth is evidenced by the construction of a 250,000-square-foot production facility in 2019 in Delavan, Wisconsin. The new plant is in addition to the company's 172,000-square-foot headquarters and production facility in New Berlin, Wisconsin. The company has been in business since 1972 and employs 260 people.

The New Berlin plant houses a total of 30 blow molding production lines. The Delavan plant, which is built to accommodate continued expansion, includes four blow molding lines and two injection molding machines operating 24 hours per day, seven days a week. Both plants produce high-density polyethylene or polypropylene containers, ranging from four to 320 ounces. The Delavan plant also

injection molds caps and closures. The compressed air systems at SCI are tailored to each operation.

The centralized compressed air system at the New Berlin plant includes four, 300 horsepower (hp) centrifugal air compressors and a 200-hp, Variable Speed Drive (VSD) lubricated air compressor. It also consists of refrigerated cycling dryers for each air compressor, as well as three dry storage tanks, including 1,500- 1,600- and 3,000-gallon units.

At the Delavan operation, SCI worked with Zorn Compressor & Equipment, Pewaukee, Wisconsin, to design and install a centralized system located in the facility's large mechanical room. The system is comprised of two, 200-hp, oil-free rotary screw Kobelco KNW Series air compressors; two refrigerated cycling dryers; two pre-filters, rated at 1 micron each; two after-filters, rated at 0.01 micron each; and a 3,800-gallon dry receiver tank.

Additionally, the air-cooled air compressors at the new plant are configured with ducting and louvers to heat the mechanical room

during cold months and exhaust hot air outside the building during warm months. It also includes a flow meter to monitor and measure compressed air use so decision makers can accurately determine when to expand the compressed air system. As with the New Berlin facility, the Delavan plant uses an aluminum piping system to distribute compressed air throughout the operation.

Constant and Reliable Air

Whether used for blow molding or injection molding, the compressed air systems at each plant are designed to provide highly reliable air with ample capacity to meet production goals – in addition to providing redundancy.

At the New Berlin plant, the three centrifugal air compressors operate at near capacity at all times, while the VSD rotary screw unit serves as a trim unit to provide additional air when needed. The fourth centrifugal air compressor serves as a backup machine. In Delavan, each air compressor is rated to deliver 814 scfm of compressed air at 110 psi. As such, one unit alone provides more than enough air to meet the

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plant's 600 cfm peak capacity, while the second machine provides full redundancy.

SCI's continuous extrusion blow-molding process is the biggest consumer of compressed air. The ability to maintain a steady supply of air at stable pressure is crucial, said Bushman.

"We're using compressed air to form the containers and the pressure and volume needs to be there," he said, noting pressure for the process typically fluctuates from 95 to 100 psi, depending on the size of the container. Compressed air, he added, is key to the integrity of the product. It's why the SCI team is automatically notified of any drop in pressure.

"When that container has a snap cap, for example, you have to size the bottle correctly so the caps fit when they go to package and fill it. The same is true with a screw-on cap. We need to make sure those threads are within specification so the caps fit correctly," Bushman said.

A constant and reliable supply of compressed air is equally essential for the injection molding process. Air primarily powers pneumatic valves on the plant's automatic robotic pick-and-place system, which transfer caps and closures throughout the production and packaging process. Compressed air is also used at both plants to actuate valves of the plant's extensive vacuum system, which conveys plastic resins from rail cars outside the buildings to hoppers

and blenders inside and onward to dedicated processing lines and machines.

"It's a continuous process," Bushman said. "Any one production line is capable of drawing close to 1,000 pounds of material per hour. My main concern is having that compressed air capacity."

Equipment and Supplier Selection

To ensure the availability and reliability of compressed air at both plants, Bushman carefully evaluates equipment and technologies regularly and matches them to the precise needs of the operations. He also looks at the big picture.

"We look at all aspects of equipment selection, including the operating and lifecycle costs of the equipment," Bushman said, pointing to the oil-free air compressors specified for the Delavan plant. "The maintenance interval is 8,000 hours for these units whereas we're looking at 2,000 to 3,000 hours between intervals on some of our other compressed air equipment. That really helps with maintenance costs."

What also helps ensure a dependable supply of compressed air at all times is a preventive maintenance contract with Zorn and a strong relationship with the firm, Bushman said. He also credits his own team for keeping equipment in top condition.

"We've got people at both plants with eyes on equipment at all times," he said, adding how he appreciates the expertise of Zorn. "Between the two of us we have a good handle on how our equipment is running. But with Zorn, for example, if we have a question about how something operates, or we want to know what we can do better to make sure our equipment is up to speed, it's as simple as making a phone call."



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The compressed air system at SCI's Delavan plant includes a 3,800-gallon dry receiver tank. (Photo courtesy of Zorn Compressor & Equipment)

Josh Susee, Zorn's Business Development Manager, said Zorn appreciates working with SCI and Bushman in particular given his knowledge and expertise in compressed air.

"Bill and SCI always do it the right way," said Susee. "By 'right,' I mean they don't take shortcuts. For instance, they chose the most efficient and the most reliable system they could reasonably get for the new facility. They always look for the best system for the value, and with the new facility, they're now able to enjoy the advantages of the installation."

Ongoing Progress in Sustainability

What SCI also aims to get right is sustainability, whether it's making educated decisions related to equipment selection or efforts to conserve resources at every level of the operation. A prime example is the company's Green Team, which it recently formed to explore all avenues of sustainability.

"The team consists of almost every area of the company," Bushman said. "It includes engineering, quality control, production, human resources. We want the team to include someone from every area so we can get an accurate measurement of what we're using as far as resources. That way,

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Zorn offers air compressors and vacuum pumps from high quality manufacturers, as well as custom turnkey installations, equipment service, parts, lubricants, rentals, and system audits. Its comprehensive product and service offerings, coupled with engineering expertise, results in compressed air solutions unique to each customer's application.

The company prides itself on unparalleled service, backed by generations of industry leadership. It delivers a high level of service through its commitment to quality and by understanding customers' applications with an emphasis on building strong personal relationships. At Zorn, air compressors are the company's business and people are its focus, reinforcing its commitment to building strong relationships with customers, employees, and industry partners. Its promise is quality, service, and expertise through leadership.

Headquartered in Pewaukee, Wisconsin, Zorn has branch facilities throughout Wisconsin, including the cities of Madison, Green Bay, Wausau, and Eau Claire. It also has facilities in North and South Chicago. Each branch offers the company's full range of resources. For more, visit www.zornair.com.



Zorn Compressor & Equipment is a leading provider of compressed air and vacuum solutions in the Midwest. (Photo courtesy of Zorn Compressor & Equipment.)



The Delavan compressed air system is designed identically with two refrigerated cycling dryers and other key components for full redundancy. (Photo courtesy of Schoeneck Containers, Inc.)

we can determine where we can best save in all areas, such as the amount of paper we're using for business purposes, the amount of energy used for compressed air, or water for cooling processes."

Minimizing misuse of compressed air is high on the list of sustainability efforts at SCI – and a top priority for Bushman.

"For example, say we have a large container that doesn't run through the conveyor system quite like it should because we normally run smaller containers in that same system. In that case, an operator might connect an open compressed air line to the conveyor to temporarily push it down the line. So I always make sure those types of stop-gap fixes don't become a long-term solution. If compressed air is not doing work it was designed to do such as operating a valve or blowing a mold, it's a waste of air and it can be costly."

Bushman said many at SCI already have an appreciation for compressed air since the company has worked with Zorn and Focus on Energy on successful leak detection programs. Focus on Energy (www.focusonenergy.com) is a statewide program in Wisconsin that offers information and financial incentives to help businesses select and install cost-effective solutions designed to save energy and money.

Zorn conducts the leak detection program for SCI because the compressed air supplier is an expert it – and it offers tremendous value to customers, said Susee.

“We’ve got the people and the tools to get it done without interrupting production,” Susee said. “With our program we can take information we gather with ultrasonic leak detection equipment and provide a figure for how much money there is to be saved for each fixed leak based on the magnitude of the leak. Then, we can go ahead and fix the leak, or SCI can do it. It’s usually a no-brainer.”

Well Positioned for Growth

Today, the goal for SCI is to keep pace with increasing demand for its line of quality products. It’s an effort made easier since the company plans well ahead for the future, just as it has with the compressed air system at the Delavan plant.

“At the new plant, we designed and installed all of our systems like compressed air with quite a bit of excess capacity because we wanted them to take us through the next five years,” Bushman said, noting the plant is already adding two blow molding lines to the operation. “Right

now, that five-year plan for growth is looking more like a 3.5-year plan, but that just means we’re growing a little faster than anticipated.”

The near term strategy for compressed air at the Delavan plant is to leverage the robust capacity of both air compressors before adding a third unit, but not before the completion of a thorough assessment. Bushman said the knowledge gained in specifying a compressed air system for the Delavan operation will be put to good use for years to come.

“Everything I learned in designing and building this production facility is going to help me out with the next one,” he said. “I’m sure there’s going to be a third one before too long.” **BP**

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Achieving “Technically Oil-Free” Compressed Air

By David Swartz, Gulf Coast Regional Sales Manager, Sauer Compressors USA

► We are often asked here at Sauer, about how much less compressed air purification equipment is needed with an oil-free air compressor. As the myth goes, oil-free air compressors will produce high quality compressed air, eliminating the need for a heap of compressed air purification gear. Unfortunately, that is not the case. While oil-free air compressors do have beneficial attributes over oil-lubricated compressors, the downstream requirements for purification, needed to achieve high quality compressed air, are identical. In this article we will discuss how to achieve actual oil-free air from your air compressor, no matter what type of air compressor it is.

Lubricated vs Oil-Free Compressors

Air compressors of all designs turn mechanical power into pneumatic power by successively concentrating air across compression stages. A rotary screw air compressor, for example, utilizes rotating helical screws to drive air forward, increasing its pressure by reducing the volume of space the air mass takes up. Mechanical compression of this nature takes quite the force and energy to accomplish, which equates to heat generation and physical wear inside of the compressor. Whether we are discussing an oil-lubricated

or an oil-free air compressor, these heat and wear factors are still present, and both require



HAUG Neptune oil-free piston gas compressor

lubrication and cooling to keep the compressor from destroying itself. That is right – an “oil-free” air compressor still uses oil to lubricate its moving parts and manage its waste heat.

What makes an air compressor “oil-free”, then? Simply put, an oil-free air compressor does not use oil during the compression stage and oil does not come into contact with the discharged compressed air flow. This is a very positive attribute in that significantly less oil is introduced into the compressed air stream than with a lubricated air compressor. Lubricating oil, however, is still used in the crankcase and as an internally recirculated coolant. This is one of three potential sources of air contamination (including hydrocarbons and oil) which can be introduced into any type of air compressor – including an oil-free air compressor.

Sources of Compressed Air Contamination

Compressed air has the potential to gain contamination from three sources. Regardless of if you are using an oil-lubricated or an oil-free compressor, these sources are the same (the oil-lubricated variety just has more internal sources where oil comes into contact with the air). Likewise, the need for downstream system design considerations and air purification equipment is also the same.

- 1) **Environmental Sources** – The air we breathe is made up of many gaseous and vaporous constituents. Some of these components are concentrated across an air compressor and build up to form harmful contaminants in our compressed air systems. Volatile Organic Compounds (VOCs), Hydrocarbons, Carbon Monoxide and

Dioxide, Sulfuric Oxide, Nitrous Oxide, Organic Particles, Dust, Dirt Particles, and other pollutants are all present in outside air. In addition to organics, various microorganisms and bacteria are equally concerning, especially in medical, food, and other hygienic applications. When brought into an air compressor’s intake, these elements can be present as oils.

- 2) **Incidental carryover from the oil-free air compressor itself** – Recirculating intercoolers and separate gearboxes often have breather valves installed in which hot oil gases can escape into the airspace around the

compressor. This vapor exhaust can be immediately picked up by the compressor’s air intake, indirectly introducing lubricating oil particles into the compressed air.

- 3) **Downstream piping and equipment** – Air receivers are notorious for contributing moisture and particulates to compressed air streams, but they are not the only culprit. Piping materials can corrode and scale off into the air stream, vapor separators can fail and recontribute moisture, flexible hoses can leech their composite polymers under pressure, and so on.

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What is “Technically Oil-Free Air”?

Marketing campaigns and terminology tend to result in misunderstandings around the quality of air you might expect from an oil-



Filter assembly drawing for dual coalescing and carbon filters: maximum pressure 5000 psi (340 bar).

free compressor. An “oil-free” air compressor alone simply cannot produce air that is demonstrably free of foreign contaminants. Similarly, reduction of foreign materials in a compressed air stream to absolute zero values is arguably not possible at industrial scales, and regulatory standards governing compressed air systems reflect this.

Depending on your locale, you might refer to International ISO, British BCAS, Safe Quality Food SQE, Canadian FSEP, or other guidance to determine your requirements for air quality. As an example, one of the highest requirements for food-grade compressed air sets the threshold at 0.01 micron at >99.99% DOP (Dioctyl Phthalate Fog Method) efficiency.

There are functional and measurability limits in both the methods, sample sizes, and instrumentation needed to test air quality, and the regulatory codes allow for these limits above absolute zero.

Since the objective is typically not the absolute removal of all foreign matter, but instead an extremely high level of removal within practical limits, some firms use the term “Technically Oil-Free Air”. For them, technically oil-free compressed air may be the lowest total oil level, remaining after an activated carbon filter, measured down to just 0.003 mg/m³.

Technically oil-free compressed air is only achievable by the use of compressed air treatment equipment including specific types of compressed air filters and dryers, in addition to the air compressor. This equipment is required after either an oil-lubricated or oil-free air compressors.

Reducing Contaminant Levels with Compressed Air Purification Equipment

Let’s run through the compressed air purification equipment categories that can be deployed, in various combinations, depending upon the compressed air dryer type and site requirements, to achieve technically oil-free compressed air.

1. **Water Separator(s)** – Reduce levels of liquid oil and water content in the air stream. The goal is to remove bulk liquid before entering a dryer or a coalescing filter.
2. **Storage Tank** – Present to store compressed air, storage tanks will also reduce levels of bulk liquids in the air stream. “Wet tanks” are installed before the dryer and “dry tanks” after.

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3. **Coalescing Filter(s)** – Reduce levels of oil and water aerosols, atmospheric particulates, microorganisms, and metallic/non-metallic particulates from the piping system (such as rust flakes or mineral scale). Goal is to remove liquid contaminants and solid particulates. Some coalescing filters are designed to focus on particulate filtration while others are designed for oil and water aerosols.
4. **Compressed Air Dryer** – Reduces water vapor levels that are suspended as a vapor in the air stream to prevent it from condensing into a liquid downstream when it cools. Moisture removal also eliminates an environment where microorganisms can grow. Removal of water and water vapor is also necessary to allow oil aerosol and oil vapor removal filters to perform optimally. Dew point requirements will vary by application and will determine the type(s) of compressed air dryers to be used.
5. **Activated Carbon Absorption Filter or Tower** – Reduces oil moisture from the air stream by absorbing oil vapors via an activated carbon media bed.
6. **Dry Particulate Filter** – Removes particulates from the air stream by use of a porous mechanical filter, with filtration options down to 0.01 microns. Used only with adsorption type dryers.
7. **Sterile Filter** – Removes even further levels of solid particles, including microorganisms, from the air stream by use of a sieve retention or membrane filter. Sterile filters are intended for frequent cleaning to assure sterility.
8. **Condensate Drains and Oil-Water Separators** – Filters, storage tanks and some types of dryers will remove gallons of liquid water, mixed with oil, via the use of condensate drains. This condensate is sent to an oil-water separator to responsibly remove the oil before the condensate is sent to drainage.

ISO 8573-1:2010 Classes for Oil Content

When using the ISO 8573-1:2010 Standard for compressed air contaminants and purity classes, it's important to note the "Class Level" system it deploys are applied to three types of contaminants. They are (1) Particles, measured by particle size in microns or by mass (2) Water, measured by vapor pressure dew point and liquid (3) Oil liquid, aerosol & vapor measured by mg/m³. A common error made

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Sauer Mistral Series WP65LB with oil-free filtration to provide ISO 8573:2010 Class 1 Oil Content.

in specifications is to use “Class 1” and not specify which of the three contaminant types it’s making reference to.

Referring to the international air quality code ISO 8573-1:2010, “Technically Oil-Free Air” could be equated to Class 0 or Class 1 thresholds for total oil content (liquid, aerosol & vapor). Class 1 describes the highest expressed quality values covered by the standard, at $\leq 0.01 \text{ mg/m}^3$ (0.008 ppm).

The definition of Class 0, applicable to all three contaminant types is, “As specified by the equipment user of supplier and more stringent than Class 1.” Class 0 is mainly for a customizable, use case specific condition, and does not state absolute zero contamination exists in the air stream.

To achieve Class 1 or Class 0 thresholds for oil content, the typical compressed air

system installation will consist of an air compressor (either lubricated or oil-free), a water separator, a coalescing filter set, a dryer, a receiver tank, an activated carbon absorption filter, condensate drains and an oil water separator. This kit will properly protect the outbound air from containing any liquid oil or oil vapors. From here, the overall air distribution system throughout the facility must be considered for additional protection depending on downstream risk points. Very likely, you will want to add additional filtration at each point-of-use, protecting from any re-contamination to the air coming from the piping system itself.

With the above information, you can see the installation of an oil-free compressor alone is not enough to properly deliver “oil-free” compressed air. The entire air distribution system must be taken into consideration, and additional post-compressor air purification

equipment is always required to treat environmental, carryover, microbial, and piping contaminants. For more information or to ask any questions, please visit our website at <http://www.sauerusa.com/>. **BP**

About Sauer Compressors USA

Sauer Compressors USA specializes in the manufacturing of medium and high-pressure air and gas compressors for naval, commercial maritime, offshore, research and development, and demanding industrial applications. In addition to compressed air, Sauer Compressors works in the CNG, N2, He, and inert gas markets. Sauer USA, located in Stevensville, Maryland, is an affiliate of J.P. Sauer & Sohn, headquartered in Kiel, Germany.

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. Sauer Compressors' modern reciprocating compressors for the compression of air and various gases reach pressures of 290 to 7,000 psi.

Besides standard products, it offers customized solutions for individual customers, OEMs and companies that operate on a global stage. With a global network of agents and representatives, Sauer maintains close proximity to its customers. By supplementing the compressor range with high-quality accessories, engineering services, assembly and service concepts, Sauer offers system solutions right up to complete turnkey installations. For more information, visit www.sauerusa.com.

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Safe and Efficient Compressed Air Nozzle Food Applications

By Jordan Shouse, Application Engineer, EXAIR Corporation

► It's easy to use compressed air inefficiently, most of the time systems are cobbled together using supplies on hand. But taking time to use the correct engineered product will not only keep users safe, it will also save money on compressed air generation costs.

There are a tremendous variety of unique and creative ways people in the food industry have overcome their need for compressed air blowoffs used for cleaning, drying, cooling, conveying and overall processing. You may have seen some of them yourself. It is not uncommon to view open copper tubes, pipes with a crushed end, plugs or caps with holes drilled into them, modular flex coolant lines or nozzles designed for liquid application but blowing air. For compressed air use, these can be dangerous and very inefficient. In many instances, companies will go through such a mixed bag of items to make a blow-off device for their application because it may be "inexpensive" to do or a quick fix. But what is very important to recognize is that

these potentially unsafe items will waste your compressed air, costing a great deal of money in the long run.

Due to the environment many food applications can be within, such as washdown with sanitizing chemicals, high or low temperatures, or exposure to the food item; material of the components takes center stage in many cases, with little consideration of using compressed air efficiently. Companies manufacturing high efficiency, high performance compressed air products like air nozzles or air knives will certainly have a selection of materials to suit food industry environments.

It may be difficult to perceive that there is much difference between air nozzles, but there are significant differences in air consumption, noise levels, effectiveness and maintaining OSHA safety standards. The best compressed air nozzles focus on these elements – efficiency, safety and effectiveness. There are services from some air nozzle manufacturers which will

provide a comparison for anyone concerned about compressed air consumption and these other values. Knowing what you are currently consuming and what improvements could be made to lower that consumption is valuable information when trying to convince higher-ups to make a change. Comparing consumption, force levels and noise can get you well on your way toward improvement because you can then determine real dollar savings and simple ROI. You may also realize increased safety. This kind



Three brass nozzles designed for spraying liquid being used improperly to blow air on a food packaging line.

of information will be difficult for any manager, executive, or HSE personnel to ignore.

Fix Compressed Air Errors

Here is a common compressed air application error. A plant had installed nozzles designed for liquid blowoff onto an application for removing rinse water from plastic bags prior to packaging that bagged food product into a box. The reason they chose these nozzles was that they were already available in the tool crib. And though we all understand the value of a quick fix, they are not the best long-term solution in just about every situation. In this case they had just set themselves up for higher energy costs and noise exposure – long term.

Years later, this plant did eventually realize there may be another simple solution that could reduce air consumption and noise levels, while still being effective. They were motivated by saving money through reduced compressed air consumption, safety for personnel and simplicity of installation which led them to investigate better solutions. Here is what was discovered.

This compressed air user had three water nozzles on a manifold that had ¼" NPT male connections. The air pressure was set at 75 PSIG (5.2 bar), and the air pattern was somewhat round. Their annual usage for this quick fix blow-off device was 7000 hours continuous, and their electric rate for their facility was \$0.10/KWh. They did take advantage of a comparison service from a compressed air products manufacturer because the operation was very loud, and they believed that they were wasting compressed air. They were interested to learn what would be recommended and what the payback period might be when looking at performance of an engineered air nozzle.

The recommendation was a 316SS air nozzle with a standard round pattern and a ¼" NPT

male connection. The material was well suited for their environment but more potential gains were available. An engineered design that concentrated on delivering compressed air, rather than liquid, can entrain the “free” ambient air into the air stream much better to generate a hard-hitting force and use less compressed air. Also, with this suggestion, there was no need to redesign their blow-off station. No additional space was required, which may be the case for a blower solution, and no need for capital cost permission from management was required. Simply remove the liquid spray nozzles and replace them with the recommended nozzles.

When the water jet nozzles were tested, they used 17.5 SCFM (496 SLPM) at 75 PSIG (5.2 bar). The noise level was measured at 91.2



¼" NPT round pattern air nozzle engineered for use with compressed air.

dBa for a single nozzle. As a comparison, the engineered compressed air nozzle used only 13.3 SCFM (376 SLPM) of compressed air at 75 PSIG (5.2 bar); and, the noise level was reduced to 73 dBA for each nozzle.

Keep Personnel Safe

One of the primary focuses was safety, in this case a very loud blowoff increased their personnel's noise exposure. High noise levels will cause hearing damage. OSHA generated



Safe and Efficient Compressed Air Nozzle Food Applications

a standard 29CFR-1910.95a with a chart for Maximum Allowable Noise Exposure. Though each individual liquid nozzle produced 91.2 dBA of noise exposure, the three combined equaled 96 dBA. From the OSHA table above, the usage without hearing protection is less than 4 hours a day. With the engineered air nozzles, the noise level is 78 dBA for all three nozzles; well below the requirement for 8 hours of exposure. It is difficult to put a monetary value on safety, but using PPE should never be the first step as a solution due to improper use and inconsistency of personnel.

OSHA Maximum Allowable Noise Exposure							
Hours per day (constant noise)	8	7	4	3	2	1	0.5
Sound level dBA	90	91	95	97	100	105	110
OSHA Standard 29 CFR - 1910.95 (a)							

OSHA's Maximum Allowable Noise Exposure
(29 CFR-1910.95(a))

If a permanent fix can be installed to reduce reliance on PPE, the wise decision is to install a permanent and safer substitution.

Incredibly Fast and Simple ROI

For the annual savings and the payback period, electrical cost is a very good value to use. Additional benefits of less wear and maintenance on your air compressor, due to reducing the demand for compressed air, are also realized.

The compressed air savings is calculated from the comparison; 17.5 SCFM – 13.3 SCFM = 4.2 SCFM saved per nozzle. With three nozzles, the total compressed air savings will be 12.6 SCFM for the blow-off station. An air compressor can produce 5.36 SCFM/

kW* of electricity at a cost of \$0.10/kWh. For an annual savings, we have the figures from the information above; 7000 hours/year x 12.6 SCFM x \$0.10/kWh x 1kW/5.36 SCFM = **\$1,645.52/year**. For the payback period in this example the 316SS engineered air nozzle has a catalog price of \$98.00 each, or \$294.00 for three. The customer above did not disclose the cost of the water jet nozzles, but even at a zero value, the payback period will be 65 days!

Not all blow off devices are the same. With the customer above, they were able to reduce their noise levels and compressed air consumption with an inexpensive, easy to install solution with an incredibly fast and simple ROI. If you see unconventional ways you are using

* The cost of compressed air depends upon system design and varies from plant-to-plant.



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compressed air, in your food plant, there can be many hidden pitfalls – especially with cost and safety. Investigating applications with open tubes or pipes, nozzles made for liquid spray, and even many commercial nozzles can result in saving your company thousands of dollars per year. **BP**



About the Author

Jordan Shouse is an Application Engineer at EXAIR Corporation located in Cincinnati Ohio. After graduating with a Bachelor of Engineering in late 2014 he spent several years in the metrology field traveling the world and getting experience with manufacturing process across many industries. For the past three years he has been working with customers directly at EXAIR helping them make their processes more efficient using EXAIR's line of Intelligent Compressed air Products.

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Microbiological Testing Considerations for Compressed and High Risk Ambient Air Systems in Food Plants

By Charles Giambrone, M.S., Vice President Technical Services,
Food Safety Division, Rochester Midland Corporation

► Introduction – The Microbial Air Biosphere¹

Air borne microbes are transported via a combination of three methods: spores [bacterial/fungal], water droplets, & biofilms [via sloughing].

Micro-aerosolized droplets are how many members of the microbial world become cross-contaminants via the air mode of transmission. Food borne viral pathogen Hepatitis A and the ubiquitous Norwalk are very often transported via micro-aerosols. It is well known that many viral or bacterial pathogens or spoilers are transmitted via respiratory bursts [coughs/sneezes] from people or air handling system, condensate,

and splash back from floors. Strict cGMPs can limit and control transmission in terms of personal & environmental hygiene.

Spores or sporocysts are a significant mode of microbial airborne transport. Airborne transport is an important mode spores/ or sporocysts rely on air currents as a transport and survival mechanism for the microbial species in question. Protozoal sporocysts from genera like *Cyclospora* / *Cryptosporidium* spp. are very hardy, biocide resistant but are not associated via airborne transmission routes.

Airborne contamination is most easily examined via microbial spores...which

evolved to develop a sporulation cycle, just like the lower and higher plant kingdom: for propagation and species survival. Bacterial spore formers like the pathogenic *Bacillus cereus* or the more infamous *Clostridium botulinum* are often associated as either part of a biofilm community [see below] or direct contamination of a food product or residual organic matter. Bacterial spores are designed to be hardy to withstand chemicals [microbial soil toxins or biocides, and to dry environments like other spore-like entities.

The fungal world's yeasts and molds also produce spores to survive in quite hostile environs. The fungal world's diversity created a diverse variety of spore casing and lifecycles

that the more primitive bacteria simply lack. There is an impressive portfolio in the beauty and varieties of the fungal fruiting bodies/ sporangia that many fungi possess. These fruiting bodies are the unique airborne transport mechanism for the fungal world.

Thankfully, out of the more than 50,000 fungal species that produce fungal spores, only roughly 50 are known pathogens.

Yeasts which are our unicellular also have direct impact on the functionality of many food products. For example, spoilage yeasts like *Zygosaccharomyces bailii* or the multi-species villains called 'Wild Yeasts' attack in a variety of food products in a stealth mode. The products range widely from salad dressings, baked products to non-fermented beverages, to the fermented beer and wine. All of these food industry markets each have vested interests in controlling bioaerosols in their processing facilities.

Regulatory Standards/Considerations

ISO Standards²: There are several key regulatory and certification bodies that discuss and impact both ambient and compressed air testing. The International Standards Organization speaks directly about compressed air testing, and the methods utilized to assay compressed [and ambient air] handling systems.

ISO 8573.1:2010 standard for compressed air was developed in 1991 and updated in 2010. It has multiple components. Part 1 describes 3 primary contaminant types with 9 classes with 9 most liberal to 0 the most exacting. Also, compressed air purity is classified as A, B, or C. Class A describes solid particles, B, liquid water/humidity; C oil particles. It also delineates the origin of the three class contaminants on the components of a compressed air handling system.

Since we are focusing here on microbiology, the Class A solid particles are our discussion. Over 75-80% of the air particles are less than 10 microns [micrometers] in size. For example, a Class 2 filtering system regarding solid particles, requires filters to remove particles [including microbes] that are 1 micron in size.

There is also the ISO 12500 standard which focuses directly on filtering systems with 1: Oil particles, 2: Oil vapors, 3: Particulates. All deal with test methods to measure respective filtering efficiencies. For example, regarding particulates, fine sized filters are challenged with particles in the 0.5 to 5 micron ranges.

Meanwhile ISO 8573-7 focuses on Microbial testing of compressed air. While ISO 8573-7 does not require a specific sampling method, *it does require Colony Forming Unit [CFU] enumeration*. A specific type of Impactor sieve sampler, the SAS Pinocchio Super II which is utilized by Trace Analytics it can provide a quantitative sampling procedure for Compressed air. This is a Surface to Air Sample (SAS) that can utilize RODAC or full Petri dishes.

The RCS Air Sampler from Millipore Sigma [formerly Merck Biotest] is another Impactor type known as a Centrifugal Air Sampler. For the past five years or so, the new version of this unit has a Compressed Air Adaptor to interface into a compressed air line.



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A third option for qualitative analyses of compressed air is the CAMTU unit [Parker-Balston] using a specialized donut shaped petri dish that easily integrates into an existing air-line. *More on these methods detailed below.* In any case one should employ a sampling device & method that best suits the respective program's requirements.

However, any of these samplers should employ proper Aseptic technique throughout the sampling protocol and utilize "blind" controls before and after actual sampling coupled with a negative control. Also, any of these samplers can grow the colonies on an agar surface not only for CFU enumeration but biochemical identifications. Any reliable sampling unit has to be fully validated before actual air sampling.

Under ISO 8573-7 proper disinfection of the actual unit, and the table or cart it sits upon should be mandated along with air feed lines, and valves preferably sampling 1000 liters of air in a 10-12.5 minute sampling time period.

GFSI Standards³:

The two primary GFSI Standards in North America are BRC and SQFI, and they both address compressed air testing.

In BRC Version 8, with regards to BRC clause 4.5.3 under Utilities [Water, Ice, Air & other Gases] states: *"Air and other gases used as an ingredient or that are in direct contact with products shall be monitored to ensure this does not represent a contamination risk. Compressed air that is in direct contact with the product shall be filtered at point of use."*

However, BRC **does not** delineate methodology or actual compressed air microbial specifications. Only that the program must document compressed air used in direct contact with food products must be tested.

Concerning SQF Edition 9 several things have been clarified and expanded concerning air testing, as with Edition 8, Module 11.5.5.1: *Compressed Air and other gases shall be clean and present no risk to food safety.*

Also 11.5.5.2 states *"Compressed air systems...that come into contact with food or food contact surfaces shall be maintained and regularly monitored for quality and applicable food safety hazards. The frequency of analysis shall be risk based and at a minimum annually."*

Furthermore, with regards to Ventilation 11.1.6 there now is a requirement to provide adequate ventilation in food processing areas preferably positive air pressure should be installed. The other addition is in High-Risk Processes [11.7.1.2] mandates that *"ambient" air in high-risk areas shall be tested at least annually to confirm that it does not post a risk to food safety."*

As with BRC, SQF does not stipulate which air sampling methods to employ nor provide actual microbial parameters either as guidelines or regulations.⁴

FSMA / SCFA Standards

With Preventative Controls, and the need to conduct a proper Hazard Analysis identifying the Critical Control Points, will prioritize where Compressed Air is utilized in a medium to high-risk process impacting zones 1 &

2 and product itself. Consequently, indirect compressed air contact has risk, with the highest risk being direct contact with compressed air.

Process Control is the only Preventive Control that FSMA mandates Validation, and since Process Controls include all compressed air applications like drying, sorting, freezing, moving, carbonating, culturing, inert packaging, & MAPs it's a critical feature of the program. So, yearly to biannual Validation of the Compressed Air quality for Microbes & other Particulates, along with moisture and oil is strongly recommended.

These compressed air system contaminants can be derived anywhere in the system ranging from the compressor itself, all joints, valves, and unions. The ambient air intakes and filters can be a source of microbial contamination if the Preventative Maintenance [PM] programs are not assiduously maintained. Condensate traps and receiver tanks can accumulate water vapor making the compressed air too humid and conducive to microbial growth.

In terms of material design for the compressed air system FDA prefers Nylon /Conductive Polymer or Stainless Steel [preferred] with Welded seals being the top pick followed by Stainless compression seals. Valving should be Stainless steel Shut-off, or Particle Free Stainless steel.⁵

FDA Guidance document on RTE foods requires a particulate filtration level at 0.3 microns. However, the main focus re FSMA and Compressed Air is that it is risk assessed under the food safety management scheme.

Other Key Standards

3 A Standard [604-05-3A] requires a filtration level of 99.9999% for sterile air, and non sterile air requires a 99% filtration level. The British Compressed Air Society [BCAS] Section 6 has dew point, oil removal and a particulate removal specification range @ 0.1 to 0.5 microns [which includes microbial spores].

Air Sampling Technologies^{1, 6}

As described above in the ISO standards discussion, there are a variety of microbial air samplers designed to test ambient air. Some of these have been adapted to test compressed air systems. All began under regulatory and international standards for pharmaceutical and clinical/microbiology clean rooms under ISO 14698-1/2.

Impingers utilize a liquid capture media tube to collect the microbes to approximate a human's respiratory capture system. The air being sampled is sucked through a slit tube the into a flask or tube with liquid media. The inlet tube's diameter controls sample flow rates. The sampling media is then volumetrically plated and a quantified count can be calculated using sample time vs. flow rate.

With Impingers some drawbacks include the damaging of the microbial cells being hurtled into the liquid media collection device. Many collection devices are glass which are verboten in food and beverage plants. A positive is that the liquid medium can be microbiologically assayed in a variety of ways including PCR.



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Some examples of Impingers include SAS-PCR from VWR utilized primarily for clean rooms and special labs. It is employed mostly for pathogen detection. Another is the Bertin Technologies Coriolis sampler that employs a cyclonic sampling of the air using centrifugal force on the vessel's cone like walls to get the microbes into liquid media.

Impactors in contrast to Impingers utilize an adhesive or solid agar media to collect the microbial particulates. A quantified sample of air per set velocity via a two types: Slit sampler or Sieve Sampler [a perforated plate] Both Slit or Sieve types will generate a laminar air flow onto the agar surface[s]. The slit's width or the sieve's hole diameters dictate the quantifiable

air velocity. There is a directional change in both units' design that will compel the microbes to "impact" the agar interface.

With an Impactor air sampler once the proper/desired air volume is achieved the units will stop sampling and either the agar plate or strip can be removed for incubation and counting. All provide a quantified Colony Forming Unit [CFU] count per set volume of air [cubic meters or cubic feet].

A positive of the Impactors is that sterile media is readily prepared or obtained from a supplier. Another benefit is that the Impactors can handle a variety of flow rates from moderate to high flow and high sample

air volumes. Impactors do rely on classical microbiological media and 1 to 4 days incubation for colony enumeration.

There are numerous varieties of Impactors. They include the following:

- Casella Slit sampler: Has an agar plate turntable positioned below a slit.
- Andersen sampler: a cascade sieve that has layers of plates from larger to smaller holes.

Here are the Impactor types primarily utilized for Compressed Air Microbial Analyses:

- Surface Air System [SAS] Sieve Samplers: SAS 180, Super Pinocchio II or the CAMTU II unit [Parker Balston] all can use a large agar plate while the Super Pinocchio can use 90 mm petri dishes, but has an adapter to use a RODAC type plate [55 mm diameter]. All these are utilized for compressed air systems.

- The Super Pinocchio II is the most precise and provides accurate, quantifiable counts. However, it is very cumbersome, heavy and somewhat difficult to utilize in a food & beverage plant environment.

- Media is relegated primarily to Total Count but can create Differential media plates for Fungal or Coliform enumerations.

- Sampling volume is usually 1000 liters.

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- CAMTU unit, is lightweight and portable and utilizes an ingenious donut shaped agar plate to sample compressed air. Parker Balston created this CAMTU unit, and states it's good for a "qualitative" analysis of compressed air systems.
- User friendly to set up and operate, I believe that although its data is qualitative, it is still very helpful for a lot of food & beverage plants to employ. [Since there are no quantified requirements for microbial counts of compressed air by any regulatory standard!]
- Reuters Centrifugal Sampler [RCS] is a Slit type Impactor using a impeller creating a vortex via centrifugal force, and a specialized agar strip containing 34 autonomous agar wells. *Versatile, the High Flow Touch model can be used for ambient air and compressed air testing in Food & Beverage plants.*
 - Developed by Merck Biotest, and now owned by Millipore Sigma this is a sampler I have employed for nearly 30 years for both ambient, and using a recent innovation, an adapter, quantified sampling for compressed air systems.
- Are reasonably lightweight and semi-portable and are easier to use in a food & beverage plant environment.
- Agar strips are easy to store refrigerated, and easy to ship for analyses to a microbiology lab for incubation and counting.
- Agar strips are of three types Total Count, Yeast Mold, and TSM [for coliforms] and colonies can be cultured and identified off these strips just like an agar petri dish.



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The Reuters Centrifugal Sampler [RCS] is a Slit type Impactor.

- Sampling can be hand held or use a tripod with remote for hard to sample production areas.
- Programmable for a variety of air volumes. For Compressed air

typically a 1000 liters @ 15 psi [air pressure adjusted] is used, but I have successively utilized 500 liters for many compressed air system samples.

Membrane Filtration: alternate approach that sampled compressed air or ambient air flows through a quantified velocity through a microbial membrane filter which is then cultured [Akin to sampling water systems for microbes]. This method is employed in Pharmaceutical industry applications.

Remarks on Data Analysis

In order for the data to be reliable and scientifically valid, the respective air sampler must be periodically validated and calibrated [Annually].

The efficiency to collect microbial particles and the ability of the technology to maintain a very high level of viability to grow the microbes into colonies on media. This includes the flow rate under large air volume sample sizes. The more the flow rate at large air volumes makes the unit's sampling more accurate.

Validation protocols are developed by the units' manufacturers. Meanwhile existing units must be periodically recalibrated either by the end user or the manufacturer. For example, Millipore Sigma with the RCS High Flow mandates yearly re-calibrations of field units.

As stated above to date of this article there are no set standards in the U.S. or mandated ranges for either High, Medium or Low Risk

microbial density per cubic unit of air. This is true both for ambient air measurement as well as for compressed air measurement in food & beverage programs. Exception to this are the British Compressed Air Society [BCAS] Section 6 and 3 A as discussed above. This is why ISO and 3A are trying to define microbiological specifications for compressed air and needed also for ambient air in high to low risk food processing modes.

So, due to a lack of regulatory guidelines or standards for food & beverage air samples, I have employed “guidelines” with varying levels of Unsatisfactory, to Substandard to Satisfactory. The results obtained from microbial air sampling both for ambient and compressed air systems are reviewed on the

basis of the risk assessment for the sampling area or site. Any result that finds less than 100 CFU per cubic meter air is considered the goal and is deemed Satisfactory. Of course, this is not applicable to sterile / aseptic processes.

The testing of air handling systems [ambient & compressed air] will continue to mature and evolve with increasing automation and accuracy of air sampling systems. The food & beverage processing markets in the past 20 years have increasingly considered air system quality a major component of their HACCP plans. Stay tuned! **BP**

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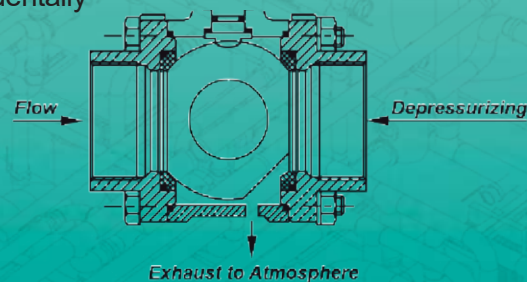
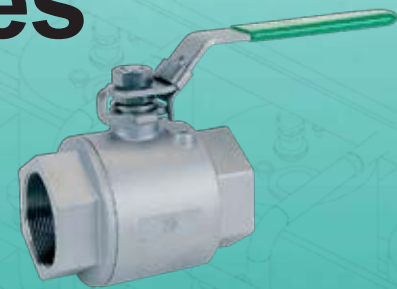
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▶ Reciprocating/piston air compressors have many moving parts and regular maintenance is an essential practice. This ensures all compressor components function at peak efficiency as well as for preventing wear that can ultimately lead to premature failure. The following tips can serve as a guide for safe, reliable, and economical reciprocating compressor operation and maintenance.

Keeping the Air Compressor Clean

Excess dirt and debris are a major cause of premature compressor failure. Compressor operators play an important role in the preventive maintenance process by watching for the accumulation of dirt during use and removing it as quickly as possible. Simply cleaning or blowing off any dirt or contaminants, using compressed air, on a regularly scheduled and routine basis is a simple and inexpensive way to ensure compressor components are kept clean.

Minimizing Vibrations

Vibration is a common issue that can lead to reciprocating compressor failure. Vibration is typically a result of the compressor not

being properly secured. Constant vibration will eventually cause compressor parts and components to loosen, leading to parts misalignment, excessive wear on the bearings, and other more serious mechanical problems. Ensure the compressor is tightly secured on a flat surface. Inexpensive vibration pads, when



Basic pump of reciprocating air compressor

Reciprocating Air Compressor Maintenance

Reciprocating Air Compressor Maintenance Checklist (Sample)

Daily

- ✓ Maintain lubricant level as recommended by manufacturer. Check the lubricant level several minutes after the compressor has run.
- ✓ Drain receiver tank, drop legs, and traps in air distribution system.
- ✓ Give compressor an overall visual inspection and be sure safety guards are in place.
- ✓ Check for any unusual noise or vibration.
- ✓ Check for lubricant leaks.
- ✓ Check all pressurized components for rust, cracks, or leaks. Immediately discontinue use of the equipment and relieve all system pressure if any of these problems are discovered.



Weekly

- ✓ Manually operate the pressure relief valves to be certain they are working.
- ✓ Clean the cooling surfaces of the intercooler, aftercooler, and compressor.
- ✓ Inspect for air leaks. Squirt soapy water around joints during compressor operation and watch for bubbles.
- ✓ Inspect lubricant for contamination and change if necessary.

Monthly

- ✓ Check belt tension.

Quarterly

- ✓ Change oil.
- ✓ Inspect valve for rust, wear, and carbon build-up.
- ✓ Clean or replace the air intake filter. Check more often under humid or dirty conditions.

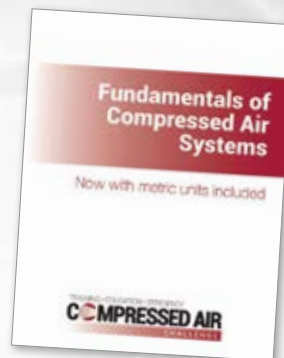
Annually

- ✓ Inspect the pressure switch diaphragm and contacts.
- ✓ Inspect the contact points in the motor/starter.

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properly installed, can help minimize/eliminate vibration issues.

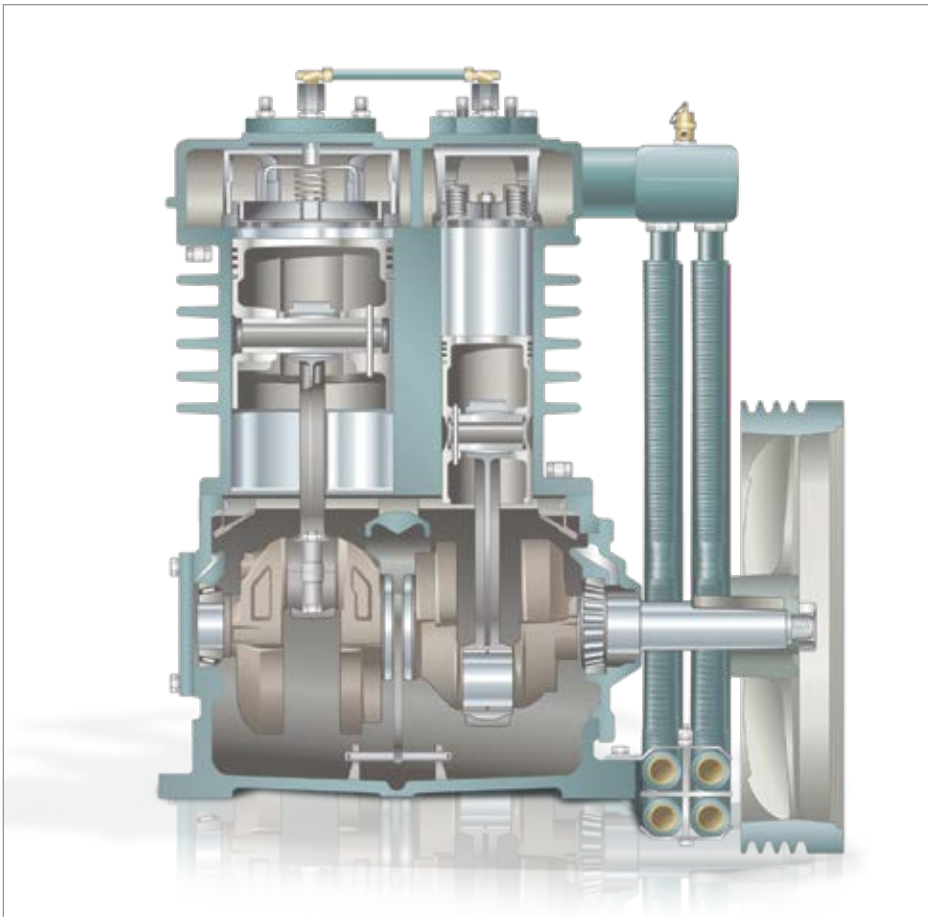
Changes in Temperature

A sudden spike in temperature during operation is a sign that a compressor is running too hot. If the operator is unable to regulate the temperature, the compressor should be shut down immediately, as running it at high temperatures for an extended period of time will most certainly lead to equipment failure. Temperature spikes could occur when crankcase oil level drops below sufficient levels and/or the compressor has accumulated a buildup of dirt/dust/grime. Additionally, electric drive motors can overheat. Proper bearing greasing per the

operator’s manual and keeping the motor clean from debris and dirt can help ensure years of trouble-free service.

Piston Air Compressor Oil Maintenance

When to add or change reciprocating air compressor oil will depend on factors such as the model type and operating conditions. In general, manufacturers recommend changing the oil on a quarterly basis, but more often with greater use. Exceptions to quarterly oil change intervals exist as some manufacturers offer long-life synthetic lubricants designed for extended life; typically 1-year or 2,000 hours, whichever occurs first. The operator should also regularly monitor the fluid level



Cutaway of reciprocating air compressor

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Reciprocating Air Compressor Maintenance

as part of a sound routine maintenance/equipment inspection process and add oil as necessary. Some reciprocating compressors come equipped with a low oil-level monitoring device, which can prevent damage or



premature pump failure from running the compressor on low oil.

Preventive Maintenance Checks

Regular service helps to ensure your machine and all inline equipment are running at maximum performance. Your business is important, if your reciprocating air compressor shuts down, so does your business. Regular service will also help to identify and head off any potential issues before they cause long term damage. Compressor manufacturers have specific maintenance schedules and maintenance kits they recommend for proper service. Remember, when performing maintenance on equipment, always ensure your unit is off and disconnected from the power source.

Following a regular maintenance schedule will not only reduce service calls, but it will ensure efficient compressor performance and extend the life of the compressor. Below is a sample checklist that can be performed on a daily, weekly, monthly, and annual basis. For specific details on a routine maintenance schedule, follow manufacturer guidelines in the operator's manual. **BP**

All photos are courtesy of the Compressed Air and Gas Institute. For more information, visit the CAGI web site at www.cagi.org.

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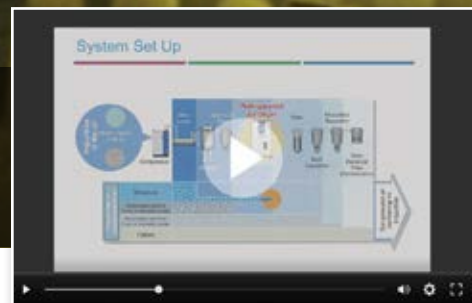
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- Safe Quality Food Standard: 5 Compressed Air Criteria
- Integrating ISO 8573-1 Compressed Air Quality Classes into SQF Food Safety Certification
- Global Food Safety Initiative (GFSI) Compliance: Two Compressed Air System Specifications

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COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

Kaeser Air System Enclosures

The new Kaeser Air System Enclosure (KASE) offers exceptional reliability, simple maintenance, and superior energy efficiency. KASE units can be purchased in several standard configurations including two 100 hp, one 250 hp, or three 100 hp rotary screw compressor units with refrigerated dryers. Kaeser also offers a 125 hp oil-free package with a heat-of-compression dryer as well as other configurations which can be designed to meet specific requirements. KASE units feature a full walk-in design and are rated for 110 mph wind loads, and 50 lbs/sq. ft. snow load. They include fully insulated, sound dampening paneling as well as entry doors and removable access panels for major service. Each KASE arrives on site completely assembled, with all piping, ducting and electrical work done. Just connect main power to the external power disconnect and pipe to the single outlet flange.



Kaeser Compressors, us.kaeser.com

Kaishan 30-100HP Two Stage Product

Kaishan USA has recently expanded the product portfolio of the KRSP2 two stage product family by releasing 30-100HP size machines with PM motors and variable speed drives. These new models offer the highest energy efficiencies in the market for this size range and are excellent candidates for power rebates offered where available. All machines come standard with the same features that customers have become to expect including full sound attenuating enclosure, stainless steel control lines, TEFC motors, and the best “no hassle” warranty in the business which includes lifetime coverage on the airend. Warranty compliance is simple and only requires the use of genuine Kaishan parts and fluid along with taking fluid samples on regular intervals. No contracts or annual kit purchases are required for coverage. The product is supported with a full inventory of replacement parts and service 24 hours a day from the Kaishan USA headquarters in Loxley, AL.



*Kaishan Compressor USA,
www.KaishanUSA.com*

Atlas Copco AIRCUBE Compressed Air Packaging

Atlas Copco has introduced AIRCUBE – a containerized range of plug-and-play compressor rooms that was launched specifically to meet the needs of customers who have space limitations or restrictions within their current facilities. AIRCUBE delivers containerized compressed air facilities when and where they are needed, saving space in production facilities or eliminating having to wait for new buildings to be constructed, allowing businesses to ramp up their output quickly. Because the applications for compressed air containers are too diverse for a one-size-fits-all solution, AIRCUBE enables companies to select their own plug-and-play configuration by choosing from a wide variety of compressed air equipment and many different options. An AIRCUBE can be equipped with fixed-speed or energy-efficient variable speed drive compressor(s) with sizes ranging from 15-110 horsepower, depending on the models chosen.



Atlas Copco Compressors, www.atlascopco.com/air-usa

CCASS Certification Exam at Best Practices EXPO

Best Practices EXPO & Conference announced it will host several opportunities to become a Certified Compressed Air System Specialist through the Compressed Air & Gas Institute exam administered during the EXPO & Conference, November 2-4, 2021, at the Schaumburg Convention Center, Illinois. CAGI's personnel certification program for compressed air system specialists provides a means of verifying the capabilities of professionals in the compressed air systems industry. The program will allow customers, utilities, employers, and others to have confidence in the skills and abilities of the professionals in the industry who design, service, sell, and install compressed air systems and compressed air systems equipment. The program has been designed to comply with the ISO 17024 standard, Conformity Assessment – General Requirements for Bodies Operating Certification of Persons.



Compressed Air and Gas Institute, www.cagi.org

COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

Hanwha Power Systems Low-Flow Centrifugal Series

Hanwha Power Systems, one of the industry's fastest growing providers of centrifugal air and gas compressors, has launched a competitive and compact line of centrifugal air compressors for low flow requirements. Hanwha's Model SM2100 and Model SA2100 achieve high efficiency in a three-stage design at lower flow rates. The SM2100 and SA2100 can cover flow rates 700 CFM to 2000 CFM, and 700 CFM to 1750 CFM, respectively, in a pressure range from 50 PSIG to 150 PSIG. The SM2100 is a water-cooled compressor with minimized mechanical losses and improved efficiency over Hanwha's previous low flow models. The SA2100 is a highly efficient, air-cooled compressor that is especially competitive in areas with low water availability, cooler environments, or higher elevations. Both models secure a competitive edge in terms of efficiency, maintenance, and life cycle costs in the low flow air compressor market.



Hanwha Power Systems,
www.hanwhapowersystems.com

Turbowin WH Series High Speed Turbo Compressor

Turbowin's premium turbo compressor, the WH Series is designed primarily to save energy. Its air foil bearing allows it to operate with zero oil, and the unique combination of multi-stage compression, titanium impellers, ultra-high speed, high-efficiency permanent magnet motor and dual cooling system significantly reduce energy consumption. Able to achieve up to 8 bar of pressure, WH Series has an excellent cooling system that does not require any other cooling devices. Turbowin's Smart Turbo Compressors, the WH-i Series, apply IoT technology to turbomachinery. These can be connected to smartphones, tablet PCs, and laptops allowing users to simply control and monitor blower systems with just a touch of a button even in remote areas. All data are real-time measured and processed through our latest version of control system, which are then sent to users for monitoring purposes.



Turbowin, www.turbowin.com

ABB High-Efficiency Motors and Drives

In a new whitepaper published, ABB reveals potential for significant energy efficiency improvements in industry and infrastructure enabled by the latest and most high-efficiency motors and variable speed drives. ABB calls on governments and industry to accelerate adoption of the technology to help combat climate change. According to the International Energy Agency, industry accounts for 37% of global energy use and some 30% of global energy is consumed in buildings. While mostly hidden from public view, electric motors – and the variable speed drives which optimize their operation – are embedded in almost every built environment. They power a vast range of applications fundamental to our modern way of life, from industrial pumps, fans and conveyors for manufacturing and propulsion systems for transportation to compressors for electrical appliances and heating, ventilation and air conditioning systems in buildings.



ABB, www.abb.com

EPA 2020 ENERGY STAR Certified Manufacturing Plants

The U.S. Environmental Protection Agency announced that 95 U.S. manufacturing plants earned ENERGY STAR certification in 2020 for being among the most energy-efficient in their industries. By strategically managing their energy use while our country dealt with challenges of the pandemic, these ENERGY STAR certified plants saved nearly \$400 million on energy bills – equal to the payroll value of over 8,000 U.S. manufacturing jobs. They also avoided the consumption of 80 trillion BTUs of energy compared to average plants and prevented over 5 million metric tons of greenhouse gas emissions, equivalent to those from the energy use of nearly 600,000 homes. Since the first industrial facilities received certification 15 years ago, ENERGY STAR certified plants have significantly helped our economy and our environment, resulting in over \$6 billion in savings on energy bills and cleaner air by preventing over 65 million metric tons in greenhouse gas emissions compared to average-performing facilities.



ENERGY STAR, www.energystar.gov

COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

KTC Launches USA Location in Ohio

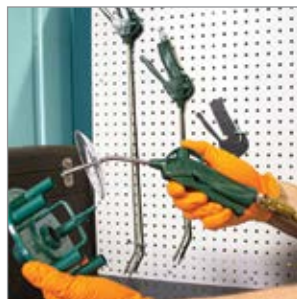
KTC rotary screw compressors recently launched the KTC-USA location in Northeast, Ohio joining our VMC-USA headquarters. KTC-USA will be located at 1209 Lowell St. in Elyria, Ohio combined with VMC-USA. We are starting with 10,000 square feet and have additional acres to expand. We are strategically located in the Midwest and will initially stock our range from 3 HP to 50 HP in various voltage, VFD, and system configurations. We currently offer up to 475 HP and a unique 2 stage design. KTC-USA will be serving the industrial and construction market segments throughout North America and will feature our world-class Compack rotary screw compressor line as one of our innovative products serving the construction market. Nicola Ceccon and David Statzer are leading the technical sales and support responsibilities.



VMC, www.vmc-usa.com

Exair VariBlast Precision Safety Air Gun

EXAIR's new VariBlast® Precision Safety Air Gun with Nano Super Air Nozzle provides a focused blast of air capable of handling tough jobs with remarkable strength. This CE compliant lightweight air gun employs an engineered variable flow trigger able to produce variable force upon a target simply by pulling the trigger. A comfortable full finger trigger and convenient hanger loop are built-in to this 1/4 NPT Safety Air Gun. The Nano Super Air Nozzle requires only 8.3 scfm and is made of Type 316SS or PEEK thermoplastic. The VariBlast Precision Safety Air Gun is available with a standard, 12" or 20" extension which can also be outfitted with an impact resistant polycarbonate Chip Shield. The air gun body is made of high impact, glass reinforced nylon.



Exair, www.exair.com

ENMET Carbon Monoxide Monitor & Air Filtration System

ENMET's Air Filtration Panels and Carbon Monoxide Compressed Airline Monitors are designed to comply with OSHA 29 CFR 1910.134 requirements for Grade D breathing air monitoring. Custom systems are available in protective enclosures that will deflect and protect ENMET breathing air equipment from hazardous environments providing continuous long-life operation. CO monitors include relays that activate auxiliary equipment, such as a strobe light and horn alerting users in the work area when a hazardous breathing air condition exists. ENMET offers a complete line of Compressed Airline Monitors for monitoring CO, O₂, CO₂, Dew Point and Total Hydrocarbon for complying with Grade D breathing air requirements.



ENMET, www.enmet.com

U.S. DOE Announces \$52.5 Million for IACs

The U.S. Department of Energy announced up to \$52.5 million for DOE's Industrial Assessment Centers that help American manufacturers and wastewater treatment facilities improve their efficiency, save money, and reduce their carbon footprint. These university-based training programs also create a pipeline for students looking to join the growing clean energy economy. The funding will be distributed through DOE's Industrial Assessment Centers, which are university-based programs that train students and offer no-cost efficiency improvement recommendations to small- and medium-sized manufacturing facilities. As part of the assessment process, participating students and faculty make recommendations for energy and water savings, waste reduction, productivity improvements, cybersecurity, and smart manufacturing opportunities for qualifying facilities – all while measuring their impact on greenhouse gas emissions. To date, the IAC program has provided nearly 20,000 assessments and more than 145,000 recommendations for improvement measures.

U.S. Department of Energy, www.energy.gov

COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

Emerson Range of Solenoid Valves

Emerson has launched a range of two-way and three-way solenoid valves that support original equipment manufacturers' need to develop more compact machines and equipment without compromising on fluid control performance. The optimized body design and internal flow path of the new ASCO™ Series 256/356 not only provides a smaller footprint, but also reduced power consumption and increased pressure ratings critical in industrial and commercial applications. The reduced overall footprint of the Series 256/356 helps OEMs optimize the internal layout of their equipment, enabling more high-performance fluid control options to be integrated into a smaller and sleeker final product. This is especially important for manufacturers of coffee machines and other beverage dispensers; heating, ventilation and air conditioning; pumps and compressors; welding equipment; and analytical and medical devices.



Emerson, www.Emerson.com

FLIR Extech Non-Contact High Voltage Detector

FLIR Systems announced the availability of the Extech DV690 its first non-contact high voltage detector with a detection range of up to 69,000 volts. The industrial-grade DV690 provides early warning alerts of energized electrical components for utility lineworkers, telecommunications installers, first responders, search and rescue teams, and tree removal services. The DV690 features five flexible mounting options: handheld, around the neck, clipped to a belt, strapped to an arm, or attached to a universal spline hot stick. The three handsfree possibilities allow the most optimal operation to efficiently and carefully complete a job. Using a hot stick creates a safer distance to target, extending operator reach. The DV690 also features a bright LED alarm and 106 decibels buzzer to notify users of the presence of dangerous voltage adding another layer of protection in hazardous conditions.



Extech, www.extech.com

SANPAR DTH Series Heatless Dryers

SANPAR Industries has introduced the DTH series heatless compressed air dryers with flow rate ranging from 5 to 5,000 cfm. The DTH dryer series can achieve a PDP of -400F and lower, based on customer requirements. SANPAR also meets customer requirements with tailor made designs, depending on air quality, operating pressure, temperature and compressor type.



Desiccants including molecular sieves, activated alumina or silica gel are employed to supply uninterrupted supply of compressed air conforming to ISO 8573.1 standards. The dryer requires less regeneration energy by using longer cycle time compared to its shorter cycle counterpart, saving adsorbents by lowering the number of load changes. DTH series is provided with coalescing and particulate filters to protect it from oil at inlet and particulate filter at outlet to prevent desiccant dust carryover into the system.

SANPAR Industries, www.sanpar.com

E+E Elektronik Air Velocity Sensor

The EE680 air velocity sensor by E+E Elektronik is used to monitor the laminar flow in cleanrooms or on safety workbenches. The sensor precisely measures the air velocity up to 400 ft/min and simultaneously the temperature. It meets the requirements of Good Manufacturing Practice and is therefore ideally suited for the pharmaceuticals, biotechnology, and microelectronics industries. The flow sensing element used in the EE680 is based on the hot film anemometer principle and enables simultaneous measurement of air velocity and temperature. It provides accurate values from as low as 20 ft/min and offers excellent long-term stability and low angular dependence. The special E+E sensor coating makes the thin film sensing element highly resistant to H₂O₂ sterilization and other aggressive cleaning agents. Factory multi-point adjustment of the air velocity ensures high measurement accuracy over the entire working range.



E+E Elektronik, www.epulse.com

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