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March 2022

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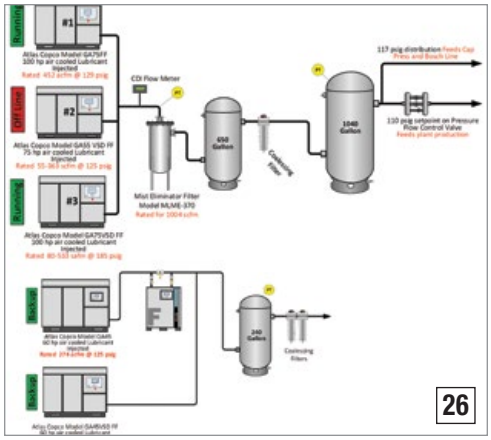

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FROM THE EDITOR

I would like to thank Héctor and Francisco Lara, from Airtec Servicios located in San Luis Potosí, Mexico, for sharing their twenty-five year experience working with a major automotive parts manufacturing plant. Our own Mike Grennier had the chance to interview them to learn how they helped this plant, located in Central Mexico, grow with reliable and efficient compressed air systems, through the partnership they shared.

"Selecting the Right Food Grade Lubricant for Your Air Compressors" is our second article, provided to us by Ingrid Ooms from Anderol. Food product manufacturers can use this as a guide to check what lubricants are being used in their air compressors.

The Grundfos Pumps facility, located in Fresno, California, worked with Frank Moskowitz to optimize their compressed air system for energy savings. Ron Marshall has sent us an article detailing the outstanding work realized by both Moskowitz and the team at Grundfos. Early results are showing a twenty percent (20%) reduction in energy costs, increased stability of pressure on critical machines and better redundancy.

We are very pleased to have Hank and Don van Ormer, from Air Power USA, return to our pages to begin a series of fundamentals-related articles. The first is titled, "Air Compressor Inlet Issues with Airborne Contaminants."

Lastly, we are accepting speaker abstracts for the Best Practices 2022 EXPO & Conference being held October 4-6, 2022 at Cobb Galleria in Atlanta. Abstracts can be sent to Clare Heinl at clare@airbestpractices.com. Save the date and visit https://cabpexpo.com for more information!

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

RODERICK M. SMITH
Editor
tel: 412-980-9901
rod@airbestpractices.com

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COMPRESSED AIR INDUSTRY NEWS

Motion Acquires Kaman Distribution Group

Motion Industries, Inc., a leading distributor of maintenance, repair, and operation replacement parts, and a premier provider of industrial technology solutions, has completed the purchase of Kaman Distribution Group ("KDG") for a purchase price of approximately $1.3 billion in cash. The strategic addition of KDG to Motion will significantly boost the latter's concentration in core industrial products and services as well as in the growing technical/automation arenas, including precision engineering. As a leading power transmission, automation and fluid power industrial distributor and solutions organization with operations throughout the U.S., KDG provides electro-mechanical products, bearings, power transmission, motion control and electrical and fluid power components to MRO and OEM customers. Headquartered in Bloomfield, Connecticut, KDG's 1,700 employees serve more than 50,000 customers.

"It's a very exciting time; this transformative move will be highly beneficial to everyone involved, especially for customers of our combined entities," said Motion President Randy Breaux. "Our customer service will be the best it's ever been with deepened and expanded capabilities. In addition, KDG shares many of our same cultural beliefs, principles and ambitions, including our commitment to providing superior service and value to our customers. We look forward to welcoming the highly talented KDG associates to the Motion team."

About Motion

With annual sales of over $6 billion, Motion is a leading industrial distributor of more than 10 million items. To increase customers' productivity, the Company offers many value-added services, including engineering, fabrication, repair, and Industry 4.0 solutions across these product groups. Motion North America has over 600 locations, including 25 distribution centers, and Mi Asia Pacific has nearly 150 locations, including eight distribution centers in Australasia. With approximately 9,000 employees, Motion serves more than 170,000 customers. Motion is a wholly owned subsidiary of Genuine Parts Company. Visit our website at www.Motion.com.

About Kaman Distribution Group

Headquartered in Bloomfield, Connecticut, KDG is a leading national distributor of highly engineered products and provider of related services with approximately 220 locations across the United States and Puerto Rico. Established in 1971, KDG's technical salesforce has been servicing its customers for over 50 years, providing components and systems for a broad range of applications, along with value-added automation, engineering and integration services. For more information about KDG, visit https://ec.kamandirect.com/.

Motion Industries, Inc. has completed the purchase of Kaman Distribution Group.

Atlas Copco Acquires Italian Distributor

Atlas Copco has acquired S.T.E.R.I. srl, an Italian compressor distributor and service provider located in the Turin area. STERI has 19 employees and mainly serves a wide range of local industrial companies in the Piedmont and Valle d'Aosta regions in Italy. The product range includes compressors, filters, and ancillary equipment.

"STERI has a strong market presence and customer base in the northwest of Italy," said Vagner Rego, Business Area President Compressor Technique. "Through this acquisition we will continue to build on our market presence in the industrial north of Italy."

The purchase price is not material relative to Atlas Copco's market capitalization and is not disclosed. The business will become part of the Compressor Technique Service division within the Compressor Technique Business Area.

About Atlas Copco Group

Our industrial ideas empower our customers to grow and drive society forward. This is how we create a better tomorrow. Atlas Copco is a global industrial group, founded in 1873 in Stockholm. In 2020 we had revenues of BSEK100 (BEUR 10) and at year end about 40 000 employees. For more information, visit www.atlascopcogroup.com.

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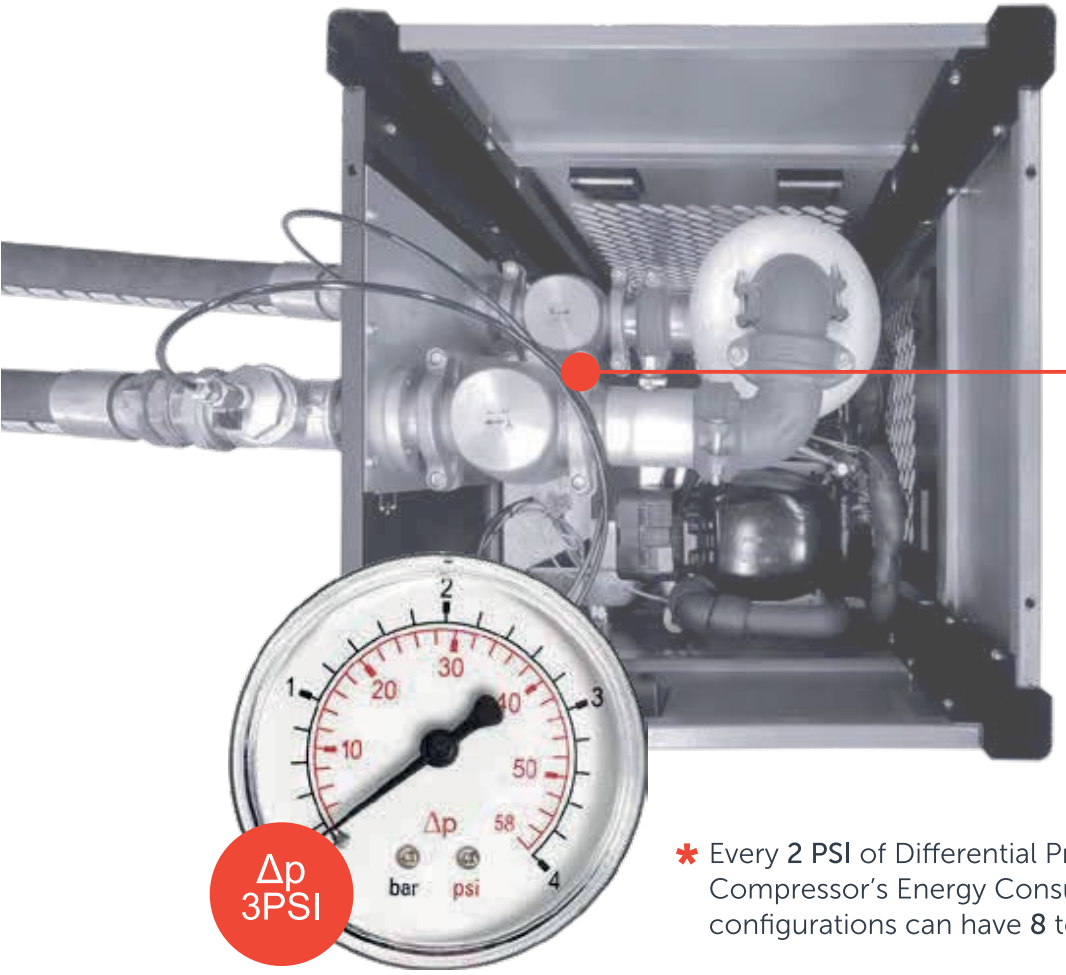
Manufacturing Forward

Save up to *5% Power from the Feed Air Compressor



Engineered and integrated Pre/Post Filtration with greater media surface

* Every **2 PSI** of Differential Pressure equals to **1%** of Feed Air Compressor's Energy Consumption. Other Filters and Dryer configurations can have **8** to **12 PSID** or more.

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Compressed Air Industry News

Kaeser Ships UPS Carbon Neutral

Kaeser Compressors, Inc. is excited to be a participant in the UPS carbon neutral program. Kaeser will absorb the additional cost of each shipment without passing the fees on to its customers. The money generated will be used by UPS to invest in carbon offset programs.

Kaeser believes that maintaining the quality of its environment is a shared commitment. "Our products not only operate with exceptional energy efficiency and maximum environmental-compatibility, but we also use natural resources as little as possible in production, sales and service," said Frank Mueller, president of Kaeser Compressors, Inc. "The UPS carbon neutral program is an additional tool for Kaeser to operate more sustainably on a daily basis."

Reliable offsets begin with accurate carbon calculations, and UPS calculates offsets based on actual shipping activity for envelopes, packages and freight. UPS's offset purchases neutralize the calculated carbon impact from shipping by reducing it elsewhere. A certified, market-based financial instrument, carbon offsets are designed to mitigate greenhouse gas emission through reforestation, methane and landfill gas destruction, wastewater treatment and other programs.

Kaeser is now a UPS carbon neutral participant.

About Kaeser Compressors, Inc.

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

UCA to Supply Compressed Air to Major Steel Producer

Universal Compressed Air announced the award of a contract with a major steel company to install a Compressed Air System at one of their world-class steel manufacturing plants in the United States. This further expands UCA's network of Plants in North America.

Universal Compressed Air to supply compressed air to major steel producer under long-term contract.

UCA will build, own and operate a state-of-the-art facility to provide up to 23,000 scfm of compressed dry air to the steel company under its long-term Pipeline Air™ performance contracting model resulting in significant savings and guaranteed reliability for the steel company. A Pipeline Air™ contract combines UCA's compressed air supply expertise with the capabilities of highly efficient centrifugal air compressors, heat of compression air dryers, closed loop cooling systems and master controllers.

Compressed Air Industry News

The unmatched performance of the UCA Compressed Air System provides the backbone of comprehensive power and reliability guarantees and truly positions compressed air as a utility for the steel company.

Due to these factors, the steel company contracted with UCA for their compressed air needs. UCA will execute the design, construction, commissioning, startup, maintenance and operations of the new plant. The plant design is highly modularized to shorten field construction time, which minimizes the transition within the steel plant's existing operations. Startup is planned for mid-2022.

More and more manufacturing companies in a variety of industries are realizing that Pipeline Air™ is a great way to outsource compressed air needs as a utility, save money, preserve capital, and focus on their core business. UCA is delighted to deliver Pipeline Air™ to a leader in the steel industry.

About UCA

Universal Compressed Air is a privately-owned and thriving high-technology business in Pennsylvania's Lehigh Valley focused on compressed air systems for industry. UCA brings decades of Industrial Gas expertise to Compressed Air Supply Systems. The systems are optimized to deliver compressed air as a utility and, in every case, an efficient and reliable solution will be designed and built to maximize savings. As a compressed air supplier, the systems are proven, trusted, and designed to optimize the end user's success. UCA's Pipeline Air™ enables large air users to benefit from a solution tailored to their site's specific requirements. For more information about UCA, visit https://UniversalCompressedAir.com/.

Xebec Acquires UECompression

Xebec Adsorption Inc., a global provider of clean energy solutions, announced it has closed the acquisition of all the outstanding shares of Colorado-based UECompression. Founded in 1983, UEC is a premier designer and builder of custom air and gas compressor solutions for power generation, industrial and energy applications.

The acquisition of UEC provides Xebec with a cost-effective and timely pathway towards expanding production capacity five-fold for standardized renewable gas systems while supporting UEC's legacy business as the operation continues its energy transition. In addition, Xebec's global manufacturing footprint is further optimized by bringing European gas generation products such as Hy.GEN to the U.S. and focuses UEC's facility on containerized and skid-mounted renewable energy systems. Furthermore, the acquisition increases the Cleantech Service Network coverage by six states to meet the increasing need for local service and support as the demand for standardized RNG and hydrogen systems accelerates.

Xebec expects that with limited changes to operations it can use UEC's excess capacity to produce approximately 150 to 190 containerized BGX Biostream™ biogas upgrading and Hy.GEN hydrogen units per year in North America. The new capacity

from UEC adds to recent capacity increases in Xebec's Canadian manufacturing facility.

"UEC helps Xebec solidify its position as a leading renewable gas player by adding a 100,000 sq. foot manufacturing facility in the U.S. With this acquisition, we are responding to the accelerating energy transition and the associated interest in containerized RNG and hydrogen systems. Furthermore, UEC's existing compression expertise in hydrogen will become increasingly relevant as the hydrogen economy develops. The acquisition will also help us in fully complying with current and evolving needs for local sourcing," said Kurt Sorschak, Chairman, President and CEO, Xebec Adsorption Inc.

The total consideration for the acquisition of the outstanding shares of UEC is of USD $8 million and is subject to certain holdbacks and adjustments. On a standalone basis, UEC is expected to have unaudited revenues of approximately USD $35.0 for 2021. With the introduction of containerized renewable natural gas and hydrogen systems and leveraging the Cleantech Service Network to support UEC's and Xebec's installed equipment base, Xebec expects to see significant growth for this operation over the coming years.

According to the United States Department of Agriculture and National Pork Producers Council, there are approximately 92,000 active dairy and hog farms in the U.S. The American Biogas Council estimates that approximately 8,574 of these farms are primed for biogas and renewable natural gas production with more than 98 farms already producing RNG for the local transportation market.

Xebec is focused on serving animal manure-based projects because of their ability to reduce emissions from agriculture, support local communities and recycle nutrients. Biostream is well positioned as a market leading solution for animal livestock operations as showcased with orders from top U.S. dairy developers which include an initial 18-unit order from the Brightmark and Chevron RNG partnership.

About Xebec Adsorption Inc.

Xebec is a global provider of clean energy solutions for renewable and low carbon gases used in energy, mobility and industrial applications. The company specializes in deploying a portfolio of proprietary technologies for the distributed production of hydrogen, renewable natural gas, oxygen and nitrogen. By focusing on environmentally responsible gas generation, Xebec has helped thousands of customers around the world reduce their carbon footprints and operating costs. Headquartered in Québec, Canada, Xebec has a worldwide presence with seven manufacturing facilities, thirteen Cleantech Service Centers and five sales offices spanning over four continents. Xebec trades on the Toronto Stock Exchange under the symbol. For more information visit, https://xebecinc.com/.

Compressed Air Industry News

Mtis is Launching in the U.S.A.

Korean specialist manufacturer Mtis Co., Ltd., supplies air and gas pressurized fluid systems in an integrated mechanical and electrical control package. It designs, manufactures, and tests in accordance with international standards and requirements for power plants, shipbuilding, offshore facilities, and petrochemicals of EPC projects that require various and rigorous specifications, and supplies systems to major EPC projects around the world.

Mtis' flagship products and services include hydrogen refueling stations, compressors and blowers, air and gas dryers, nitrogen generators, sound enclosures, portable compressors, and control systems.

Mtis installs and commissions hydrogen fueling station packages. It also sells and repairs a wide range of compressors and blowers and integrates and packages dryer accessories. They are designed and manufactured according to the needs of users. Mtis' nitrogen generator is based on adsorption technology, which produces high-purity nitrogen gas from the air for various industrial applications. Nitrogen gas produced on-site has the advantage of stable supply and reduces costs when purchasing other industrial gases.

Mtis' Propane Dryer.

Mtis responds to various customer requirements through maintenance and remodeling of supplied systems and manufactures to various specifications according to customer needs.

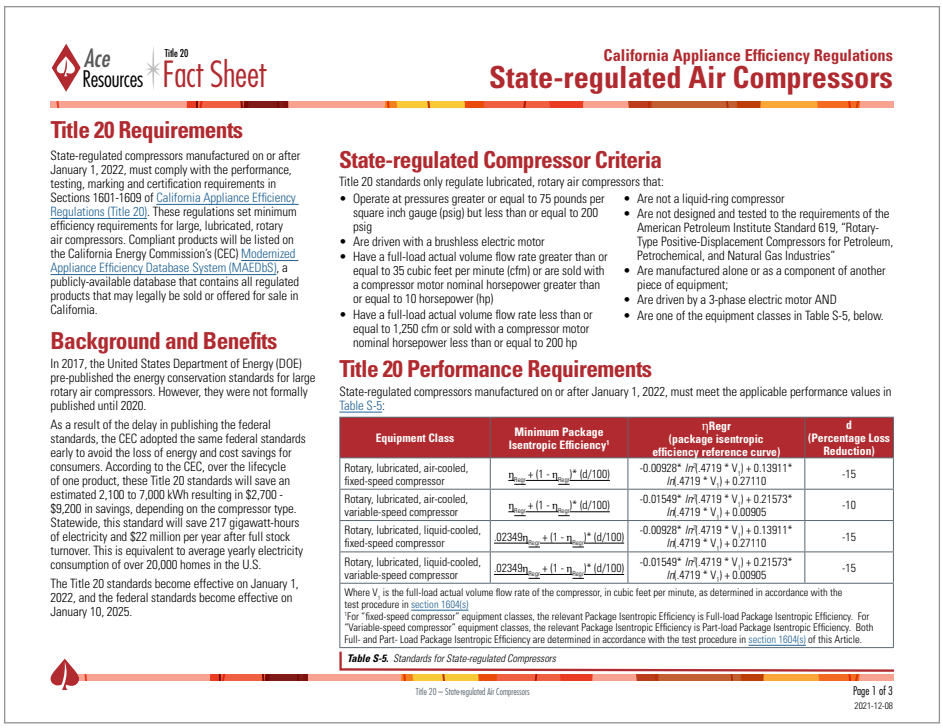
For more information, visit http://m-tis.co.kr/en

Energy Code Ace Publishes Title 20 Fact Sheet on Air Compressors

Energy Code Ace is offering no-cost help for complying with new regulations impacting the air compressor market. The California Appliance Efficiency Regulations (Title 20) for state-regulated air compressors becomes effective on January 1, 2022. Large, lubricated and rotary air compressors manufactured after this date must comply with the performance, testing, marking and certification requirements. These standards and test procedure requirements are identical to the federal regulations that will become effective on January 10, 2025.

While the compressed air industry has a long history of investing in energy efficiency improvements, the variety of new California Title 20 appliance efficiency regulations and U.S. DOE appliance standards can make compliance seem challenging. Fortunately, help is available at no charge to you. Applicable tools, training and resources are now available on EnergyCodeAce.com.

A detailed fact sheet explaining the upcoming Title 20 regulation for air compressors, including its scope, requirements and compliance process is now available for download.



Ace Resources Title 20 Fact Sheet

California Appliance Efficiency Regulations

State-regulated Air Compressors

Title 20 Requirements

State-regulated compressors manufactured on or after January 1, 2022, must comply with the performance, testing, marking and certification requirements in Sections 1601-1609 of California Appliance Efficiency Regulations (Title 20). These regulations set minimum efficiency requirements for large, lubricated, rotary air compressors. Compliant products will be listed on the California Energy Commission's (CEC) Modernized Appliance Efficiency Database System (MAEDbS), a publicly-available database that contains all regulated products that may legally be sold or offered for sale in California.

Background and Benefits

In 2017, the United States Department of Energy (DOE) pre-published the energy conservation standards for large rotary air compressors. However, they were not formally published until 2020.

As a result of the delay in publishing the federal standards, the CEC adopted the same federal standards early to avoid the loss of energy and cost savings for consumers. According to the CEC, over the lifecycle of one product, these Title 20 standards will save an estimated 2,100 to 7,000 kWh resulting in $2,700 - $9,200 in savings, depending on the compressor type. Statewide, this standard will save 217 gigawatt-hours of electricity and $22 million per year after full stock turnover. This is equivalent to average yearly electricity consumption of over 20,000 homes in the U.S.

The Title 20 standards become effective on January 1, 2022, and the federal standards become effective on January 10, 2025.

State-regulated Compressor Criteria

Title 20 standards only regulate lubricated, rotary air compressors that:

- Operate at pressures greater or equal to 75 pounds per square inch gauge (psig) but less than or equal to 200 psig
- Are driven with a brushless electric motor
- Have a full-load actual volume flow rate greater than or equal to 35 cubic feet per minute (cfm) or are sold with a compressor motor nominal horsepower greater than or equal to 10 horsepower (hp)
- Have a full-load actual volume flow rate less than or equal to 1,250 cfm or sold with a compressor motor nominal horsepower less than or equal to 200 hp
- Are not a liquid-ring compressor
- Are not designed and tested to the requirements of the American Petroleum Institute Standard 619, "Rotary-Type Positive-Displacement Compressors for Petroleum, Petrochemical, and Natural Gas Industries"
- Are manufactured alone or as a component of another piece of equipment;
- Are driven by a 3-phase electric motor AND
- Are one of the equipment classes in Table S-5, below.

Title 20 Performance Requirements

State-regulated compressors manufactured on or after January 1, 2022, must meet the applicable performance values in Table S-5:

Equipment Class	Minimum Package Isentropic Efficiency[1]	ηRegr (package isentropic efficiency reference curve)	d (Percentage Loss Reduction)
Rotary, lubricated, air-cooled, fixed-speed compressor	$\eta_{Regr} + (1 - \eta_{Regr}) * (d/100)$	-0.00928* *ln*(.4719 * V_l) + 0.13911* *ln*(.4719 * V_l) + 0.27110	-15
Rotary, lubricated, air-cooled, variable-speed compressor	$\eta_{Regr} + (1 - \eta_{Regr}) * (d/100)$	-0.01549* *ln*(.4719 * V_l) + 0.21573* *ln*(.4719 * V_l) + 0.00905	-10
Rotary, lubricated, liquid-cooled, fixed-speed compressor	$.02349\eta_{Regr} + (1 - \eta_{Regr}) * (d/100)$	-0.00928* *ln*(.4719 * V_l) + 0.13911* *ln*(.4719 * V_l) + 0.27110	-15
Rotary, lubricated, liquid-cooled, variable-speed compressor	$.02349\eta_{Regr} + (1 - \eta_{Regr}) * (d/100)$	-0.01549* *ln*(.4719 * V_l) + 0.21573* *ln*(.4719 * V_l) + 0.00905	-15

Where V_l is the full-load actual volume flow rate of the compressor, in cubic feet per minute, as determined in accordance with the test procedure in section 1604(s)

[1]For "fixed-speed compressor" equipment classes, the relevant Package Isentropic Efficiency is Full-load Package Isentropic Efficiency. For "Variable-speed compressor" equipment classes, the relevant Package Isentropic Efficiency is Part-load Package Isentropic Efficiency. Both Full- and Part- Load Package Isentropic Efficiency are determined in accordance with the test procedure in section 1604(s) of this Article.

Table S-5. *Standards for State-regulated Compressors*

Title 20 – State-regulated Air Compressors

Page 1 of 3

2021-12-08

A detailed fact sheet explaining the upcoming Title 20 regulation for air compressors is now available for download.

Additional applicable Energy Code Ace Title 20 offerings are described in the Compressor Industry brochure and include on-demand training for manufacturers detailing how to submit products to California's Modernized Appliance Efficiency Database System (MAEDbS), and on-demand training for retailers, distributors, contractors and importers showing how to navigate the MAEDbS to verify that products meet Title 20 and U.S. DOE requirements.

The Title 20 Reference Ace™ allows you to easily navigate the code using hyperlinks and a search function. Creating an Energy Code Ace account allows you to stay up-to-date on all Energy Code Ace offerings and Title 20 news with targeted emails. You can contact subject matter experts directly at title20@energycodeace.com for further assistance.

About Energy Code Ace

EnergyCodeAce.com is a "one-stop shop" offering no-cost tools, training and resources to help industry professionals and consumers meet the requirements of California's building energy code, Title 24, Part 6, and Title 20 appliance standards. It is funded by California utility customers under the auspices of the CPUC and implemented Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E®), Southern California Edison Company (SCE), and Southern California Gas Company (SoCalGas®) in support of the California Energy Commission. For more information, visit https://energycodeace.com/.

Compressed Air Industry News

Dalgakiran Group Shares its 2030 Vision

Dalgakiran Group, a leading Turkish manufacturer and exporter of industrial air compressors (including Hertz Kompressoren), has recently set global targets for 2030. To celebrate its 56th anniversary, the Dalgakiran Group Board of Directors gathered with Deputy Minister of Technology and Industry, Hasan Büyükdede, Deputy Minister of Trade, Rıza Tuna Turagay and global stakeholders at its "Vision 2030" meeting in Istanbul. Recently appointed as Chairman of the Executive Board, Steven Young shared his goals of

Rıza Tuna Turagay, Deputy Minister of Trade, Hasan Büyükdede, Deputy Minister of Technology and Industry, Adnan Dalgakıran, Group Chairman of the Board, and Steven Young, Board Member and Chairman of the Executive Board, Dalgakiran Group (left to right).

Adnan Dalgakıran, Group Chairman of the Board, and Steven Young, Board Member and Chairman of the Executive Board, Dalgakiran Group (left to right).

reaching $1 billion revenue and additional employment of five thousand people. Adnan Dalgakiran, Group Chairman of the Board, reflected on the history of Dalgakiran Group, then shared his beliefs in new management and further ambitions for the future.

"We have full confidence that Steven Young, one of the most valuable professionals in Turkey, will continue to set the bar even higher than when he first took over," said Dalgakiran. "With his vast experience and business knowledge, Steven will contribute greatly to the commercial development of Dalgakiran Group in domestic and international markets. Under Steven's leadership, our vision for Dalgakiran Group is to be recognized as a top-five organization in machinery and technology industries."

"Before I first approached Steven with the opportunity to lead this organization," continued Dalgakiran, "I asked myself, would someone as qualified as Steven – having already led large organizations successfully – be interested in this adventurous field? Shortly after, I received Steven's swift decision to accept the position, and lead our organization forward. My life philosophy is, if the excitement ends, life ends. It is very important that the journey is as enjoyable and exciting as the goal itself – because when you reach the goal, you're able to set new ones, so the continuous journey will pass with excitement. Life is also a journey. As Dalgakiran Group, we have decided to grow together with Steven Young. We have goals for 2030 – such as proving that this company can represent Turkey well as a strong brand in the machinery and technology industries. This is also important to me: if I prove to this country that what we have been saying for 20-25 years can be done, I will feel quite happy. Together with Steven Young, we will march strongly towards our new goals," said Dalgakiran.

"If we look at how technology has changed in the last 50-60 years and what awaits us, we will see there is a rapid and devastating trend occurring," said Young. "If you review the Fortune 500 list from 2000, you will find 52% of the companies no longer exist. In addition, 41% of companies on Turkey's 2000 ISO 1000 list no longer exist. Needless to say, we cannot be complacent with recent success, and must continue to raise the bar. Looking ahead, we will base our vision in three key elements – Branding, Global Footprint, and Technology. To achieve our vision, Dalgakiran Group has set a goal of becoming a top-five competitor globally by 2030. To put it quantitatively, we have a revenue target of $1 billion dollars. A global star is born from Turkey," said Young.

About Dalgakiran Group

Founded in 1965 in Istanbul Karakoy, Dalgakiran Group has grown with great momentum and introduced Turkish engineering globally. By combining its 55 years of experience and its first R&D center, Dalgakiran Group develops solutions suitable for the needs of its business partners and continues its sales and after-sales service operations in more than 130 countries. Continuing its manufacturing activities with its new 50,000 square meter integrated smart facility, Dalgakiran Group develops solutions for its global business partners through its main offices in Germany, the United States, Ukraine, and Russia. For more information, visit www.dalgakiran.com.

A Quarter Century of Positive Change at Automotive Supplier's Mexico Plant

By Mike Grennier, Compressed Air Best Practices® Magazine

➤ Long ago a major automotive supplier decided it would commit to using best practices and the most advanced, yet proven technology possible at its new manufacturing plant in Central Mexico in order to maintain its role as a trusted supplier to automotive makers throughout the world. Its strategy paid off.

Today, leading automotive makers rely on the plant for parts used to produce some of the most sought-after vehicles. Additionally, the nearly 600,000-square-foot manufacturing facility achieved ISO 50001 certification in 2021. Here's a look at how the plant grew for the better over more than 25 years – and its compressed air system along with it.

Rental Air Meets Temporary Need

To meet initial demand for windshield wipers mechanisms and other critical components, the international company adopted a two-pronged approach to increase production in Mexico. One approach involved construction of a new manufacturing facility. Simultaneously, it carved out space at a nearby sister plant to produce additional components during construction of its newest plant.

Production of more components at the sister plant required additional compressed air. As such, the automotive supplier looked to Airtec Servicios, San Luis Potosí, Mexico, to provide a solution. Given the temporary need for air at the plant, Airtec provided the company with a 75-horsepower (hp) rotary screw rental air compressor rated to deliver 375 scfm at 110 psi to supplement available air.

The performance of the rental air compressor and ongoing recommendations from Airtec regarding compressed air best practices marked the beginning of a long partnership between the automotive supplier and the compressed air services company.

Production Officially Kicks Off

Production at the new facility began in 1995 with an appropriately sized compressed air system designed by the facility's general

contractor. Peak demand for air at the time was 375 CFM. The system featured two, 75-hp rotary screw air compressors, each of which was capable of providing up to 375 scfm at 110 psi.

The system also included two refrigerated dryers, each with a Pressure Dew Point (PDP) of 39°F (4°C), as well as a 800-gallon dry receiver tank. Other components included a solid particulate pre-filter to filter air from the air compressor before it entered the dryers, as well as a oil coalescing after-filter to further filter air supplied to the receiver tank. The system, which operated in modulation with one air compressor meeting the bulk of the demand for air and the second serving primarily as a backup machine, supplied an ample amount of compressed air to the plant via a three-inch-diameter steel piping loop.

More Compressed Air with Stable Pressure

As expected, demand for compressed air grew at the plant from 375 CFM to 1,000 CFM by 2003. The growth necessitated a compressed air system upgrade. The automotive manufacturer subsequently hired Airtec for the project.

Based on Airtec's recommendation, the plant replaced the original air compressors with two 100-hp rotary screw air compressors, each rated to deliver up to 500 scfm of air at 110 psi. The new air compressors were installed in an existing glass-enclosed air compressor room with little room to spare.

To address the critical need for consistent and stable pressure, the upgrade also included a method for pressure-flow control, which included the installation of a 1,000-gallon wet receiver tank and a flow control valve downstream from the dry receiver.

Multiple dryers and an assortment of filters, as well as oil-water separators, address the plant's need for clean, dry air.

"The need for compressed air in this plant fluctuates significantly with low demand occurring during the weekend and third shift. Yet peak demand periods can require the compressed air system to deliver 1,000 scfm of air," said Hector Lara, President of Airtec, noting the plant needed stable pressure regardless of the fluctuations in demand. "The addition of the receiver tank and flow control valve allowed the system to provide consistent pressure to all users. Having periods of very low or very high pressure would otherwise create production problems."

On the new system, Airtec also installed a gladhand connection outside of the air compressor room so a rental air compressor

A Quarter Century of Positive Change at Automotive Supplier's Mexico Plant

The automotive supplier's compressed air system includes a flow control valve to support the need for consistent and stable pressure.

could be quickly connected in case one of the air compressors needed major work, or the plant needed additional air before implementing the next system upgrade.

Compressed Air Capacity Doubles

By 2008 the plant needed more compressed air to keep pace with increased production, and continued to add more sophisticated production capabilities including advanced robotic and pneumatically operated equipment.

To meet the need for 2,250 CFM of air, Airtec worked with the plant to double the size of the compressed air system and increase the size of the room to house it. The team added one, 100-hp rotary screw air compressor able to provide

up to 500 scfm of air at 110 psi and one 150-hp rotary screw air compressor able to produce 750 scfm of air at 110 psi to the existing system.

To power sensitive production equipment with clean and dry air, Airtec also installed a third refrigerated dryer rated to deliver air at 39°F (4°C) PDP and a desiccant dryer for delivering air at -40°F (-40°C) PDP. It also upsized the flow control valve to accommodate the delivery of more air.

Additionally, the upgrade included a master controller to manage which air compressors produce air and when – with the least amount of energy consumption. Additionally, the controller balanced runtime of the air compressors with the oldest units logging the fewest hours to minimize machine wear and tear and ensure maximum system uptime. The addition of a master controller also allowed the team to monitor system data for proactive maintenance and gain insight for ongoing system optimization.

Increased Production Drives Upgrade

In 2015 the automotive supplier set out to move production from a nearby sister manufacturing facility to the 600,000-square-foot plant, driving the need for yet another compressed air system upgrade.

To address increased demand for air of 5,250 CFM, Airtec added three duplex air compressors to the existing system. Two duplex units are fixed-speed machines, while the third is a Variable Speed Drive (VSD) machine. Each of the duplex air compressors is rated to deliver 1,000 scfm at 110 psi. In all, the compressed air system today consists of four fixed-speed air compressors and three duplex machines capable of delivering up to 5,250 scfm of air at 110 psi.

Airtec Servicios

Located in San Luis Potosí, Mexico, Airtec Servicios S.A. de C.V.'s mission is to exceed the quality expectations for services it provides for a wide range of industrial clients.

As a full-service compressed air company, Airtec offers complete compressed air systems in addition to rotary screw air compressors; advanced controls for automated compressed air optimization; dryers and filters; condensate management solutions, smart flow control valves; and compressed air system monitoring and measurement systems.

Its experienced staff of professionals are dedicated to fast response times and solutions designed to lower operating costs and deliver energy savings, while helping them protect the environment. For more, visit https://www.airtec-servicios.com/.

A Quarter Century of Positive Change at Automotive Supplier's Mexico Plant

To operate the air compressors as a cohesive network, the Airtec team upgraded the master controller. To efficiently deliver air, the VSD air compressor operates as the primary compressor and runs solo when needs are low. The controller adds fixed-speed air compressors when demand for air exceeds the capacity of the VSD machine. The VSD air compressor subsequently adjusts to meet fluctuations in demand while the fixed-speed units operate at 100% capacity.

The team also added two desiccant dryers, each of which is rated to provide air at -40°F (-40°C) PDP. Other measure to address air quality included the addition of oil mist eliminators

The large manufacturing plant's compressed air system grew to include three duplex air compressors.

A master controller (left) and a smart controller ensure the compressed air system efficiently delivers air at a stable pressure to plant users.

and oil-water separators. Also added were zero-loss drains.

Given the critical nature of stable pressure, the team added a 5,200-gallon dry receiver tank to the system and installed an eight-inch flow control valve to replace the six-inch valve. It also installed a smart controller to regulate the flow control valve. The system now delivers air to all users at 85 psig with a variation of plus or minus 0.5 psig.

Ongoing Improvement a Priority

Since the initial delivery of a rental air compressor, Airtec worked closely with the automotive supplier to ensure the most efficient operation of the compressed air system. It also guided the company through a host of best practices, including a leak detection and repair program and numerous compressed air demand-side initiatives.

"I believe the company today has a compressed air system that operates at optimal efficiency," Lara said, adding how the efficiency of the compressed air system played a major role in the plant's ability to earn ISO 50001 certification. The future, he said, points to ongoing changes toward more efficiency, reliability, and quality.

"It's a process," Lara said. "We're now working with them on giving even more attention to monitoring and measurement of factors like kW, pressure, and flow throughout the plant. It's constant improvement. It's constant change." BP

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Selecting the Right Food Grade Lubricant for Your Air Compressor

Ingrid Ooms, Global Technology Manager, Anderol B.V.

With many (food and drink) processors running their production 24/7, compressor equipment needs to provide optimal reliability and performance, with minimal downtime. It is essential that the right lubrication is applied.

Compressed air is a key energy source, trusted across the food and beverage industry for all aspects of production and processing – from transport and processing of raw materials through to the final stages of packaging and bottling. Clean and contaminant-free compressed air is vital.

Growing awareness of the importance of food grade lubricants for consumer safety and Hazard Analysis and Critical Control Point (HACCP) regulations, as well as increasing consciousness about Kosher and Halal registrations triggered an increasing demand for high performance food grade lubricants.

With so many different lubricants to choose from, selecting an appropriate lubricant for your compressor that boasts the specific properties can be difficult. The right solution means considering consumer safety and

enhanced performance, while also helping to reduce maintenance costs and downtime.

Standard mineral oil is unable to meet the greater demands that are now being placed on air compressor lubricants. Semi-synthetic and fully synthetic lubricants have excellent thermal oxidation stability, allowing for long machinery service intervals, and are able to cope with additional oil ageing caused by increased oil temperatures and downsized oil volumes.

The following offers a Good, Better, and Excellent guide to selecting the most appropriate food grade compressor lubricant for your equipment:

Good: Semi-Synthetic Lubricants

Semi-synthetic food grade oils offer an attractive blend of low cost and good performance. These are formulated from synergistic blends of severely hydrotreated, hydrocracked (Group III) base oils to provide a more refined, high-quality product.

They are enhanced with premium synthetic esters and proven additive technology, which help to improve viscosity, wear resistance at higher temperatures, and stress levels, as well as increasing their detergency properties – resulting in clean machinery lubrication. Semi-synthetic oils can easily last up to 4,000 hours, twice as long as the 2,000 hours achieved by standard mineral oils.

Semi-synthetic lubricants offer some of the most desirable characteristics of a premium synthetic lubricant at a significantly lower cost. This makes it an economically attractive choice for customers looking to take advantage of the benefits of synthetic oils over mineral oils without additional costs.

The Anderol® FG S lubricant series is a good example of a compatible semi-synthetic and there is no need for special precautions when switching from a mineral oil-based lubricant for use with paints, seals, gaskets and hoses.

Better: PAO Based Synthetic Lubricants

Synthetic lubricants offer excellent levels of performance and have many advantages over mineral oil lubricants. Rotary screw

Selecting the Right Food Grade Lubricant for Your Air Compressor

compressors, in particular, require a synthetic lubricant.

Polyalphaolefin (PAO) based lubricants are most suitable for compressors and they offer a series of advantages such as high temperature thermal and oxidative stability, high flash point and low volatility, as well as being hydrolytically stable.

At Anderol we offer the Anderol® FG XL Series which is a high performance synthetic food grade lubricant with improved detergency for compressors and vacuum pumps. Its nominal operating range is -40°C to 170°C and the performance time is up to 8,000 hours.

Excellent: PAO/Ester Based Synthetic LUBRICANTS

Companies are increasingly balancing efficiency and sustainability. Machine operators expect longer machinery service intervals and therefore longer-life compressor lubricants. Longer oil life properties result in simply fewer production stops, a higher production output, less oil consumption and reduced waste.

PAO/ester based lubricant offers the best of a PAO base, enhanced with a special ester to take additive solubility and the detergency of the whole formulation to a completely different level. This results in very low deposits and cleaner machinery which improves the lubricant's longevity and machine life.

For example, Anderol® SYNcom FG HiPerf 46 offers excellent viscosity to temperature behavior, has a wide operating temperature range (-40°C to 240°C), very low evaporation loss (<0.01% @100°C) of 22hrs according to ASTM D 972, and a very good film strength. This oil can last an entire maintenance cycle.

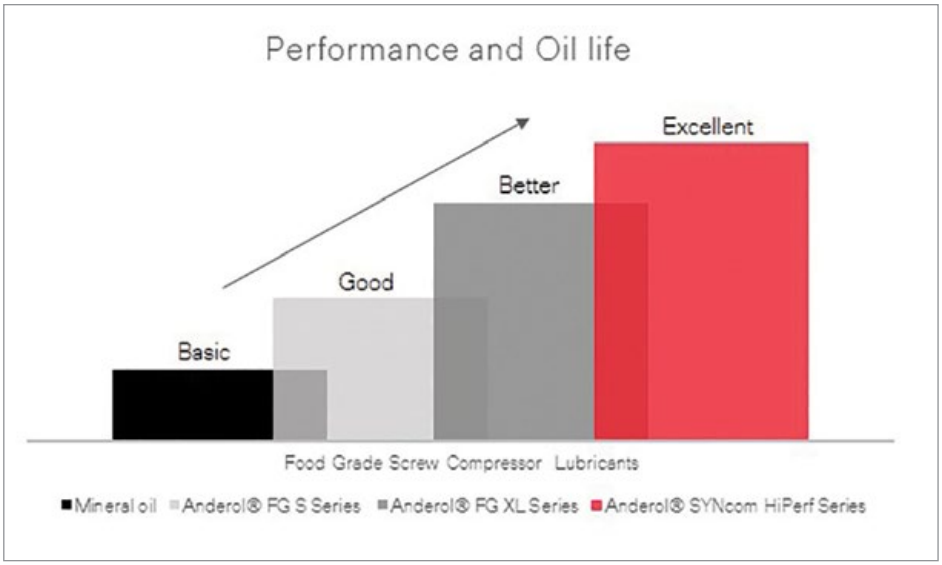
Extreme Environments

Very humid and acid environments require a special lubricant that does not hydrolyze at high temperatures, form sludge, or attack the seals and paints.

To meet these requirements, Anderol B.V. has developed C-NRT FGC for compressors and C-NRT Plus FG for vacuum pumps, which are inert to the reactive gases found in the more challenging compressor and vacuum environments. Anderol® C-NRT lubricants are full cyclic aromatics or mixed with a synthetic hydrocarbon base specially formulated to increase service life in aggressive environments.

Not only will this product withstand attacks of aggressive gasses and resist rapid breakdown, it is also capable of keeping the deposits in solution which has not been seen with any other mineral/ester/PAO based product in these circumstances. The thermal and oxidative stability of the base fluid together with oxidation inhibitors, extends the lubricant life at elevated temperature conditions.

Inert products do not degrade at the same speed as other lubricants in harsh conditions, thereby dramatically increasing the service life of the compressor or pump. They are specifically designed to provide inertness and long-term lubrication in applications, where contact with (reactive) chemistries cannot be avoided. Thanks to its excellent detergency effect deposit/lacquering formation is avoided.



Delivering Cost Savings

Synthetic high-performance compressor lubricants offer significant savings. Although the cost of synthetic lubricants may be higher, their benefits offset the initial outlay to offer an excellent return on investment.

Oil and filter replacement is minimized, disposal costs are reduced, and less maintenance brings down expensive labor costs. In addition, they improve machinery protection, reducing production stops and downtime and increasing productivity and output. BP

About Anderol B.V.

Anderol® is a specialty lubricants product line and brand within the Lubricant Additives Business Unit (LAB) from LANXESS. Anderol B.V., the European producer of Anderol® products, is a wholly owned subsidiary of specialty chemicals company LANXESS. All Anderol® Food Grade Compressor lubricants are NSF H1 Registered, produced in an ISO 21469 certified plant and Kosher and Halal certified. Anderol B.V. has a proven track record and over 80 years of experience specializing in compressor and food grade lubricants. Find out more about our food grade lubricants and our customized solutions at https://anderol.com

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Compressed Air Assessment at Grundfos Finds Big Energy Savings

By Ron Marshall, Marshall Compressed Air Consulting

A compressed air assessment conducted by Draw Professional Services, a division of Atlas Copco, at the Grundfos Pumps facility located in Fresno, CA has found some significant improvement opportunities. The company manufactures centrifugal pumps and hydraulic components at this facility. Grundfos is the largest pump manufacturer in the world, based in Denmark, with more than 19,000 employees globally.

As part of the Grundfos corporate goals, the company has always focused on sustainability, and this carries through to their compressed air system, plant management wanted to ensure their system was fully optimized to ensure minimize wasted energy. The system already consisted of a combination of fixed speed and variable speed drive air compressors, making the supply side efficiency very good, however, a detailed look at their compressed air system components and end uses showed some surprising improvements could be made to greatly increase efficiency, improve reliability, and reduce costs.

Background

The system consists of two separate, but interconnected, compressor rooms located in Building 1 and 2 shown in Figure 1. Five lubricated screw compressors are available for

Grundfos Compressed Air Baseline Energy running 100 hp fixed speed and 100 hp VSD using $0.195/kWh							
Daytype	Total OpHrs	Avg Airflow, acfm	Avg Airflow, %Cs.	Peak Demand, kW	Load Factor, %	Annual Energy, kWh	Annual Energy Cost, $
Mon - Fri	6,240	613	45.3	153.5	50	777,322	$151,578
Sat	1,248	357	26.4	81.5	28.2	87,578	$17,078
Sun	1,248	340	25.2	99.9	27.6	85,862	$16,743
System Totals	**8,736**	**537**	**39.7**	**153.50**	**43.7**	**950,763**	**$185,399**

Grundfos baseline calculations.

service, but the Building 2 compressors are designated as spare, not normally operating. One of the two variable speed drives in the main compressor room was down for repairs during the assessment. All the compressors except one have air dryers installed within the compressor enclosure. The air output of the compressors is filtered by mist eliminator filters, and some additional fine coalescing filtration. The system had storage receiver capacity totaling only 1,700 gallons located upstream of a pneumatically controlled pressure/flow controller and minimal general storage capacity in the Plant 2 building. Certain specific production areas in Plant 1 require higher than normal pressure, so a special tap was installed on the high-pressure side of the pressure/flow controller to feed this need. The assessment found that the flow controller was not regulating properly, causing pressure problems in both buildings.

Data loggers were placed for a period of two weeks on the system to monitor system pressures at various critical points, compressor/dryer power, and system flow. During the plant assessment it was noticed that various important machines were experiencing periods of low pressure, so special detailed pressure testing was done to determine the causes.

Analysis of the pressure data logging (Figure 2) showed that, while the variable speed drive compressor maintained a constant discharge pressure near 120 psi, the pressure at various critical points fell to as low as 85 psi during peak production operations. General pressure in the plants, especially Plant 2, fluctuated between 102 and 112 psi, showing that the pressure/flow control valve was not regulating properly, and that Plant 2 lacked enough general storage volume to support transient flows. Plant personnel were also reporting frequent production outages, affecting plant throughput, caused by pressure fluctuations.

"We found three production machines in the plant that required higher than desired compressor discharge pressure. Two of these were simply caused by undersized supply filters and regulators. And one required such low flow it could be supplied using a pneumatic pressure

Compressed Air Assessment at Grundfos Finds Big Energy Savings

amplifier", said Frank Moskowitz, lead auditor, "Once these problems were addressed, we found it would be possible run the whole plant with 100 psi discharge pressure."

Special Pressure Testing

Typical data logging with slower sampling frequency does not capture the required detail to properly assess transient pressure losses caused by undersized components, so special testing was done in problematic areas at a higher data logger sample rate. Figure 3 shows the results of the testing on a screw machine

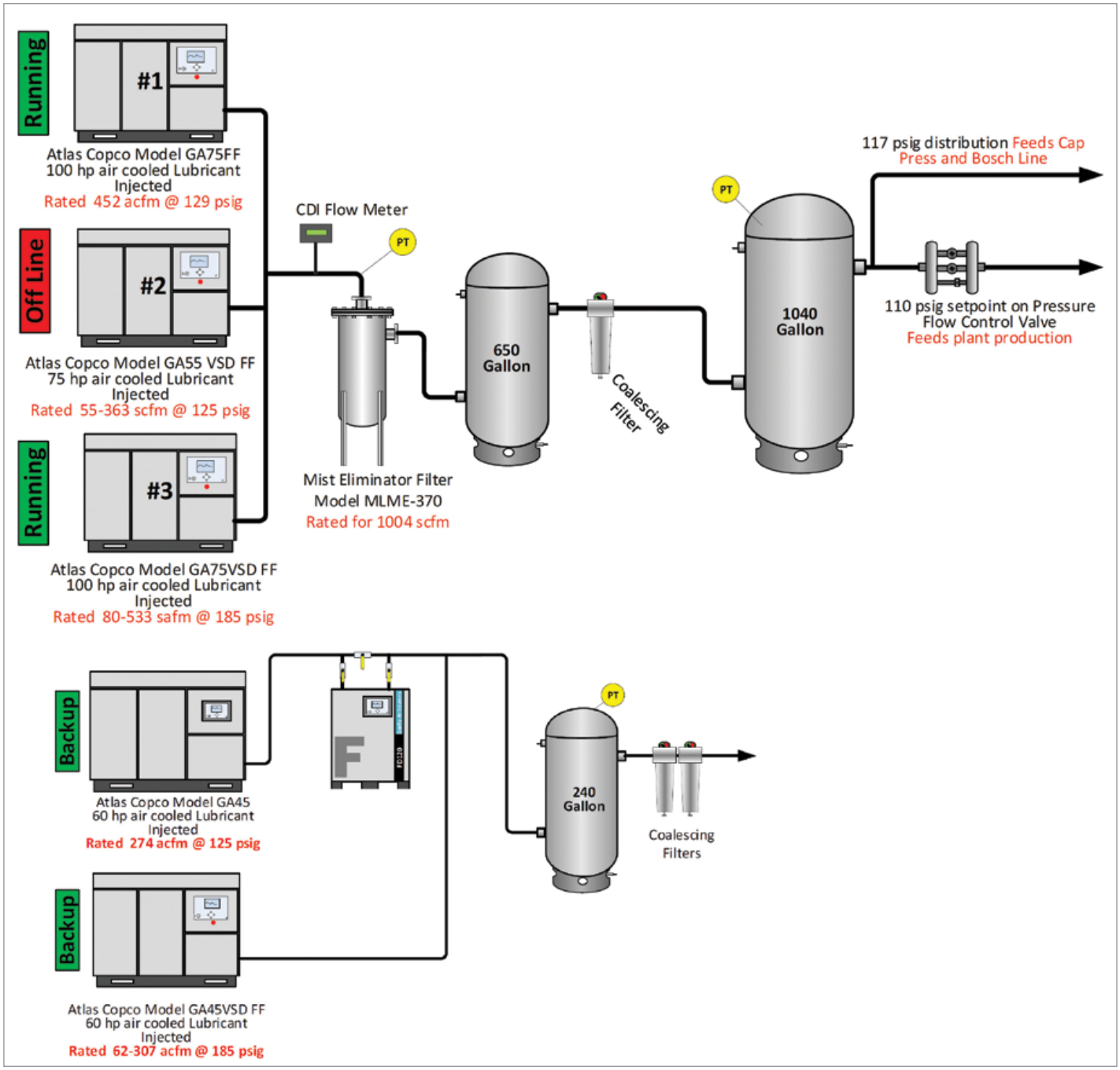

Figure 1. Two separate but interconnected compressor rooms exist, one in each building. The main compressor room had a pressure/flow controller to reduce the pressure in the plant, but also a high-pressure tap running to critical production processes. The coalescing filters were causing excessive pressure loss and were found to be redundant.

EEM -- Use Automatic Sequencer and operate at 100 psig, Reduce 50 scfm of additional leakage, Replace Air amplifiers with electric							
Description	Energy Savings, kWh	Energy Savings, $	Energy Savings, %	Demand Savings, kW	Installed Cost, $	Total Savings, $	Simple Payback, years
Use Automatic Sequencer	231,591	$45,160.00	24.4	31.8	$36,300.00	$45,160.00	0.8
Reduce Air Leaks by 50 scfm	64,661	$12,609.00	6.8	7.4	$0.00	$12,609.00	0.0
Replace air amplifiers with electric blowers	122,592	$23,905.00	12.9	13.8	$800.00	$23,905.00	0.0
TOTALS	**418,844**	**$81,675.00**	**44.1**	**53.1**	**$36,800.00**	**$81,675.00**	**0.5**

The assessment report recommendations showed that significant potential savings are possible by lowering discharge pressure, better controlling the compressors, and reducing compressed air waste.

done at a one second sampling rate, the large pressure drop is caused by an undersized supply filter and regulator, and a lack of storage capacity. This problem only appears when the machine is consuming air, and goes away when flow stops, shown by the high low-pressure steps. Properly sizing these supply components and adding some small local storage receiver capacity and a pressure amplifier as shown in Figure 4 corrected the problem, allowing the compressor discharge pressures to be reduced.

Assessment Results

The analysis of the data collected showed the following baseline:

A thorough machine-by-machine inspection found a number of potential inappropriate uses including air blowing and vacuum generation. About 275 cfm of non-production flow was seen during weekend operation, most of this attributed to leakage. Detailed research and calculation showed the following could be done to significantly reduce operating costs and stabilize plant pressures:

- Use an automatic sequencer to stage compressors and set a lower target pressure at around 100 psig. The sequencer would automatically start backup compressors in case of failure of any main unit.
- Replace blowing nozzles on four machines for cooling parts with motor driven air-cooling fans.
- Purchase and install a pneumatic amplifier for the high-pressure application which will allow the rest of the plant to operate at the lower setpoint pressure.
- Replace the existing regulators for screw machines with high flow regulators. Add small surge tanks for pressure support.
- Remove the secondary coalescing filter at the main pad.
- Remove the pressure flow control valve or bypass it at the main pad.

Compressed Air Assessment at Grundfos Finds Big Energy Savings

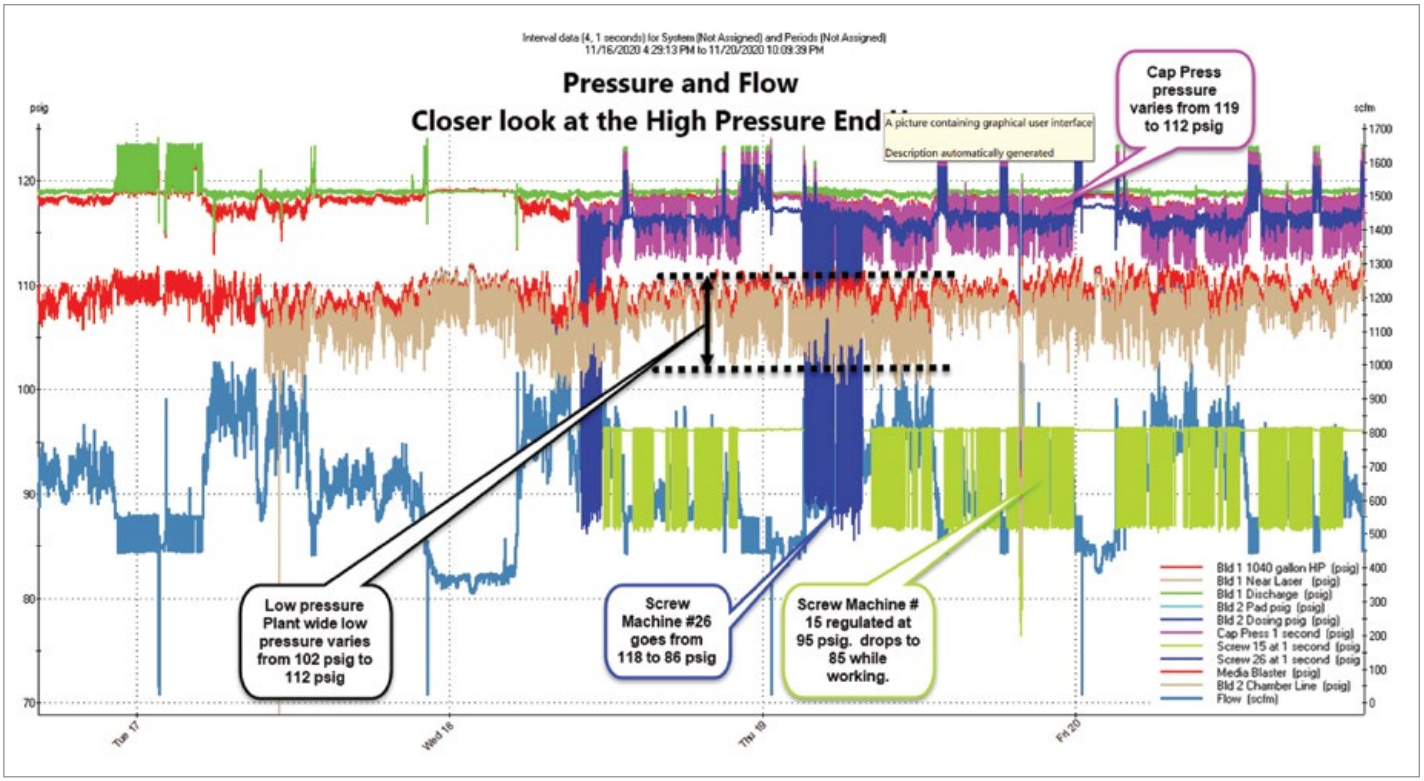

Figure 2. Plots of the various critical system pressures show low and variable main system pressure in Plant 2 and highly variable pressure on critical machines.

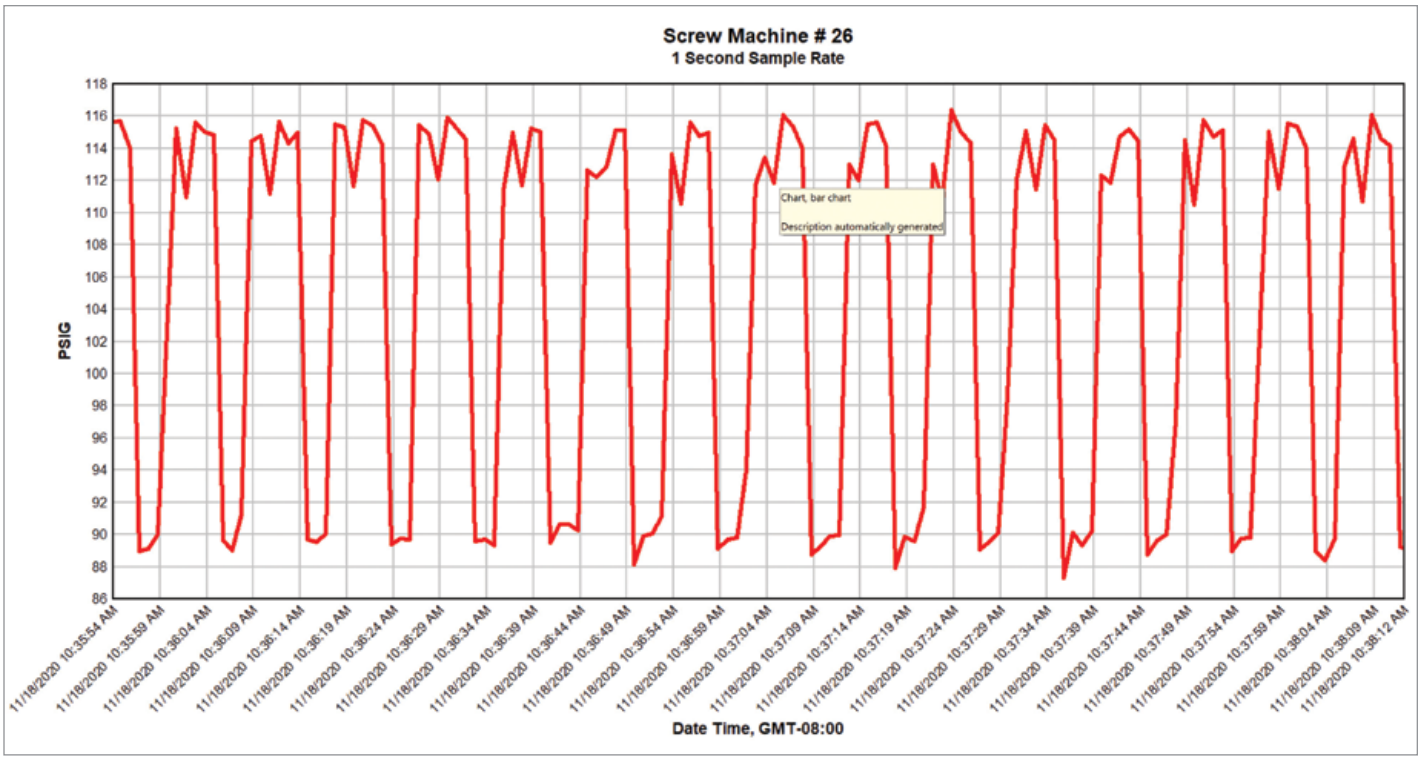

Figure 3. When this screw machine starts consuming air the pressure drops significantly, causing production problems. This forced the plant personnel to increase compressor discharge pressure which wastes energy.

- Purchase and install a 2,560 gallon receiver to be used as a dry side receiver volume to stabilize pressure in Plant 2.
- Add 650-gallon storage tank at a large sand blaster to stabilize pressure caused by high flow.
- Replace open blowing plastic tubes with engineered nozzles. This will maintain the required blow with reduced airflow.
- Raise awareness of employees on compressed air cost. They should shut off equipment when not needed. Investigate automation such as solenoid valves that shut off air when not being used.
- Purchase a leak detector and use it in a focused waste reduction effort. Reduce air leaks by 50 cfm (just a starting point).

Potential Savings Calculations

Based on the main recommended measures the following are the estimating savings for the various measures as calculated by the AirMaster+ program:

Currently the project is nearing completion and preliminary estimates show the lower discharge pressure and reduced flow has changed the specific power of the compressors from 20.2 kW per cfm to a new level of 18.2 kW per cfm for a reduction of about 10 percent in production energy consumption per unit output. Overall, the energy reduction, including flow reduction is currently crossing the 20 percent level and expected to increase to higher levels.

Furthermore, the system has become more reliable, because there is now enough automatic-start backup to ride out the failure of any one, perhaps even two main compressors. And one of the best benefits of all the changes is the increased stability of the pressure on critical machines and in other production areas. New well sized components and large localized storage receivers ensure that production continues without a hitch, making it possible for Grundfos to pump out more and better product in the coming years.

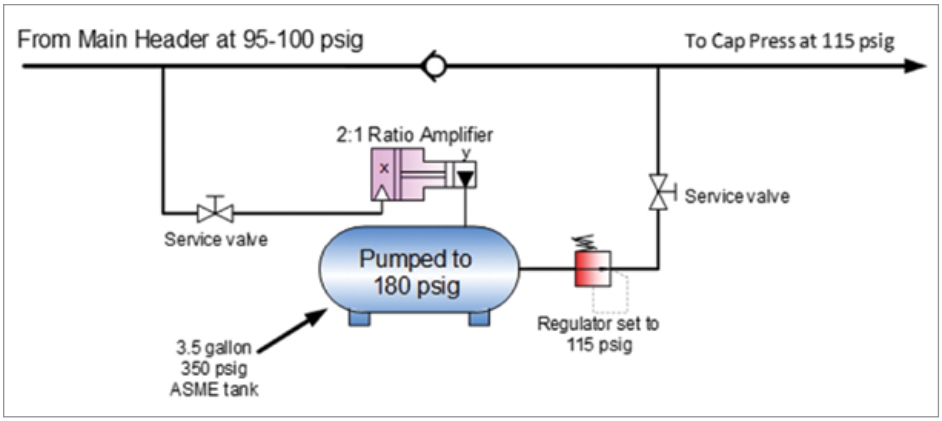

Figure 4. Properly sizing the filter, regulator, lubricator components, and installing small local storage reduces the pressure loss, allowing the compressor discharge pressure to be reduced.

Compressed Air Assessment at Grundfos Finds Big Energy Savings

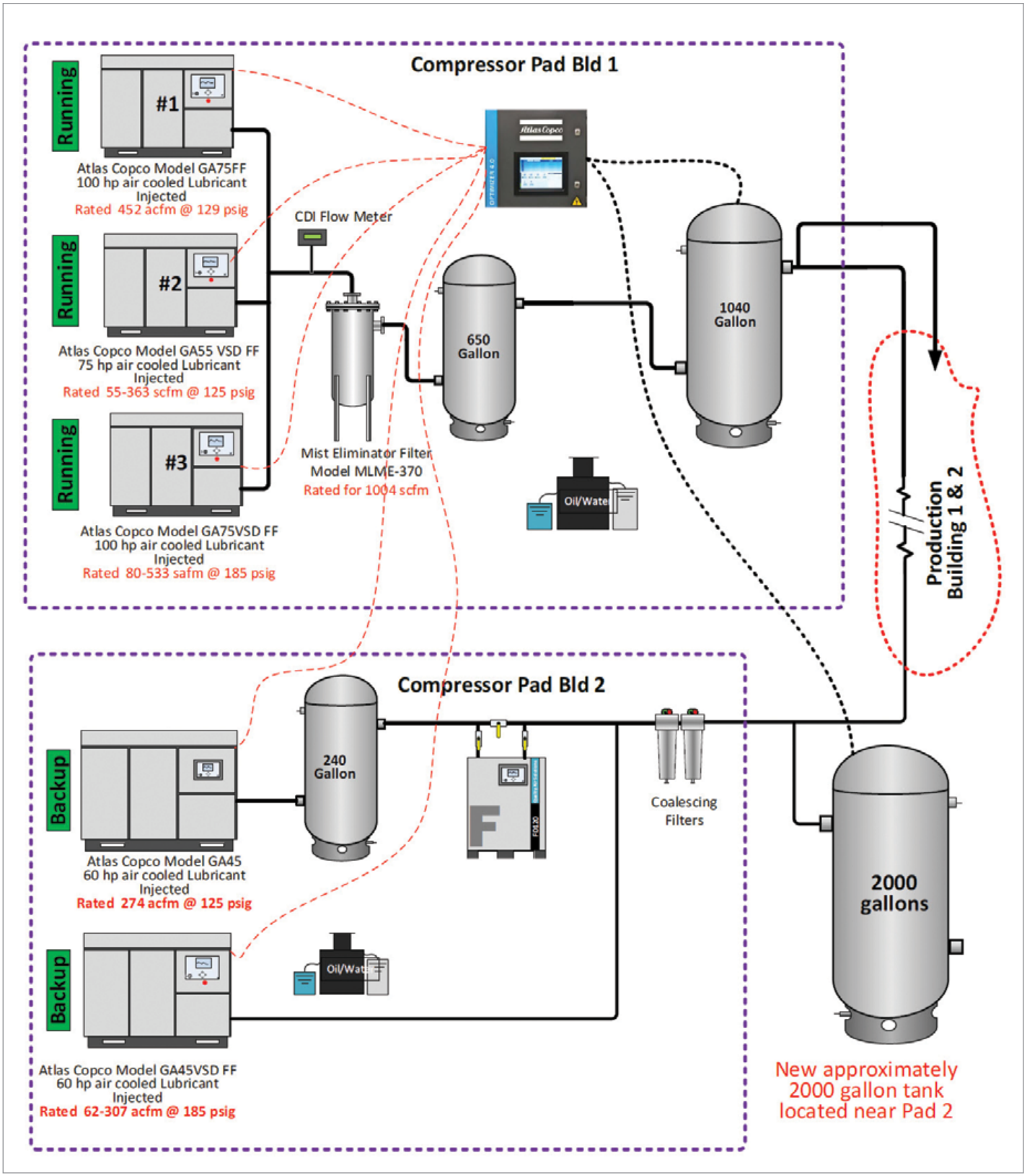

Figure 5. Final arrangement of compressor rooms showing coordinated control at a lower 100 psi pressure.

Conclusions

The results of this assessment show that simply having VSD compressors and a pressure control is no guarantee of high efficiency. It is always best to have an expert compressed air auditor assess your system by carefully measuring with data loggers and performing a detailed plant walk-through. Often, unexpected conditions will be uncovered that, if corrected, will bring significant benefits to plant production throughput and energy costs.

Says Moskowitz, "I'm very impressed with the compressed air improvement team at Grundfos, we do many compressed air assessments per year, but it is quite rare to have a client agree to do all of our recommendations, and also come up with more of their own."

"We are happy we relied on the experts in the field to tell us how to improve our air systems. I knew we were on the right track and the results show it." said Sean Wolfe, APU Manager at Grundfos, "We continue to make improvements in our compressor control, have expanded our efforts to reduce leaks, and now are going to move forward with a weekend shutdown schedule to reduce energy (in our down time)." BP

For more information about this article, contact Frank Moskowitz at Draw Professional Services tel: 602-809-4195, website www.drawproservices.com.

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

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

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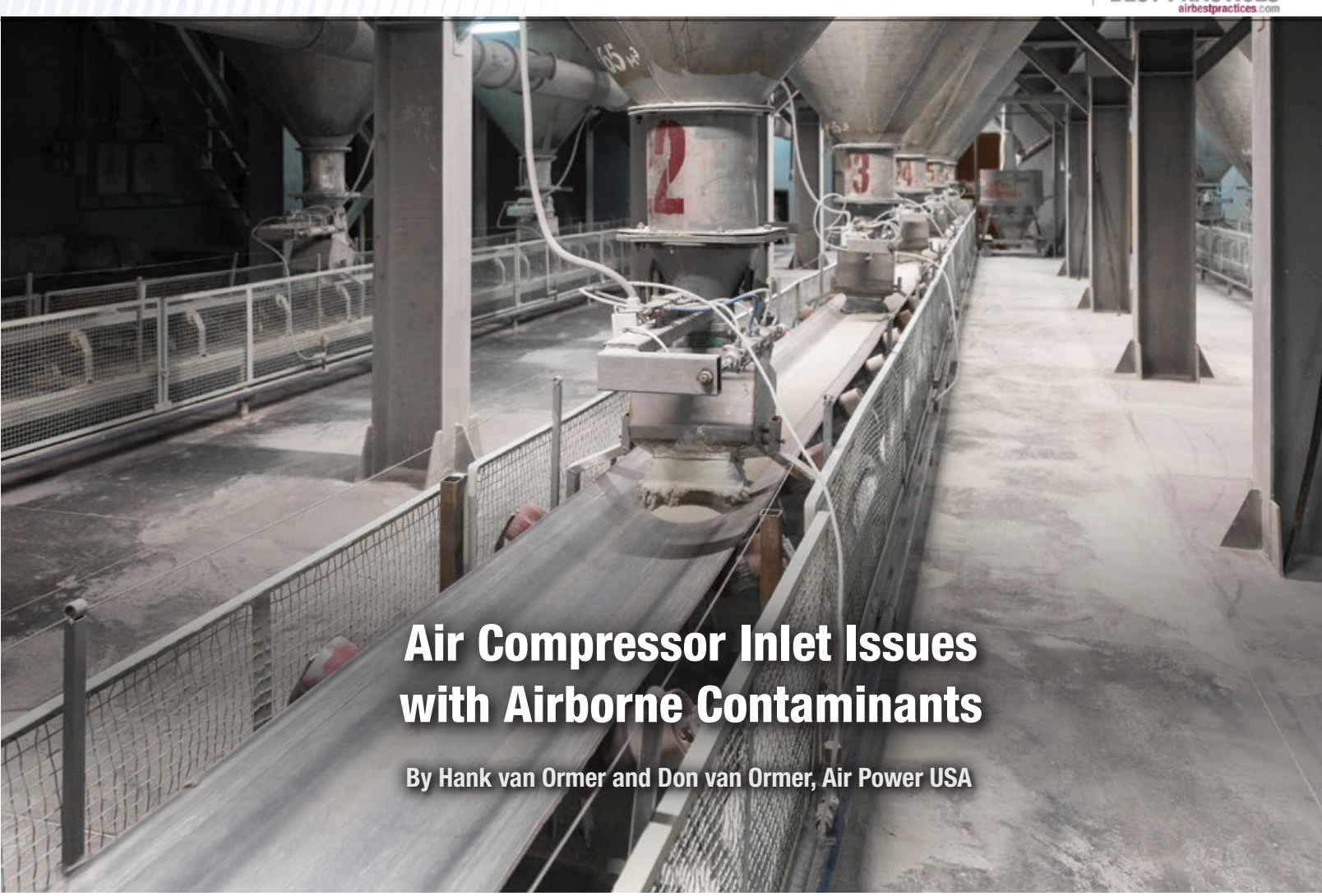

Air Compressor Inlet Issues with Airborne Contaminants

By Hank van Ormer and Don van Ormer, Air Power USA

As production machinery and processes continue to evolve more, and more industries are requiring cleaner and drier air for both machinery reliability and product integrity. Line speeds and productivity continue to accelerate; anything that stops production or significantly slows it down can have very expensive aftereffects. Product contamination cannot only lead to expensive scrap levels but even worse, very expensive recalls.

Just as many ambient air issues with regard to the actual equipment operating environment are created by personnel and can be corrected by personnel, inlet air contamination is always created by humans and there is almost always a correction that will either eliminate the issue or mitigate the effect.

Airborne particles are usually a very straightforward contaminant that is often ignored. The compressor OEM installs an inlet air filter (Figure 1) usually rated for "standard conditions" which most often means 99% removal of all particulate 5-micron and larger, and 95% removal of all particulate 3-micron and larger.

Normal life of these elements is expected to be two months to six months. When high dust applications are encountered such as corrugator plants, mineral processing, etc., the high dust will usually be quite visible and a multi-stage high dust version of the inlet filter is used which usually includes a pre-cleaning area where the heavier dust loads fall out

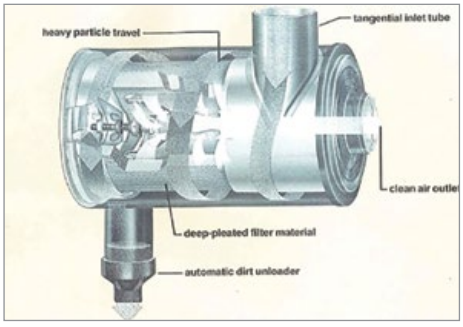

Figure 1. Typical high dust filters.

Air Compressor Inlet Issues with Airborne Contaminants

and are removed before they get to the main filter element.

Today, most units use dry filter cellulose paper, however on large units with relatively stable inlet flows there still may be oil wetted screen filters in use.

A major, not so obvious problem with compressor inlet air is not the visible high dust, but rather when the inlet air ambient area has very small fines (<3 microns smaller) which pass through the standard filters. A good example of this is manufacturing of automotive catalytic converters which fills an ambient area with a high concentration of very small fines. These fines pass through the inlet filter and shortened the normal one to two-year separator life of a lubricated rotary to often two months or less.

An example was at a catalytic converter plant where the first resolution attempt was an oil bath filter which didn't do a good job because it only wetted the screen properly at high flows. The compressor was at modulation control with constantly varying flows, and at low loads everything passed through even worse resulting in as low as one month separator life.

The final fix was a high quality, oversized dry filter with an oil wetted pre-filter screen. The screen was kept oil wetted by a pneumatically aspirated oil spray. It was effective in trapping the fines and had

Figure 2. Typical lubricant-cooled rotary compressor air/oil separator.

to be manually cleaned about once a week, but, the separator problem went away.

Rated at 3 micron filtration which constantly removes the oil aerosols from the air flow going to the user. Normal life is one to two years but poor ambient conditions can adversely affect this life.

Often Overlooked: The Effect of Ambient Particulate Contamination on Air Cooled Heat Exchangers on Compressors and Dryers

The obvious effect of damage inside an air compressor of any type from particulate contaminants is not the only problem in compressors and dryers from ambient particulate contamination. There is the outside fouling or plugging of all air cooled heat exchangers such as oil/coolant air coolers, air cooled aftercoolers, electric motor cooling, and certainly air cooled condensors on refrigerated dryers. The negative impact of this has been addressed on performance and machinery reliability. Now, what can be done about it?

Package Pre-filtering – many air compressor units are packaged in full sound and ambient controlled enclosures. When this is the case, all incoming cooling air and inlet air to the compressor can be pre-filtered with material and methods appropriate to the identified contaminants before they enter the compressor package (Figure 3).

The same panel type or air handling room filtration can be applied to total compressor room pre-filtration; much of which is seen now in laboratory and even powder paint installations.

The simplest action of all is to identify the source of the contaminant and either, eliminate the source, move the source, or move compressor location.

Aggressive airborne vapors and gases are also often overlooked and hard to find contaminants and, depending on the situation, can do the very expensive damage.

Remember that the contaminant vapor or gas comes in with the air at a certain concentration with the inlet air, and as the contaminant vapor is compressed to a smaller volume, the concentration of the contaminant is increased. These contaminants, their sources and their results can vary greatly. For example:

Air Compressor Inlet Issues with Airborne Contaminants

Figure 3. Heating cooling air.

- Hydrocarbons entering through the compressor inlets and migrating through to product contamination (food, paint, etc).
  - A commonly overlooked source may be an outside wall on a parking lot or roadway with constant automotive exhaust
  - Operating forklifts in the area where the engine exhaust is taken into the compressor
  - Furnace or other similar exhaust flue air migrating to the compressor area ambient.

This list could go on and on, but what is to be done if you can't avoid or eliminate after the source is identified?

The quickest and most practical way is to install an appropriate carbon filter, designed to adsorb the identified vapor contaminants after the compressed air dryer and primary filters – problem solved. Depending on the magnitude of risk, you may want to change filters on a predetermined regular basis or install a trace measurement system downstream to alert. Most if not all these type of filters will not have a physical signal (like measurable change is ΔP pressure loss) that it is saturated.

Aggressive Caustic or Acidic Vapor That May Become More Aggressive Once Inside the Compressor

Some of the more well-known aggressive vapor contaminants such as fluorides and chlorides are usually avoided by location as well as such items as cleaning acids, caustics, etc. However, in many cases the compressor room, particularly when well-designed, appears to be very spacious in a crowded plant, but often becomes a storeroom for various plant supplies. It is not unusual to see such items as water cooler cleaners (usually acid), water treatment supplies, stored in or near the compressor and dryer ambient air.

A soft drink syrup plant was experiencing a great deal of problems with the extreme short life of their food grade lubricant coolant (PAO). It was found that water treatment chemicals were being stored with open containers right next to the compressor. After further investigation, it was determined this to be the basic cause and the plant was warned that there would be an excellent chance that further damage would be incurred to critical internal parts.

Figure 4. Typical main line compressed air carbon filter for vapor adsorbtion.

Plant personnel did not agree until it was pointed out that all copper piping was now green from exposure to the

ambient air. Once the chemicals were moved, the problem disappeared.

Other Benign Vapors that Can Easily Become Aggressive Inside the Compressor and then Move Down into the System

SO_2 is a very common transient vapor or gas in many plants. The most common sources are wash stations and battery chargers. If this gas or vapor enters the air compressor where it becomes concentrated along with the always present water vapor (H_2O), it can and often does combine into H_2SO_4 – sulfuric acid – which then attacks internal parts of the compressor such as the aftercooler, drains, dryer, etc and particularly black iron pipe. This is a common enough problem that it bears special attention on a continuing basis.

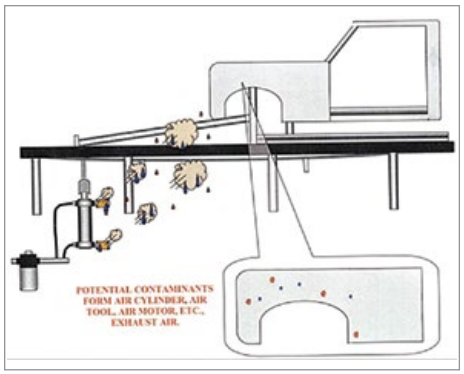

Figure 5. Potential contaminants from air cylinder, air tool, air motor and exhaust air.

Evaluating a compressed air system ambient location is very critical to energy efficient operation and operating reliability. This topic is also something that maintenance personnel should continually address to ensure continuous awareness.

Airborne Oil Mist is another contaminant often overlooked. If the negative impact on the product integrity and/or operating equipment, particularly air cooled coolers, shows up early it can create significant problems unless identified and corrected.

Some oil mist contaminants, such as this cylinder exhaust air, were contaminating the fender with oil leading to crater problems in paint (Figure 1). Most conventional crankcase gearbox vent systems will have some type of baffle or filter aglomerator to capture and collect the oil mist coming from the case. This amount will vary by drive case pressures. These type aglomerators will range from relatively crude to very sophisticated but they all rely heavily on mechanical tapping and careful and timely maintenance.

If the oil mist is allowed to become a viable part of the ambient air it will enter the compressor through the inlet, become concentrated and go through the compressors – which in an oil free compressor, there is no oil separation system – and then enter the air system in varying levels of contamination. This could overwhelm a dryer filter system originally designed for oil free discharge air.

Recently, a new closed loop, gear case, oil mist recovery system has been introduced to the market to address and eliminate this issue.

- 99.99% of the oil mist is reported to be removed from the vent air
- The removed oil is collected and returned to the gear case

Figure 6. Centrifugal air compressor with typical crankcase or gearbox breather filter/aglomerator to stop and collect the oil mist from migration to the ambient air.

- The gear case is kept in negative pressure to allow no outward oil migration
- This unit appears to be much less prone to early fouling and allow excessive crankcase pressure build up.

Conclusion

In order for a compressed air system to deliver compressed air in an energy efficient manner and continue to deliver predictable proper compressed air quality, operating ambient conditions cannot be ignored. The internal plant operating ambient conditions can be very hostile. These conditions were created by people and in most cases are correctable. BP

For more information contact Hank van Ormer, Technical Director, or Don van Ormer, Senior Auditor, Air Power USA at tel: 740.862.4112, email: support@airpowerusainc.com or https://www.airpowerusainc.com/contact/

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COMPRESSED AIR TECHNOLOGY NEWS

Tsunami Introduces New Compressed Air Dryers and Filters

Tsunami Compressed Air Solutions has four new products ready to order for the new year – adding more capacity and customization to its product line.

Tsunami's new products include: an 80 CFM Pure Series Dryer, an 800 CFM Oil Coalescing Filter, a 120 CFM Activated Carbon Filter, and a Pneumatic Drain option for the Tsunami Rove. These products will fill out many gaps that were found in the product lines for its air filters and dryers. Specifically, the Pure 20 Series Dryer is a game changer for patrons looking for more air demand, at an economical price.

"We're looking to fill our product line gaps to set the stage for larger, and more customizable dryers," said Troy Robins, Product Portfolio Manager, Tsunami Compressed Air Solutions. "The best is yet to come."

About Tsunami Compressed Air Solutions

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

The new Pure 20 Series Regenerative Dryer from Tsunami Compressed Air Solutions.

Anderol B.V. Launches Hazard Label Free Compressor Oil

Anderol B.V. has added a high performance synthetic diester based compressor and vacuum pump oil free of any hazard labeling to their product portfolio. The hazard label free Anderol® Syncomp DE HSL 100 meets the most demanding safety and performance requirements, while reducing environmental impact. Approved by the German Federal Institute for Materials Research and Testing (BAM), it complies with the safety standards for vacuum pumps up to 2 bar and 100 degrees Celsius operating temperature. The oil also offers extremely high thermal oxidation stability resulting in long oil life and superb control over deposit formation.

The hazard label free Anderol® Syncomp DE HSL 100 meets the most demanding safety and performance requirements.

Ingrid Ooms, Global Technical Manager at Anderol B.V. said, "This is a very interesting product for compressor and vacuum pump lubrication as it is one of only a few diester based products that are BAM registered without hazard Safety label. The benefits would be that there is no obligation in meeting the legal CLP requirements. We have worked very closely with compressor original equipment manufacturers to formulate this, and it is testament to our commitment to developing sustainable synthetic lubricants without compromising on safety or performance."

Compressed Air Technology News

About Anderol B.V.

Anderol B.V., the European producer of Anderol® products, is a wholly owned subsidiary of specialty chemicals company LANXESS, a globally leading independent solutions provider for the lubricants market across the full value chain. The Anderol® product line consists of high-performance synthetic lubricants formulated specifically for industrial and food-grade applications. Anderol® fluids support lubrication needs in applications such as compressor and vacuum pumps, heavy duty gears and bearings, hydraulic and chains as well as H1 plant lubrication for the food and animal feed industries. Anderol® products are sold in more than 50 countries worldwide and are manufactured in Europe, North America and Asia. For more information, visit www.anderol.com.

MPW Expands into Modular Compressed Air Services

MPW Industrial Services launched Industrial Air to elevate your system's performance so you can focus on core business needs. Our Manufactured Modules for Compressed Air Solutions will transform your current supply to deliver the most reliable air at a lower cost and higher efficiency. Industrial Air Modules are designed with the customer in mind and built to individual specifications. Our technical team has over 20 years' experience in air solutions and over 50 years' experience in Industrial Services which include water, cleaning, facility management and waste.

Our CAS Modules feature a combination of centrifugal, rotary screw and dryers to provide customer specific air needs. The modules are energy efficient, pre-piped, wired, tested, and monitored to combine components designed and supplied by internationally recognized compressor and dryer manufacturers.

The long-term, IAS BOOM (Build, Own, Operate and Maintain) service offers significant financial savings by eliminating capital expenditures and providing 24/7 monitored reports to maintain such a system across many industries. "Like our Industrial Water Modules, the Compressed Air Solution Module is another step in MPW customer flexibility. The Compressed Air Modules offer low-monthly-costs vs. major capital expenditures for customers supplementing or replacing their current compressed air systems," said Jeff Amburn, Business Development Manager for the IA division.

The Modules, maintained by MPW, are available on a monthly fee-for-service basis.

About MPW Industrial Services

MPW Industrial Services – dedicated to safety, innovation and service – offers a variety of industrial cleaning, water treatment, industrial air compression systems, and environmental management to thousands of clients throughout North America. Its diversified services offerings are applicable to a wide array of customer needs and enable clients to prosper in today's competitive environment. MPW improves operating reliability and profitability by coupling the best trained professionals with the most innovative technologies. MPW's in-house engineers and fabrication technicians customize proprietary tooling and mobile operating systems to accommodate specialized industry requirements and ever-changing environmental demands. To learn more, visit our website www.mpwservices.com/industrial-air-services.

CAS modules are energy efficient, pre-piped, wired, tested, and monitored to combine components designed and supplied by internationally recognized compressor and dryer manufacturers.

Teledyne FLIR Expands Acoustic Imaging Offerings

Teledyne FLIR has expanded its acoustic imaging category with two additional models of the FLIR Si124 Industrial Acoustic Imaging Camera: The Si124-LD, specific for compressed air leak detection, and the Si124-PD, for partial discharge detection within high voltage electrical systems. This expansion provides additional, tailored solutions for different end-users needs, from utility infrastructure to plant environments, at a fraction of the cost.

The FLIR Si124-PD and Si124-LD devices also include easy-to-use onboard analytics with access to an online portal through the FLIR Acoustic Camera Viewer cloud service. This software empowers users to perform both quick diagnostics tasks and conduct deeper analysis. With this data, Si124-PD users can determine the severity of partial discharge issues in high voltage equipment, improving electrical grid reliability. Likewise, the Si124-LD model helps users determine the severity of compressed air leaks, potentially saving tens of thousands of dollars in energy costs.

"The FLIR Si124 acoustic imaging family of cameras provides for more precise issue detection by offering an unrivaled number of integrated microphones with improved microphone signal-to-noise ratio as well as a top detection frequency of 35 kHz to help users further pinpoint problem areas," said Rob Milner, Global Business Development Manager – Condition Monitoring, Teledyne FLIR. "The Si124-PD and LD editions features the same robust artificial intelligence software capabilities of the Si124 but are customized to provide a more economical option for particular uses, such as locating corona at a utility substation or compressed air leaks in a factory setting. Taken together, the family of Si124 devices can help reduce inspection times up to 10x versus traditional methods."

The new Si124-PD features automatic electrical fault classification for partial discharge issues, including surface, discharge, floating discharge, and discharge into air. With the PD Severity Assessment software

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feature, users can also input the kind of component, the equipment voltage, and the distance from the component to get a severity assessment specific to those parameters. This feature is included within the FLIR Acoustic Camera Viewer cloud software.

The Si124-PD, for partial discharge detection, and Si124-LD, for air leak detection, provide customers specialized operations for a greater return on investment.

Furthermore, users can safely detect problems from distances up to 130 meters (430 feet) with the flexibility to operate the device with one hand. Operators can also easily review images on-screen, even in bright, outdoor conditions.

The Si124-LD features real-time, on-device leak sizing and cost analytics, allowing users to instantly view the leak rate onscreen as it occurs, either in liters per minute or cubic feet per minute, and to quantify leak size. This feature provides a quick assessment of how much air is being lost and estimated cost savings from fixing the issue. By incorporating the Si124-LD as part of a regular maintenance program, organizations can extend the life and efficiency of existing compressors while reducing the need to install new units and lowering electricity costs.

The FLIR Si124-PD, Si124-LD, and the original Si124 Industrial Acoustic Imaging Camera models are available for purchase globally from Teledyne FLIR and its authorized dealers. To learn more or to purchase, visit https://www.flir.com/products/si124.

Air Products Introduces Air Products Membrane Solutions

Air Products, the global leader in production of gas separation and purification membranes, announced a new brand identity for its world-leading membrane business units, which will now all operate around the world as Air Products Membrane Solutions.

The new identity moves the former business units including Air Products PRISM Membranes, Air Products Norway, and Permea China Ltd. teams under one name to simplify the customer experience and further spur collaboration and innovation amongst the three entities.

"Air Products has been a leader in membrane technology for 30 years. This effort demonstrates our continued commitment to advancing membrane technologies," said Dr. Samir J. Serhan, chief operation officer, Air Products. "Combining the talents of these teams in one unified business will position Air Products Membrane Solutions to better serve our customers by strengthening our offerings and presence in the marketplace."

Air Products Membrane Solutions specializes in the development of hollow fiber membrane separators and systems for onsite gas generation. Air Products designs, engineers, manufactures, and markets a full portfolio of PRISM Membrane Separators, Marine Systems, and Engineered-to-Order Systems to protect lives and goods at sea, on land, and in the air, to create more sustainable energy sources and raise productivity across a variety of industries and applications.

About Air Products

Air Products is a world-leading industrial gases company in operation for 80 years. Focused on serving energy, environment and emerging markets, the Company provides essential industrial gases, related equipment, and applications expertise to customers in dozens of industries, including refining, chemical, metals, electronics, manufacturing, and food and beverage. Air Products is also the global leader in the supply of liquefied natural gas process technology and equipment. The Company develops, engineers, builds, owns, and operates some of the world's largest industrial gas projects, including gasification projects that sustainably convert abundant natural resources into syngas to produce high-value power, fuels, and chemicals; carbon capture projects; and world-scale carbon-free hydrogen projects supporting global transportation and the energy transition. For more information, visit www.airproducts.com.

Parker Launches Advanced Competitive Fit Replacement Filters

The Industrial Gas Filtration and Generation Division of Parker Hannifin Corporation, the global leader in motion and control technologies, has introduced two new aftermarket cartridge filters. Parker designs filters to meet special applications and manufactures aftermarket filters for most OEM dust collection equipment with design improvements to help customers improve their bottom line.

The division's newest development is a replacement cartridge filter for an OEM brand dust collection system. The key advantage to this filter is the enhanced, more conventional design. This filter is constructed without the inner conical filter the OEM included, creating a greater pleat depth. For enhanced sealing, the filter has a wider gasket contact area than the OEM filter. To resist bowing, the replacement cartridge is constructed with a stiffer, and heavier gauge sheet metal top pan and the robust filter design also includes a galvanized expanded metalcore, urethane potting compound and four 1" wide reinforcement straps.

This filter is constructed without the inner conical filter the OEM included, creating a greater pleat depth.

Compressed Air Technology News

Another notable feature of this pulse-jet cartridge filter is that it can directly interchange with the OEM filter without any required modification of the dust collector. This enables the replacement cartridge to be compatible for use in any application currently using the OEM filter with similar media.

"This replacement cartridge was engineered to solve problems customers experience with the OEM brand filter. With greater pleat depth and proven design enhancements, beta site customers report lower pressure drop and longer filter life," said Jeff Canfield, senior product engineer, Industrial Gas Filtration and Generation Division.

Parker has developed dozens of OEM brand competitive fit filters, including a 52" cartridge using a continuous, full-height pleatpack rather than the original configuration of stacking and joining two 26" tall cartridges. For customers, this means less potential for leaks, no wasted media at the connection of the two sections and less labor and materials needed to make one full height pleatpack. Parker delivers improved performance – ultimately leading to a safer, cleaner, and lower maintenance work environment.

For more information or to discuss the right replacement filter for your system, please visit Parker.com/BHA.

About Industrial Gas Filtration and Generation (IGFG) Division

Parker Hannifin's IGFG Division protects and purifies using diverse solutions engineered for the customer's unique application. We are the filtration resource for customers backed by state-of-the-art labs and advanced filtration research, world-class manufacturing processes, and application engineering experience for any filtration challenge. For more information, please visit www.Parker.com/BHA.

SUTO iTEC Introduces New S520 Portable Dew Point Meter

SUTO iTEC is proud to launch the new S520 Portable Dew Point Meter, an easy-to-use single handheld unit to perform on site measurements in compressed air systems. It has been re-designed from the ground up, offering new features and new sensor modules. The S520 comes with two options of measurement ranges. The standard sensor unit has a measurement range of -100 – +20 °C and comes with an integrated pressure sensor. The economic sensor unit offers the user a range of -50 – +50 °C.

With the S520, SUTO is introducing Smart Features, which can predict the dew point end value, before its measured. This helps service technicians quickly understand the compressed air system performance. The integrated indicator for ISO 8573 shows the measured, the predicted and the target class of the system regarding ISO 8573-1. The new dew point meter is the successor of our well known S505 model. It offers our users and customers many advantages, as well as major improvements.

About SUTO iTEC

SUTO is a leader and trusted global partner for reliable measurement and monitoring solutions for compressed air and gas systems. Our wide range of products play a vital role in system processes of leading companies around the world. Since our foundation in 2005, we offer our customers outstanding service and solutions and continue to innovate dependable measurement technology. For more information, visit www.suto-itec.com.

New Portable Dew Point Meter S520

Festo Introduces the CMSH Smart Positioner

Festo introduces the CMSH smart positioner for process valves. This new smart device features HART communication. Because of its high airflow rate, the CMSH is suitable for both large and small actuators in such applications as dosing, mixing, and filling. The CMSH offers extensive integrated functions for self-monitoring and diagnostics with clear recommendations for corrective action.

The CMSH is user-friendly and simple to operate because of its large and rotatable plain-text display that can be read from various directions. The setup wizard makes it easy to commission. As part of this process, fast or robust control mode can be selected.

About Festo

Festo is a leading manufacturer of pneumatic and electromechanical systems, components, and controls for process and industrial automation. For more than 40 years, Festo Corporation has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performing, more profitable automated manufacturing and processing equipment. For more information on Festo, call 800-993-3786 and/or visit https://www.festo.us.

The high air flow rate of the CMSH positioner makes it suitable for a broad range of applications for either small or large actuators.

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

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

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

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

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