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QUALITY, SAFETY & RELIABILITY FEATURES

SUSTAINABILITY & ENERGY/WATER EFFICIENCY FEATURES

SUSTAINABILITY & EFFICIENT TECHNOLOGY NEWS

EVERY ISSUE

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FROM THE EDITOR

Quality, Safety and Reliability

Reliability has many enemies. High on the list is high ambient temperature. Thanks go to Neil Mehltretter, from Kaeser Compressors from his useful article titled, "Air Compressor Sizing for High Ambient Temperatures."

The "Digital Transformation of Pneumatic Systems" is a term used by Emerson's Amit Patel in his article focused on how a new era of collecting data will improve predictive maintenance and sustainability performance.

Sustainability & Energy/Water Conservation

We go north of the border to Ontario, Canada to learn about a compressed air energy conservation success story at PC Forge thanks to the work done by Quentin Foran and Brian Wilkins from Compressors for Manufacturing, Inc. Realizing $266,000 in annual energy savings plus increasing the production capability of forging operations by 40% is very impressive!

Have you ever done a remote compressed air audit? Ron Marshall writes about a successful project at a Canadian sawmill, where although not ideal, working together with plant personnel they were able to data log and audit the compressed air system for energy savings.

In Part 2 of "Industrial Central Vacuum System Evaluations", Hank van Ormer states that audit measures can start with looking for vacuum leaks and reviewing piping design for pressure drop.

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

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CORPORATE GHG-REDUCTION NEWS*

Featuring: Atlas Copco, Greencore, JLL, SBTi

* Scope 1 and 2 GHG Emissions from Direct Operations

Atlas Copco Raises Climate Ambitions by Setting Science Based Targets

Nacka, Sweden, October 29, 2021 – Atlas Copco has set Science Based Targets to reduce greenhouse gas emissions in line with the goals of the Paris Agreement. The Group aims to reduce emissions from its own operations in line with keeping the global temperature rise below 1.5 degrees, and to reduce emissions from the value chain in line with keeping well below a 2-degree temperature rise. The goals are validated by the Science Based Targets initiative.

"We are significantly raising our climate ambitions by setting absolute reduction goals for the entire value chain," said Mats Rahmström, President & CEO of the Atlas Copco Group. "The absolute majority of our impact comes from the use of our products and this is where we can make the most impact. We will continue to develop energy-efficient solutions that enable customers all over the world to lower their greenhouse gas emissions."

Atlas Copco has for a long time worked to offer the most energy-efficient products and solutions. In our own operations, there is a focus on buying renewable electricity, installing solar panels, switching to biofuels in portable compressor testing, implementing energy conservation measures, logistics planning improvements as well as switching to more environmentally friendly transport. This has resulted in a 28% reduction of CO_2 emissions from the energy consumption in operations and transport of goods in relation to cost of sales and compared to a 2018 baseline.

To reach the targets, Atlas Copco will continue to focus on increasing the energy efficiency of products and supporting customers to reach their own sustainability ambitions, as well as reducing emissions from our own operations.

"To reach a net zero-carbon world, there is a need to transform society," said Mats Rahmström. "We contribute to this transformation by developing technologies and products needed for heat recovery, renewable sources of energy, and the abatement of greenhouse gases. We provide the products and solutions needed in, for example, the production of electrical vehicles, wind and solar power and biofuels."

Atlas Copco's Science Based Targets will be implemented from 2022.

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: www.atlascopcogroup.com

Greencore's GHG Emission Reduction Targets Approved by Science Based Targets initiative (SBTi)

September 30, 2021 – Greencore, a leading manufacturer of convenience foods in the UK, has had its carbon emission reduction targets approved by the Science Based Targets initiative.

The targets covering greenhouse gas emissions from Greencore's operations (scopes 1 and 2) are consistent with reductions required to keep warming to 1.5°C, the most ambitious goal of the Paris Agreement and our target for the emissions from our value chain (scope 3) meet the SBTi's criteria for ambitious value chain goals, meaning they are in line with current best practice.

"Greencore Group plc commits to reduce absolute scope 1 and 2 GHG emissions 46.2% by FY2030 from a FY2019 base year. Greencore Group plc also commits to reduce scope 3 GHG emissions from purchased goods and services and upstream transportation and distribution by 42% per tonne of product sold within the same timeframe."

Last year Greencore unveiled a range of sustainability pledges, including commitments that all of the Group's packaging will be recyclable or reusable by 2025, that food waste will be reduced by 50% by 2030, and that Greencore will operate with net zero emissions by 2040.

Greencore's sustainability credentials are already well established, and the pledges build on the strong progress that the Group has made in this area in recent years.

Commenting on the SBTi approval, Andy Wright, Head of Sustainability at Greencore, said: "We have a long track record of driving sustainability at Greencore. Last year we published our inaugural sustainability report, where we set out a range of pledges. We are delighted to have received approval by SBTi on our emissions reductions targets as these will play an important role in how we create a more resilient and sustainable future."

For more information visit https://www.greencore.com/sustainability/

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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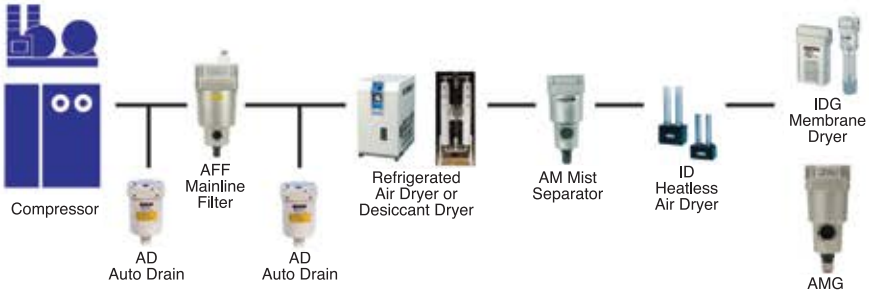

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Corporate GHG-Reduction News

JLL Commits to Net Zero Target for 2040

CHICAGO, May 4, 2021 – JLL (NYSE: JLL) announced its aim to achieve net zero carbon emissions by 2040 across all areas of its operations, including the client sites it manages, globally. To deliver this commitment, 95% of JLL's 2018 baseline greenhouse gas emissions will be fully abated, and any residual offsets required will be limited to no more than 5% of that baseline.

JLL has also become a signatory of The Climate Pledge, standing with Amazon, Global Optimism and the other signatories in a commitment to being net zero by 2040 – ten years ahead of the Paris Agreement.

This announcement strengthens the firm's previous goals, reinforcing JLL's leadership position on climate action.

In September 2020, JLL signed the World Green Building Council Net Zero Carbon Building Commitment, which positions energy efficiency as a central component to achieving decarbonization across global real estate portfolios, in addition to generating and procuring renewable energy to meet reduced energy demand. In April 2020, the firm announced its science-based target, as aligned to the 1.5°C ambition of the Paris Agreement.

"Climate change is the defining issue of our time," said Christian Ulbrich, JLL CEO. "We recognize that tackling global warming requires an urgent and comprehensive response from all parts of industry and society which is why we have chosen to commit to achieving net zero emissions by 2040 and also to sign The Climate Pledge. At JLL, we are determined to play our full part by working with our clients, people and communities to shape the future of real estate for a better world."

Helping clients achieve net zero carbon emissions is a key pillar in JLL's strategy, and the firm is making significant investments in sustainability services capabilities. By using the breadth and strength of its global platform, JLL will enable its clients to decarbonize their portfolios by 2040, partnering with them to

move the needle on real estate carbon reduction and sustainability.

In line with Race to Zero criteria, JLL is committed to taking urgent action on decarbonization and contributing towards reductions in global emissions, whilst working to its 2040 net zero goal. In the interest of transparency and driving advocacy, JLL will publish its pathways to net zero later this year, ahead of the COP26, the United Nations Climate Change Conference.

About JLL

JLL (NYSE: JLL) is a leading professional services firm that specializes in real estate and investment management. JLL shapes the future of real estate for a better world by using the most advanced technology to create rewarding opportunities, amazing spaces and sustainable real estate solutions for our clients, our people and our communities. JLL is a Fortune 500 company with annual revenue of $16.6 billion, operations in over 80 countries and a global workforce of more than 91,000 as of December 31, 2020. JLL is the brand name, and a registered trademark, of Jones Lang LaSalle Incorporated. For further information, visit jll.com.

SBTi Launches First Net-zero Corporate Standard

October 28, 2021, The Science Based Targets initiative (SBTi), the global body enabling businesses to set emissions reduction targets in line with science, today launches the world-first Net-Zero Corporate Standard.

To combat this, the SBTi's Net-Zero Standard is the world's first science-based certification of companies' net-zero targets in line with the Paris Agreement's goal of keeping planetary warming to 1.5°C.

Corporate GHG-Reduction News

Alberto Carrillo Pineda, Co-Founder and Managing Director of the SBTi, said: "Companies are currently self-defining net-zero targets without credible and independent assessment of their ambition and integrity.

"For the first time, the SBTi Net-Zero Standard offers companies robust certification to demonstrate to consumers, investors and regulators that their net-zero targets are reducing emissions at the pace and scale required to keep global warming to 1.5°C. We're now inviting all companies with net-zero targets and ambitions to show stakeholders that their decarbonization pathway is aligned with science. And the rest of the business sector – we call on you to join the Race to Zero."

The first seven firms to have their net-zero targets certified as part of the SBTi's pilot scheme are unveiled today. They are: AstraZeneca (UK), CVS Health (US), Dentsu International (UK), Holcim (Switzerland), JLL (US), Ørsted (Denmark), and Wipro (India). More companies are now invited to commit to set net-zero targets, which the SBTi will begin validating from January 2022.

90%+ decarbonization by 2050 is the only route to science-based net-zero

Companies adopting the Net-Zero Standard will be required to set both near- and long-term science-based targets across all scopes.1 Near-term targets cover immediate emissions reductions for the next 5-10 years, while long-term science-based targets determine the total level of decarbonization by 2050 or before.

Through the standard, the SBTi clarifies that science-based net-zero requires companies to achieve deep decarbonization of 90-95% before 2050.2 At that point, a company must neutralize any limited residual emissions that are not yet possible to cut. However, the SBTi sets clear parameters that these residual emissions – which must be neutralized through carbon removals – cannot exceed 5-10% of a company's emissions depending on its sector. Neutralization activities can take the form of technological removals (i.e. Direct Air Capture (DAC) with geological storage) and nature-based solutions (i.e. reforestation).

Mads Nipper, CEO of Ørsted, said: "Ørsted is proud to join the Science Based Targets initiative in the launch of the new Standard and to become the first energy company in the world with a science-based net-zero target. We recognize that the only route to a climate-safe future is one that prioritizes emissions reductions, both in the near and long-term. That's why we're set to reduce our carbon intensity by at least 98% by 2025 compared to 2006 in our energy generation and operations, and target net-zero emissions across our entire value-chain by 2040. We need bold but credible net-zero plans from companies. If you are a business leader who wants to walk the talk, I encourage you to align your company's climate strategy with what is required by science."

The principle at the heart of the SBTi Net-Zero Standard is the "mitigation hierarchy". This means companies should address value chain emissions and implement strategies to achieve these targets as the main strategy to reach net-zero emissions.

Johan Rockström, Director of the Potsdam Institute for Climate Impact Research (PIK) and Professor in Earth System Science at the University of Potsdam, said: "The Net-Zero Standard gives companies a clear blueprint on how to bring their net-zero plans in line with the science, which is non-negotiable in this decisive decade for climate action. Because we are running out of time. Extreme weather events are occurring more frequently with greater intensity. We are also rapidly approaching critical tipping points. We have to bend the curve of emissions now. We have to create a net-zero world economy in just one generation. There is only one pathway forward, that involves rapid and deep emission cuts and additionally investment in nature-based solutions – which are absolutely fundamental."

The SBTi recognizes the urgent need to scale up near-term finance to help address the nature and biodiversity crisis and increase the likelihood the global economy limits warming to 1.5°C. Given that, the Standard recommends companies make investments to reduce emissions outside their value chains. However, these investments should be in addition to, not a substitute for, rapid and deep reductions of a company's own emissions.

Furthermore, the role of finance in corporate decarbonization is vital for the world to reach net-zero emissions. The SBTi is therefore leading efforts to define and develop metrics around what net-zero looks like for financial institutions to decarbonize the real economy and is launching its Net-Zero Foundations for Financial Institutions: Draft for Public Consultation on 10 November 2021.

Developing the first-ever science-based net-zero target

The Net-Zero Standard was developed in consultation with an independent Expert Advisory Group, made up of experts from academia, civil society, science and business. More than 80 companies took part in a road-test of the Standard in August 2021.

The Expert Advisory Group will continue to refine and develop the Standard in early 2022, specifically looking at best practice in beyond value chain mitigation and how to further support companies in reducing scope 3 emissions.

To date, more than 600 companies have made a commitment to reach science-based net-zero before 2050 through the SBTi's Business Ambition for 1.5°C campaign. Companies can commit to setting a science-based net-zero target, join this campaign and the UNFCCC Race to Zero on the SBTi website.

Michael Hugman, Director of Climate Finance at the Children's Investment Fund Foundation and a member of the Expert Advisory Group, said: "Ensuring investments and engagements are supporting true climate-alignment at companies has been almost impossible until now. There has been no way of knowing which net-zero targets are credible. The launch of the SBTi Net-Zero Standard is the solution to that problem. We can now clearly see which companies have net-zero targets that are aligned with climate science. This is a game-changer that will enable us to focus only on the companies with robust near-term climate action plans that deliver science based targets, and measure their annual emissions performance versus targets to hold them accountable."

Corporate GHG-Reduction News

Lila Karbassi, Chief of Programmes, UN Global Compact and SBTi Board Chair, said: "The Science-Based Target initiative's new Net-Zero Standard is a historic milestone. Cutting emissions at the right pace and scale is key to reducing the impacts of climate change in all regions of the world and building resilience in the most vulnerable communities. We are witnessing a rise in the number of champion companies from developing and emerging markets adopting net-zero pathways. They represent the fastest growing sustainable markets for investment opportunities aligned with the goals of the Paris Agreement."

Thierry Delaporte, Chief Executive Officer and Managing Director of Wipro Limited, said: "Ambitious climate action towards a net-zero economy is achievable with clearly defined, science-based standards to which all companies and organizations can be held accountable. Wipro thanks the SBTi for their partnership, as we work towards achieving net-zero emissions across our entire value chain, by 2040."

Richard Batten, Chief Sustainability Officer at JLL, said: "Without a common science-based definition of what constitutes a net-zero target, companies and their stakeholders can't be sure that their long-term climate targets are credible or ambitious enough. The SBTi Net-Zero Standard applies the latest climate science to the target setting process, providing organizations with a rigorous, consistent, and highly credible methodology to determine their net zero goals.

"Speaking from a JLL perspective, the Net-Zero Standard has helped create the discipline and focus to be truly ambitious in setting our own net-zero target: to reduce absolute emissions across all scopes by 51% by 2030, and 95% by 2040 from a 2018 base year.

Anna Lungley, Chief Sustainability Officer at Dentsu international, said: "At Dentsu International we are proud to be one of the first companies in the world with a science-based net-zero target. In 2020 we set a science-based target to reduce our emissions by 46% by 2030. But the latest climate science from the IPCC shows that the world is at a tipping point. Rapid and deep decarbonization is essential if we are to have any chance of mitigating the worst impacts of climate change. So we have gone further, setting a new, additional, long-term target to reduce absolute emissions by 90% by 2040 across our entire value chain. "The new SBTi Net-Zero Standard will create alignment, facilitate investment and most importantly, drive action. At Dentsu we are committed to the most ambitious level of climate action and won't claim net-zero until we get there, and we urge others to do the same."

Jan Jenisch, CEO of Holcim, said: "The building sector has an essential role to play to accelerate our world's transition to net-zero. I am proud to be joining the Science-Based Targets initiative today to announce Holcim's net-zero pathway to 2050. By setting the first Net-Zero Standard for our industry, we are walking the talk on our commitment to take science-driven action to win the race to net-zero."

Eileen Howard Boone, Senior Vice President of Corporate Social Responsibility and Philanthropy, Chief Sustainability Officer for CVS Health, said: "CVS Health is proud to be

one of the first companies in the world to have our net-zero targets validated by the SBTi's net-zero methodology. We're focused on taking bold, climate action to help improve the health and well-being of our communities and finding innovative solutions to further mitigate our impact on the environment. By 2030, we will reduce our environmental impact by more than 50% and achieve net-zero emissions by 2050."

Katarina Ageborg, Executive Vice-President, Sustainability at AstraZeneca, said: "Since announcing our Ambition Zero Carbon strategy last year, we've made good progress towards eliminating greenhouse gas emissions from our global operations and value chain. We've much still to do and as a science-based company it is important to us that these targets, as well as how we achieve them, are verified independently. Working with the Science Based Targets initiative, their rigorous and high quality analysis of our emissions goals will support us in delivering AstraZeneca's net-zero climate commitments."

About the Science Based Targets initiative

The Science Based Targets initiative (SBTi) is a global body enabling businesses to set ambitious emissions reductions targets in line with the latest climate science. It is focused on accelerating companies across the world to halve emissions before 2030 and achieve net-zero emissions before 2050.

The initiative is a collaboration between CDP, the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF) and one of the We Mean Business Coalition commitments. The SBTi defines and promotes best practice in science-based target setting, offers resources and guidance to reduce barriers to adoption, and independently assesses and approves companies' targets. www.sciencebasedtargets.org @sciencetargets

1 The SBTi Net-Zero Standard covers all of a company's value chain emissions, including those produced by their own processes (scope 1), energy and power they buy in (scope 2) and those generated by suppliers and end-users (scope 3).

2 With the exception of the forestry, land-use and agricultural (FLAG) sector in which 20% of carbon removal is permitted after deep decarbonization of 80% by 2050. Currently the GHG Protocol is developing new guidance for corporate land use and removals accounting and, in parallel, the SBTi is developing specific science-based target setting methods for companies with land sector emissions which will provide FLAG companies with the opportunity to factor in land sector emissions and reduction opportunities into their net-zero strategies. This will become mandatory for companies setting SBTs in land-intensive sectors starting in September 2022.

Re-engineered Compressed Air System Scores Perfect "10" at PC Forge

By Mike Grennier, Compressed Air Best Practices® Magazine

Compressed air is vital to production at PC Forge's forging operation in Colborne, Ontario, Canada.

With an eye toward energy savings and production efficiency, PC Forge scored high marks when it decided to re-engineer the compressed air system powering its forging operation in Port Colborne, Ontario, Canada.

Since completion of the system upgrade in the fall of 2020, PC Forge is on track to save an average of 1.9 million kWh and $266,000.00 per year in energy costs – and increase the production capability of its forging operation by 40%. The project also achieved a one-year payback with a $245,000 incentive from Government of Ontario's utility Independent Electricity System Operator (IESO).

Bud Kinney, IMT Forge Vice President, Innovation and Development, and PC Forge General Foreman Ron Reece, said they could not have asked for more from the compressed air system upgrade.

"We're able to reduce the number of kilowatt hours per year we use and still get increased production capability," said Kinney. "The project exceeded our expectations."

Said Reece, "From the production end of things, the difference in the compressed air system is night and day. On a scale of 1 to 10, it's a 10."

Compressed Air Powers Large Forging Hammers

An IMT Forge Group partner, PC Forge (www.imtforgegroup.com) specializes

in custom, closed-die forging with the ability to process most commercially available materials, including multi-grades, ferrous and non-ferrous materials, brass, aluminum, titanium, stainless and nickel-based alloys. At the PC Forge operation, the company employs 62 people who work two shifts, five days per week to produce diverse products used in a variety of applications in mining, automotive, aerospace, defense, oil and gas, and energy industries.

At the heart of PC Forge's 50,000-square-foot forging facility are five forging hammers weighing between 2,000 to 8,000 pounds each. The hammers, which are powered by compressed air, pound metal into shape with controlled high-pressure impact blows. The value of compressed air at the plant, said Reece, cannot be measured.

"If we don't have compressed air, we don't run. It's really critical," he said, noting volume and proper pressure of compressed air are equally vital. "We also have to keep pressure in the system close to 100 psi at all times."

Efficiencies and Costs Drive Change

Over the years, the compressed air system at PC Forge increasingly struggled to provide a reliable and stable supply of air to the plant. The system included six 350-horsepower (hp) fixed-speed rotary screw air compressors, each of which is rated to deliver up to 1,500 scfm at 110 psi. It also included a 5,000-gallon receiver tank.

The limited capacity of the compressed air system hampered production, which ultimately became unacceptable given high demand for PC Forge's products. The issue, Reece said, was the inability of the system to keep pace.

"Our goal is to keep the hammers running at full capacity when needed without running ourselves low on air," he said. "Unfortunately, if we were running three hammers at the same time we'd be starved for air, which would slow them down. Other times there wasn't enough air to have both of our two bigger hammers running at the same time so we'd have to shut one down until the other one was finished before we could start it back up. It just wasn't good for efficiency."

Additionally, the costs of electricity to power the compressed air system – as well as the entire plant – continued to climb.

"Our problem is that electric utility costs have been skyrocketing, "Kinney said. "We're upwards of 15 cents per kWh and it's only expected to go higher."

Compressed Air Partner Tapped

With the goal of reduced operating costs, Kinney explored IESO's Save on Energy Retrofit program, which helps fund retrofits, energy audits, and controls at plants with programs that reduce electricity demand at peak usage times. Knowing the full extent of the potential incentive, Kinney decided the time was right to revisit the compressed air system.

Re-engineered Compressed Air System Scores Perfect "10" at PC Forge

Kinney invited Compressors for Manufacturing, Inc. (CFM) of Burlington, Ontario, Canada, to recommend improvements to PC Forge's compressed air system given the potential IESO incentives. CFM is PC Forge's long-time compressed air system partner.

Compressors for Manufacturing, Inc. (CFM)

Founded in 2004, Compressors for Manufacturing, Inc. (CFM) prides itself on providing outstanding service and support to companies in Southern Ontario. The full-service firm, based in Burlington, Ontario, Canada, works with diverse companies from medical labs to large manufacturing operations in a wide range of industries.

CFM offers air compressors, air dryers, oil/water separators, filters, breathing air purifiers, and air compressor controllers. Its extensive product line also includes industrial blowers, nitrogen generators, industrial vacuum and readily available parts. Additionally, it offers rental air compressors and dryers to customers' meet short- and long-term needs.

With its extensive industry knowledge, CFM offers comprehensive system audits and installation and maintenance services designed to help companies maximize system efficiencies and achieve energy savings. For more, visit www. https://comp4mfg.ca.

Quentin Foran and Brian Wilkins, Compressors for Manufacturing, Inc. (left to right).

Although familiar with the plant's system, CFM conducted a thorough evaluation of plant operations and the use of compressed air to formulate a plan for achieving PC Forge's goals for a more efficient and less costly system. CFM's compressed air assessment included a review of the plant's Panoramic Power™ monitoring system, which tracks electrical power consumption for all plant systems, including air compressors. CFM also installed an airflow meter on the header of the compressed air piping system to gain insight into actual compressed air usage.

"The Panoramic Power system gave us all of the amperage and calculated kilowatt hours and we overlaid that information with data about plant compressed air flow to determine how much they could save with a system upgrade, said Quentin Foran, CFM Project specialist. "Once we saw the data it confirmed what we originally thought about the issues and what do to do fix them."

Issues Thoroughly Vetted

PC Forge manually controlled the air compressors and normally operated all six units in modulation, non-stop throughout production. The air compressors operated part load at 70 to 80 percent five days a week, as well as alternating Saturdays.

On a typical day, the plant would turn on all of the air compressors at the start of the production shift and operate them in modulation. Doing so gave PC Forge the ability to meet wide swings in demand for compressed air since the amount of air needed was driven by the number of hammers in operation at any given time. Each forge

hammer required 1,000 to 1,600 cfm. Demand for air plantwide could be 700 cfm one minute and surge to 6,500 cfm the next.

System pressure also swung widely, although each hammer required a stable supply of air at 100 psi. When numerous hammers operated, pressure would drop to as low as 80 psi. When fewer hammers operated, pressure would climb to 110 psi.

Brian Wilkins, Owner of CFM, said PC Forge had little choice but to keep the air compressors operating in modulation given the demand profile.

PC Forge, Colborne, Ontario, Canada, installed an Atlas Copco GA 315 Variable Speed Drive (VSD) air compressor as part of a re-engineered compressed air system project that saves energy and increases production efficiencies.

Re-engineered Compressed Air System Scores Perfect "10" at PC Forge

Key to the upgraded compressed air system at PC Forge are two 8,000-gallon air receiver tanks.

"The machines couldn't start up and then add air to the system quickly enough since pressure would drop in seconds. The only way to combat it over the years was to leave them all on in modulation so they would all be making air already and could meet the big surge in demand," Wilkins said.

In all, the compressed air system at PC Forge consumed 3.4 million kWh of power per year. The cost for electrical power, production issues and the opportunity for an IESO incentive of up to $300,000 pointed to the need to re-engineer the system.

Re-engineered System Delivers Results

The retrofit recommended by CFM involved the installation of a 420-hp Atlas Copco GA 315 Variable Speed Drive (VSD) air compressor rated to deliver up to 2,200 scfm at 100 psi. CFM also installed two 8,000-gallon air receiver tanks. Additionally, it added an Atlas Copco E6 master controller to the system, along with Atlas Copco Mark 5 graphic controllers on five air compressors. The team de-commissioned the sixth air compressor, originally installed in the 1980s.

The master controller automatically controls the operation of the air compressors to gain maximum system efficiency. The VSD is used to satisfy fluctuations in demand for air up to 2,000 cfm. When the need for air climbs above 2,000 cfm, the system adds base-load air compressors as needed and runs the VSD machine at part load as a trim machine. The master controller also rotates the operation of base-load machines to minimize wear and tear on any one unit. The storage tanks, in the meantime, eliminate problems with pressure drop.

Since the completion of the installation in 2019, the system has performed flawlessly – allowing PC Forge to operate any and all hammers when needed to meet production goals. The ability to run all five forge hammers at any given time represents a 40% increase in forging capability.

"We learned a lot and we thank the folks at CFM for how much we learned since now know the VSD unit, controller, and additional storage together contribute to the outcome," said Kinney, adding how the project exceeded expectations. "We're running fewer air compressors to get the results we need. Before we were running five machines and not meeting the load. Now, we can generally run two to four machines and meet the load."

Today, the compressed air system consumes approximately 1.5 million kWh of electrical power compared with 3.4 million kWh of power before the retrofit. As a result, PC Forge saves $250,00-$350,000 per year, which varies based on the IESO rate structure. IESO also awarded PC Forge a $245,000 incentive, resulting in a one-year project payback.

With the completed project, PC Forge can now focus on production and not whether the compressed air system can match demand.

"It's what we needed. We're able to run the whole shop at the same time and not have problems with air when we're at full capacity," said Reece. "Now it's right there all of the time. From the production standpoint, it's just great." BP

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Air Compressor Sizing for High Ambient Temperatures

By Neil Mehltretter, Technical Director, Kaeser Compressors

➤ Like the old game "telephone" when you were a kid, pieces of the puzzle can be lost between multiple parties, different vendors, engineering firms, and the contractors. Price often dictates what equipment gets installed as well.

When specifying a new facility, flow, pressure, and air quality are the most important inputs to design a system. In my experience, we – equipment manufacturers – spend a lot of time talking about these three items with customers.

However, room temperature, or ambient temperature, has a significant effect on plant operation. The amount of space, or lack thereof, for compressed air equipment and the cooling flow all have an important impact on plant operation; because if the air compressors are down; so are you!

Volumetric Flow and Altitude

When sizing compressed air equipment, it is important to remember that most compressors are rated in volumetric flow (CFM-FAD). If the end use applications are rated in mass flow (SCFM), make sure that demands are converted back to volumetric flow so there is enough air at the point of use.

Additionally, any change in altitude around the world will affect the available mass flow. The higher the altitude, the more volumetric flow will be required to achieve the same mass flow at sea level. Therefore, the facility's elevation will affect the mass flow. For example, if the facility is in Denver, the location will have a big effect on the mass flow. Denver is a mile

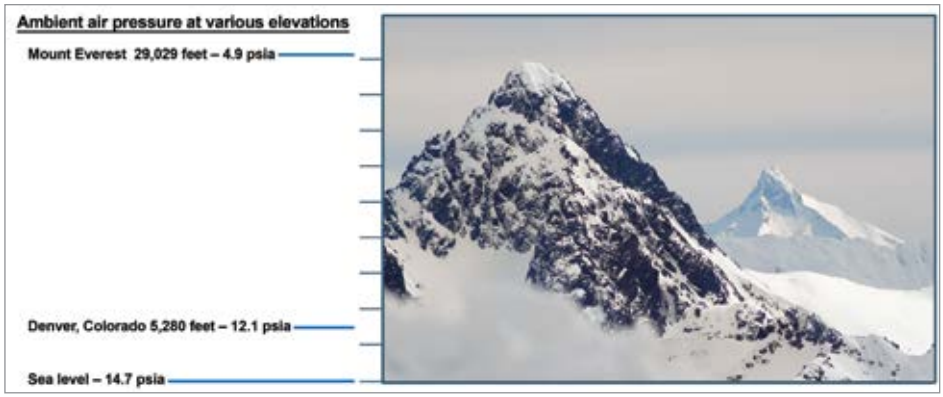

Figure 1: Ambient air pressure at various elevations

high, so the air is thinner. At 5280 feet above sea level the atmospheric pressure is derated to 12.1 psia. If the system requires 1250 scfm, and the compressor is rated for 1250 cfm-fad, in Denver this compressor will be too small. Using a 1500 cfm-fad (volumetric flow) compressor, the compressor would be capable of providing about 1250 scfm (mass flow) at this altitude, whereas it would be 1500 scfm at sea level (see calculation in Figure 2). That's greater than a 15% drop in mass flow from sea level to Denver. So be aware! If the system in this project was sized by volumetric flow instead of mass flow, this application would be short by at least 50 hp worth of air compressor.

$$acfm = scfm \times \frac{P_s}{[P_a - (PP_{wv} \times RH)]} \times \frac{(T_a + 460)}{(T_s + 460)}$$

Where:

P_s = Standard Pressure, psia

P_a = Actual Pressure, psia

PP_{wv} = Partial pressure of water vapor at actual temperature

RH = Relative humidity

T_a = Actual temperature, °F

T_s = Standard temperature, °F

Figure 2: Calculating volumetric flow from mass flow requirement

The typical operating range of an air compressor is between 40°F (4.4°C) and a little over 100°F (38°C). The low point is based on the freezing point of water, and the limitation of many controllers that have been integrated to compressors over the years. The maximum temperature is limited by the coolers, either aftercoolers or intercoolers, depending on the compressor. Be aware of what the compressed air equipment needs to operate properly and design the compressor room around those parameters.

The cooling method for the air compressor is a significant design decision. Air cooled compressors and dryers need thousands if not tens of thousands of cubic feet per minute (cfm) of cooling air to maintain operating temperatures. It all depends on the size of the system. Here's a simple test: try opening the door to the compressor room, if it slams open or requires Herculean strength to open the door, this is a good indication there is a problem in the compressor room. In these cases the

Capacity Correction Factors for Operating Conditions

Inlet Pressure (psig)	Inlet Temperature (°F)											
	75	80	85	90	95	100	105	110	115	120	125	130
60	0.96				0.86	0.77	0.67	0.60	0.53	0.47	0.41	0.37
80	1.11				0.99	0.89	0.78	0.69	0.61	0.54	0.48	0.42
100	1.25				1.12	1.00	0.88	0.78	0.69	0.61	0.53	0.48
115	1.32				1.18	1.05	0.93	0.82	0.73	0.64	0.57	0.50
120	1.33				1.19	1.06	0.94	0.83	0.73	0.65	0.57	0.51
125	1.35				1.21	1.08	0.95	0.84	0.75	0.66	0.58	0.52
140	1.39				1.25	1.11	0.98	0.87	0.77	0.68	0.60	0.53
160	1.46				1.31	1.16	1.02	0.91	0.80	0.71	0.63	0.56
180	1.51				1.35	1.21	1.06	0.94	0.83	0.73	0.65	0.58
200	1.55				1.39	1.24	1.09	0.97	0.85	0.75	0.67	0.59
230	1.59				1.43	1.27	1.12	0.99	0.88	0.77	0.68	0.61

Capacity Correction Factors for Ambient Temperature

	Ambient Air Temperature (°F)									
	75	80	85	90	95	100	105	110	115	120
Factor	1.09				1.05	1.00	0.96	0.92	0.87	0.81

Figure 3: Capacity correction factors for sample refrigerated dryer

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compressor room is starved for air, and there is a severe negative pressure in the compressor room. This effectively creates a Denver-like atmosphere in the compressor room, causing the compressors to work harder, and for that mass flow to drop as well.

TIP: If your compressor room doesn't have the ability to bring in fresh air, or if the location will continuously exceed the maximum rated operating temperature of your equipment you may want to consider water-cooled equipment. More on that point later.

Figure 4: Example of air-cooled air compressor

Approach Temperature

It's hard to condense, no pun intended, all the details about high ambient sizing into one article, but one thing to be aware of is the air compressor's approach temperature. This is how effectively the coolers will cool the compressed air before discharging to the main plant piping. The *approach temperature* is a reference point on how close the compressed air discharge temperature is to the ambient temperature.

Most air-cooled compressors have an approach to ambient temperature listed as 10°F (-12°C), 15°F (-9.4°C), or higher; it all depends on the size of the compressor and the rated design conditions. Keep in mind that the stated approach temperature is most likely at the cooler design conditions, not the actual conditions.

TIP: Always check with the air compressor manufacturer for the worst case conditions, and note that most manufacturers can supply either air-cooled or water-cooled compressors.

Let's look at an example. At design conditions, that approach temperature is about 15°F (-9.4°C). Taking a closer look at the design conditions, that's 68°F (20°C), 30% relative humidity, and sea level. If the ambient temperature was 68°F, the air would come out of the aftercooler to the dryer at 83°F (68°F + 15°F approach = 83°F). In a climate-controlled room, or a mild climate, such operating temperatures can be expected. However, in extreme environments with a high ambient temperature, or during the hot summer months, temperatures in a compressor room can climb significantly if the space is not climate controlled. If the ambient temperature in the room was instead 100°F (38°C), the

Figure 5: Example of water-cooled air compressor (with plate type heat exchangers)

outlet temperature would then be 115°F (100°F + 15°F approach = 115°F). This warmer discharge temperature will be passed on to the dryer(s) in the system. When designing the system, we need to ensure that the dryer is sized appropriately to handle the hotter discharge temperature (more on that later).

If the relative humidity in the air is higher than 30%, this can significantly increase that approach temperature. Note that as air heats up, it's affinity for moisture also increases. Therefore, talk to the equipment manufacturer to make sure an accurate approach temperature is taken into account.

TIP: Make sure that your compressor discharge temperature is below 120°F (49°C) as this is generally the maximum inlet temperature a dryer can handle; and even then anything over 100°F (38°C), can seriously derate the dryer (meaning it won't be able to dry the same amount of air as advertised). This could cause moisture in your plant production piping or cause your compressed air system to shut down.

High Ambient Temperatures and Refrigerated Dryers

Of all dryer types refrigerated dryers are the most ubiquitous, and they experience a significant deration in capacity due to high inlet temperatures and high ambient temperatures. Refrigerated dryers are typically rated at 100 / 100 / 100; 100 psig inlet pressure, 100°F (38°C) ambient temperature, and 100°F inlet temperature. Generally speaking, an increase in pressure over 100 psig increases the dryer capacity but increases in temperature decreases the capacity. The opposite is also true: decreasing pressure below its' rating decreases dryer capacity and decreasing temperature below its' rating increases capacity. Figure 3 shows sample correction factor for a refrigerated dryer. For our example, with a 300 hp compressor, capable of 1500 cfm-fad, with a 15°F approach temperature at 100°F ambient temperature, that's 115°F (46°C) inlet to the dryer. Assuming 100 psig inlet to the dryer, the correction factor comes out to 0.69. Meaning that a refrigerated dryer of 1550 scfm (sized most closely to the compressor output), would only be capable of drying 69% of that capacity, or about 1070 scfm. Even at the altitude condition in Denver, this dryer would be undersized for the worst-case high

Figure 7: Sample inlet louvers for an indoor compressor room

Figure 6: Sample exhaust ducting with recirculating louvers for space heating and exhaust fan for dryer ventilation

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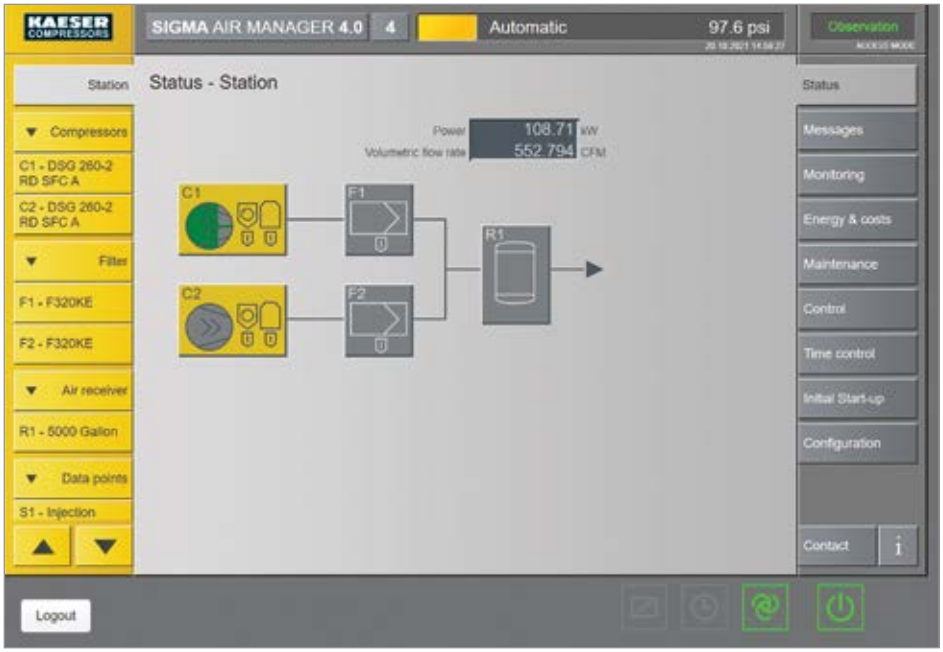

Figure 8: Operating status screen of a compressed air station

temperature conditions. Therefore, the next larger sized refrigerated dryer would need to be considered to ensure a consistent pressure dew point during the worst-case ambient conditions. Capacity correction tables are specific to each dryer manufacturer and are published for each dryer type (refrigerated and desiccant dryers).

TIP: Consult with your equipment manufacturer for dryer capacity correction factors.

Water-cooled Air Compressors

Water-cooled air compressors are a good option when it comes to high ambient temperature. Water-cooling can ensure that the compressor discharge temperatures are maintained in the system's comfort zone, or Goldilocks Zone.

There are multiple water-cooler types, such as plate type and shell and tube, to decide from. Additionally, the required flow, pressure, and quality of the water are other aspects to consider.

One of the biggest detractions of water-cooled compressors is the overall cost. Capital cost between an air-cooled and water-cooled compressor is not huge, but the operating costs can be. For a 300 hp air-cooled air compressor, there is about a 7.5 hp ventilation fan. Running all year (8760 hours) at $0.10/kWh, it's about $5400 per year to operate. The cost of cooling water for each facility is typically difficult to determine and needs to be confirmed for each site. However, $3.00/1000 gallons is a good place to start (https://coolingbestpractices.com/technology/chillers/calculating-water-costs-water-cooled-air-compressors). With a 300 hp, water-cooled compressor, it would need roughly 70 gallons of water per minute at $3.00/1000 gallons of cooling water (8760 hours) that's well over $100,000 per year and may not include the maintenance of the cooling water system, filtration, etc., and any electrical devices associated with this compressor's cooling circuit. Another consideration: is there water on site to pull from or does a cooling tower or chiller system have to be added? Any cooling tower or chiller is a big capital expense as well. Plus, many companies are reducing their carbon footprint and reducing their water consumption, so adding a cooling tower or chiller may be less desirable.

Dirty, Dusty Environments

High ambient temperatures are often accompanied by additional severe duty conditions, such as dusty, dirty environments. If the compressed air system is in a dusty or dirty environment, and/or high ambient temperatures, the service intervals will need to be shortened to ensure no unplanned outages. Motor greasing or rather lack thereof can be devastating to the compressed air system. Remember that with an oil-flooded rotary screw compressor, the lubricant is keeping the temperatures down in the compression circuit as well as filtering the ambient air and sealing the system. The hotter the ambient temperature, the more moisture in the compressor circuit. High moisture content or particulates can have a severe effect on operation.

TIP: It's always best to sample your oil to ensure it is within manufacturer recommendations and adjust your service schedule based on this data.

Air-cooled air compressors and dryers rely heavily on ventilation and exhaust to ensure proper operation. Insufficient or lack of proper ventilation and exhaust can be devastating and an on-going problem for a compressed air system. Location of the compressed air equipment is a huge factor in determining the equipment's lifetime.

TIP: Putting your compressed air system in a closet with no windows and no doors is a recipe for disaster; it's an exaggeration for sure, but think of it this way: Your system may not be in a high ambient climate but you're simulating one for your compressor room with improper ventilation. Moving the compressed air system to a more hospitable location will have the most significant benefit.

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Figure 9: Message and alarm history of a compressed air station

Summary

Don't forget heat recovery, whether it is an air-cooled or a water-cooled air compressor. Using space heating during winter months can offset the cost of operation and is highly recommended. Using the waste heat to heat a process is also a great opportunity and production cost offset, and therefore highly recommended.

The best tips for ventilation are to make sure there is enough inlet air, and that the room is set up to remove the hot air. Recirculation is great during the winter months, but the system should be designed to ensure there is not too much. Inadvertent recirculation can wreak havoc on a compressed air system and

production. Remember that refrigerated dryers also require cooling air and have hot air exhaust, so this should be accounted for as well.

Keep the air compressor operating in the Goldilocks Zone. I've talked a lot about cooling temperatures, but operating temperatures are just as important, you don't want to run the compressor too hot or too cold.

Knowing how the compressed air system is running makes a huge difference in understanding and managing the system. Just like the production, monitoring key items will give indications on how well or poorly the compressor, dryer, and overall compressed air system is running. Certainly, you want to get alarms and warnings, but system pressure, airend discharge temperature, and motor temperature, as well as the state of all the equipment, compressors, dryers, and especially drains are important.

Always make sure that there is enough service space for the compressed air equipment, that it is getting enough ventilation, and assume worst case conditions when designing the system. Trim coolers may be a good option depending on where in the world the equipment is located, but keep in mind the overall costs and benefits. Depending on the time of year and location in the world, compressed air will have some or a lot of moisture. Drains are a critical part of every compressed air system. A simple drain failure could ruin production, so make sure these are accounted for in the design.

- Size your compressor for your conditions
- Keep your air compressor comfortable
- Measure and monitor
- Look for trends in reports
- Be proactive BP

About the Author

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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 https://us.kaeser.com/. All photos courtesy of Kaeser Compressors, Inc.

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Remote Audit Done During Travel Restrictions Reveals Savings

By Ron Marshall, Marshall Compressed Air Consulting

Running a successful compressed air auditing business usually requires a toolbox full of instruments, a well packed suitcase, and some airplane tickets. Popular compressed air auditors are very often near the top tier of the travel mile ladder, with many an hour expended sitting in an aircraft seat or waiting in a lounge.

Recent developments in the area of compressed air system measurement have reduced the need for expensive and time-consuming travel, this article discusses some experiences in using cellular connected data loggers to perform a compressed air assessment during a time when travel was restricted. While not ideal, this exercise identified huge savings for this customer.

Background

Contact was made in summer of 2020 with an inquiry about performing a compressed air assessment at a sawmill in another province about 1,000 miles to the West. This was a time of the first peak wave of Covid-19 and travel was restricted, so the plant could not be visited by out-of-province travelers at that time. But what was offered was remote data logging using specialty loggers. Fortunately, we were associated with a compressed air services company located near this customer, so some site assessment and demand side assessment could also be done by subcontract.

The site in question did not have a complicated compressed air system, just a simple single air compressor set-up with a large 250 hp lubricated screw compressor, with a wet tank and a heated blower style desiccant air dryer. The plant already had a thermal mass flow meter installed which would make it easy to determine the true compressed air system loading. The system diagram is shown in Figure 1.

The air compressor and dryer were located in a separate self-contained building located away from the main sawmill to make it easier to control dust which impacts the coolers of the air compressors. The main compressor amps were measured along with the amps consumed by the air dryer. These amps were converted to kilowatts using data taken by the power utility. Pressure was measured both before and after the air dryer and filters. However, there was a challenge, the flow meter was installed

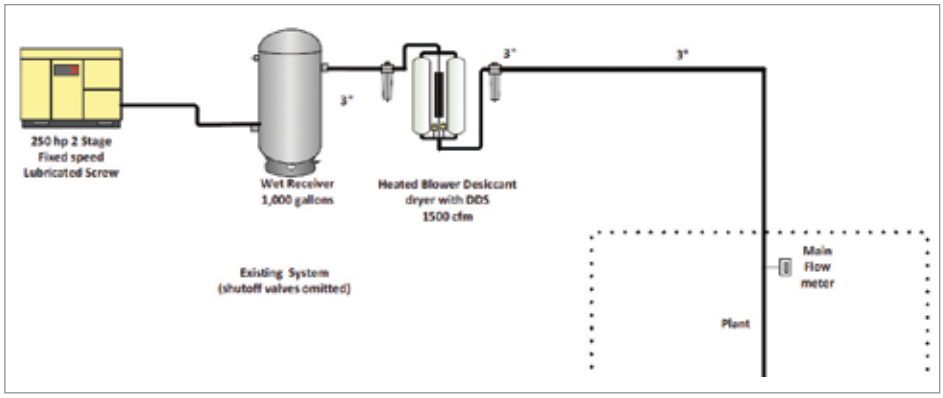

Figure 1. This sawmill had a simple one air compressor system, making system measurement simple, however, the flow meter was installed in the piping across a busy roadway, making it difficult to monitor using a central data logger system.

in the main plant, which was supplied by an underground pipe running under a busy roadway. The preferred data logging method was to use a new type of data logger with cellular communication. This was of central style, meaning wires needed to be run to all sensors, but running a wire across a busy roadway was not possible in this case. More information about this style of data logger, and how it can be used can be found in this Compressed Air Best Practices® Magazine article (Cell-Connected Compressed Air Monitoring Systems Save Time and Money).

Site photographs taken by smart phone immediately showed there was a high potential for some significant energy savings, based on the air compressor's modulating operating mode, and analyzing the number of loaded hours compared to run time hours (Figure 2). This compressor, through its lifetime spent

Figure 2. A look at the air compressor operating mode and loaded/running hours can often show a compressed air auditor that there is a big potential for savings.

Figure 3. Two of these central style data loggers were used for this assessment and the data synchronized together by the cloud software. This eliminated the need for a connecting cable to the remote flow meter which was of similar make as the meter in the picture. The meter outputs both 4 to 20 ma and digital signals. Installation is simple and can be done by site personnel, eliminating the need for the auditor to travel many hours to site for set-up.

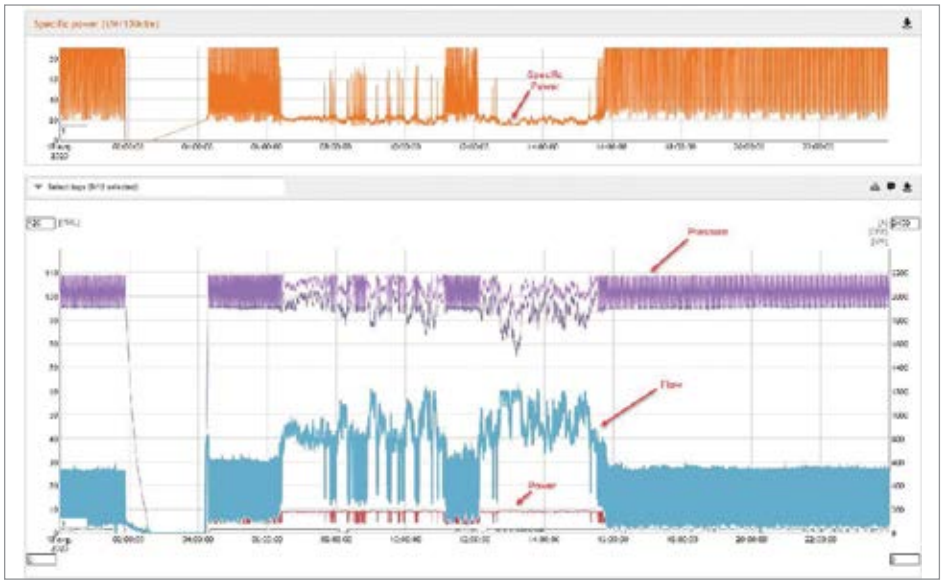

Figure 4. Data showed the specific power was abnormally high during light loaded periods because the compressor was oversized for the light loading. Excessive pressure loss was detected across the dryer and filters. High heater load on the dryer showed there was an overheating problem with the compressor discharge air.

Remote Audit Done During Travel Restrictions Reveals Savings

significant time in the unload operating condition, where it consumes as much power as a fully loaded 100 hp compressor, even while producing no air.

Selection of Loggers

Most data logger systems used by compressed air auditors come in two basic styles, central logging or independent self-contained:

- **Central Logging –** Data logging is done by connecting instruments to a multi-channel central box collection box that stores the data samples from multiple channels at selectable sample frequencies and durations. These boxes must be powered from 120 volt mains or large capacity battery. Wires for each channel must be run to the central box, this becomes a limitation of compressors are in different locations in a plant or when pressure readings at various remote locations are required. This type of logger can display real-time data if connected via an internet or cellular data connection, so any errors in data sampling (such as when a wire falls off or someone closes a valve) can be detected immediately. Often the viewing and setup can be done remotely by an experienced auditor, so the equipment can be installed by plant personnel.

- **Self-contained loggers –** Small portable loggers with independent battery power are deployed to various locations in the plant. Often pressure, amp, power, dew point, temperature and flow parameters need specific data logger types that are specially designed to be used to capture the required measurement. Some styles require additional mains powered instruments to do the actual measurement, with the logger just storing the output in battery backed-up memory. The loggers capture the data with precise time synchronization and are then downloaded to a central location via a base station or laptop. The data can then be viewed using specialized laptop-based software. Because the data is only viewed at the end of the data capture, errors in the data may only be noticed when the data sampling is completed, which may require the data sampling to be repeated, an expensive exercise when hours of travel are involved. This type of logger often requires a well-trained person with a laptop containing special set-up programs to do the installation and downloading.

Item		Low	Ave	High
Discharge	psi	89.9	102.5	109.0
Plant	psi	74.9	97.2	104.9
Dp	psi	15.0	5.3	4.1

Table 1: Pressure baseline

Item	Unit	Shift	cfm	Hours	Ave kW	Annual kWh	Annual $	Specific Power
Compressor	kVa	Production	1200		196.9		$ 21,927	
Compressor	kW	Production	889	2339	177.5	415,173	$ 23,362	20.0
Compressor	kW	Non-Production	240	2842	115.3	327,683	$ 18,439	48.0
Dryer kVa	kVa	Production			21.9		$ 2,439	
Dryer	kW	All	533	5181	21.9	113,464	$ 6,385	4.1
Total		All	533	5181	143.4	856,319	$ 72,551	26.9

Table 2: Power baseline

Measure	kW	kWh	$ Saved	% Saved	Cost	Payback (y)
VSD Control	0.0	292,102	$ 16,366	23%	$ 116,150	7.1
Pressure reduced	7.0	14,333	$ 1,591	2%	$ -	0.0
Leaks reduced	10.3	45,667	$ 3,715	5%	$ 1,200	0.3
Drains	0.7	3,013	$ 246	0%	$ 2,600	10.6
Filters	2.7	5,816	$ 628	1%	$ 37,100	59.1
Dryer repairs	15.3	79,369	$ 6,174	9%	$ 10,000	1.6
Other	0.0	-	$ -	0%	$ 34,300	
Total	36.1	440,300	$ 28,720	40%	$ 201,350	7.0

Table 3: Potential improvement measures

Many auditors have many different logger makes and models which they chose from for each individual assessment. The author has 6 different types of loggers that are used for various jobs. For this assessment a central cell-connected data logger style was selected. The style chosen has the ability to link together numerous loggers located at various locations, all sending data to a central cloud connected database. This solved the issue of the remote connection to the flow meter located in the plant.

Results

Once the data loggers were installed the auditor could immediately see various problems. The site plant production hours were only between 6:30 am and 3:30 pm yet the large compressor was left to run to near 2 am and started back up at 4:30 am to feed various small operations in the plant. During these non-production hours, the compressor ran very inefficiently at 48 kW per 100 cfm produced. The data also showed the air dryer heater and blower was running with a high duty cycle, subsequent

investigations revealed plugged coolers on the air compressors were sending overheated air to the air dryer.

Pressure loss across the air dryer and filters was also higher than normal, indicating fouled filters which reduced plant pressures during peak flows. Figure 4 shows a typical 24-hour profile of the plant.

Baseline data was captured as shown in Tables 1 and 2.

Potential Savings

Based on the data and some site investigation some possible energy conservation measures were proposed:

- Replace the existing 250 hp air compressors with two smaller compressors, one of which is VSD
- Upgrade filters for low pressure loss
- Reduce compressor discharge pressure
- Reduce leakage by 60 cfm
- Repair air dryer, change operation to dew point control
- Install low loss drains
- Improve cooling air ventilation and filtering

Project economics are shown in Table 3.

At first glance it appeared the simple payback of this project is not very attractive, however, the power utility incentives offered for this project were significant. An incentive covering 75% of the project was available which made the work very attractive.

Conclusions

The use of cell-connected loggers and local compressed air assessment talent allowed the analysis part of this project to be done remotely even when travel was restricted. This has proven to be an economical way to assess compressed air systems even halfway around the world from the safety of the office.

And once again the results of the audit have proven that simply measuring and observing key aspects of a compressed air system can reveal significant problems, very often with excellent solutions available. BP

For more information about this article, contact Ron Marshall, Marshall Compressed Air Consulting, tel: 204-806-2085, email: ronm@mts.net

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Solving Predictive Maintenance and Sustainability Challenges Through Digital Transformation

By Amit Patel, Marketing Manager, Digital Transformation – Industrial Automation, Emerson

It's not uncommon for an industrial facility to dedicate nearly a third of its energy use to generating compressed air.[1] Unfortunately, not all that is produced is used for processes – some goes to waste. Faulty components can cause leaks through which compressed air escapes, and processes using insufficient pressure can consume more compressed air than they need. But identifying components before they fail, locating leaks early and calculating proper pressure ratios while maintaining cycle time isn't easy without the right information at the right time.

Yet, many plants don't currently have a way to access that information at *any* time, let alone the right one. Operators, technicians or third-party resources may manually collect periodic measurements, but this invites the chance for human error and, if they're accurate, the resulting spreadsheets or one-off reports are often stale by the time they're used to make decisions. These facilities may never know the actual condition of their assets, which means leaks can go undiagnosed and air consumption can go unchecked. When maintenance is performed, it may mean fixing equipment when

Figure 1. This dashboard for pneumatics applications from Emerson offers a comprehensive picture of a facility's pneumatic system performance in one screen, enabling quick, informed decision-making that makes predictive maintenance possible and can optimize energy use.

it fails or replacing components on a time rather than health basis, incurring high costs and unplanned downtime.

Luckily, there's another way. Through the digital transformation of pneumatic systems, facilities can now monitor compressed air consumption in real time and immediately access the valuable data and insights needed to optimize pneumatic processes and advance approaches to maintenance. By using intelligent technologies to make better decisions and take immediate action, facilities can significantly reduce compressed air consumption, enable predictive maintenance and improve sustainability.

The Digital Transformation of Pneumatic Systems

The industrial internet of things (IIoT) and industry 4.0 have digitally transformed the way facilities operate, enabling processes that are smarter and more efficient than ever before. But digital transformation is still new to some and may seem abstract or ambiguous. In actuality, it's quite the opposite.

Digital transformation is a process that a facility system or piece of equipment undergoes that allows end users to see real-time data, make decisions based on it and act based on those informed decisions. Quite simply, digital transformation places the right information in front of the right expert at the right time. It eliminates guessing about process parameters or waiting for equipment to fail (see Figure 1).

The digital transformation of compressed air systems can be as basic as adding a smart sensor that measures consumption or as elaborate as connecting an entire line or floor. Both cases open previously inaccessible levels of compressed air data and asset condition, affording operators a clearer understanding of the current, past and possible future state of their pneumatic system. This expertise empowers them to confidently make informed decisions and take quick action.

By using technology to automate and optimize operational processes in this way, facilities put a continuous cycle into motion. This cycle has three stages: See, Decide and Act. In compressed air applications, different smart solutions automate each stage.

See Stage: This stage sets off the cycle, starting at a sensor that creates the appropriate data in a continuous, repeatable and reliable way.

In pneumatic systems, this process includes capturing the acceleration and cycles of pneumatic valves and cylinder actuation as well as measuring the volumetric flow rate, pressure, temperature, mass flow rate and flow velocity of compressed air. Such real-time data provides around-the-clock information about the actual health of a facility's assets and energy consumption and is the foundation for timely, informed decision-making (see Figure 2).

Decide Stage: In this stage, the sensor delivers the collected data to a controller or gateway device that continuously aggregates that information in real time and presents trends through an easy-to-interpret visualization tool. At-hand expertise like this empowers operators

Solving Predictive Maintenance and Sustainability Challenges Through Digital Transformation

Figure 2. Emerson's AVENTICS™ Series AF2 Flow Sensor continuously monitors airflow in pneumatic systems, providing operators with clear, actionable insights regarding flow, pressure and temperature.

to make quicker, smarter decisions that drive faster, appropriate actions (see Figure 3).

Act Stage: Mobility tools used in this stage send notifications to specific personnel that prescribe clear, necessary actions to take based on the current state of operations. This can include which cylinders are approaching end of life, have an increase in acceleration over time or have already moved past their targeted cycle time. These directives enable personnel to resolve issues before they can slow or shut down operations.

Together, these stages offer valuable analytics; their endless cycle generates a technology loop that enables predictive maintenance while

continuously improving expertise and energy efficiency.

Minimizing Unplanned Downtime Through Predictive Maintenance

Maintenance is inherent to all industrial facilities. In pneumatic systems, valves wear out over time, causing leakage that leads to excessive compressed air consumption. Some systems can have many valves, which can make identifying a faulty one challenging. Leak troubleshooting can be time-consuming and, with the ongoing labor shortage and skills gap, maintenance personnel may already be stretched thin. There may not be enough staff to keep up with what must be done, and historical knowledge may not exist. When production must stop for repairs, it can be very expensive. For mid-sized food and beverage facilities, unplanned downtime costs around $30,000 per hour.

It's in a facility's best interest to prevent issues before they can arise. That's where predictive maintenance comes in. Predictive maintenance can significantly decrease operations and maintenance costs and eliminate unplanned downtime.

Now that we know how the See-Decide-Act cycle works, it's easy to imagine how the digital transformation of a pneumatic system makes predictive maintenance possible. Let's consider

Figure 3. Emerson's RXi2-LP Industrial PC runs HMI, historian and analytics applications right at the machine. This powerful IPC enables real-time control of pneumatic systems in a compact size.

Solving Predictive Maintenance and Sustainability Challenges Through Digital Transformation

pneumatics maintenance in food and beverage processing where compressed air is heavily used to actuate auxiliary and hygienic valves through discrete pilot valves or valve systems.

Auxiliary and hygienic valves can be used to heat, cool, dose or fill additives and ingredients to sanitary valves that transport consumable goods or beverages. Connected smart sensors, controllers and edge gateways capture a more complete picture of valve health, enabling the system to detect when valves are worn or nearing the end of their service life. If such a valve is detected, the system immediately sends an alert to maintenance personnel, who schedule planned maintenance.

The ability to predict potential problems before they occur helps reduce unplanned downtime while real-time root-cause analysis clearly prescribes the appropriate action to take. Automated troubleshooting and analytics further reduce maintenance time, increase equipment availability, improve productivity and, in the case of leaks, save energy.

Optimizing Energy Use for Greater Sustainability

Today's smart pneumatic devices provide a more complete picture of pneumatic system performance. This gives facilities a better understanding to effectively control energy use by locating and diagnosing leaks and optimizing compressor system pressure.

Air compressors consume a lot of energy to operate, and that amount is often more than needed for normal operating conditions. It's estimated that 20 to 30% of a typical facility's energy consumption goes to producing compressed air. When mid-sized facilities often spend $2.5 million a year on energy, any reductions in compressed air consumption can equal substantial savings. The more a facility can track leaks and balance an operated valve, the greater control it has over its energy use. Optimizing the compressed air a valve consumes while still achieving the required cycle time limits the amount of work the compressor must do and allows it to only consume the energy it truly needs to do it.

By digitally transforming their pneumatic systems to diagnose leaks and calculate proper pressure ratios, facilities can typically see a 10 to 20% reduction in compressed air consumption and energy costs and a 5 to 10% reduction in CO_2.

Taking the First – or Next – Step

No matter the size of their operation or how far along on their i4.0 journey they already are, facilities can begin or continue digitally transforming their pneumatic systems. Operations that are ready to take the next step can request a workshop with a comprehensive solutions provider that offers proven expertise, sensors and hardware. In this workshop, the provider works with a facility to pinpoint challenges and prioritize solutions to implement. It's important to note that no application is the same; digital transformation works best when it's deployed on a case-by-case basis working closely with a proven provider.

For those just starting their digital transformation journey, the saying is "start small, scale fast." A low-barrier entry into IIoT is to focus on one key domain or challenge, even one machine, then use lessons learned to scale up. Some providers offer turnkey, vertically integrated solutions that can include everything from components to sensors, controllers to analytics that enable facilities to receive the value of digital transformation at the level that is right for them. For facilities that are farther along, providers can deploy analytics based off their existing sensor and controller infrastructure with edge analytics, too.

Digital transformation doesn't have to be complex. A pragmatic approach of See-Decide-Act can help facilities kickstart their journey. Through this process, real-time information can be collected and converted into useful analytics and insights that can be used to enable predictive maintenance and optimize energy use. BP

About the Author

Amit Patel is marketing manager for digital transformation within the Fluid Control & Pneumatics business at Emerson. He focuses on driving the marketing direction and strategic vision for the Industrial Automation segment. Amit earned his Bachelor of Science degree in electrical engineering from the New Jersey Institute of Technology and holds a Six Sigma Black Belt for Process Improvement using statistical methodologies. For more information on Emerson visit https://www.emerson.com/en-us. All photos courtesy of Emerson.

1 https://www.energy.gov/sites/prod/files/2014/05/f16/compressed_air1.pdf

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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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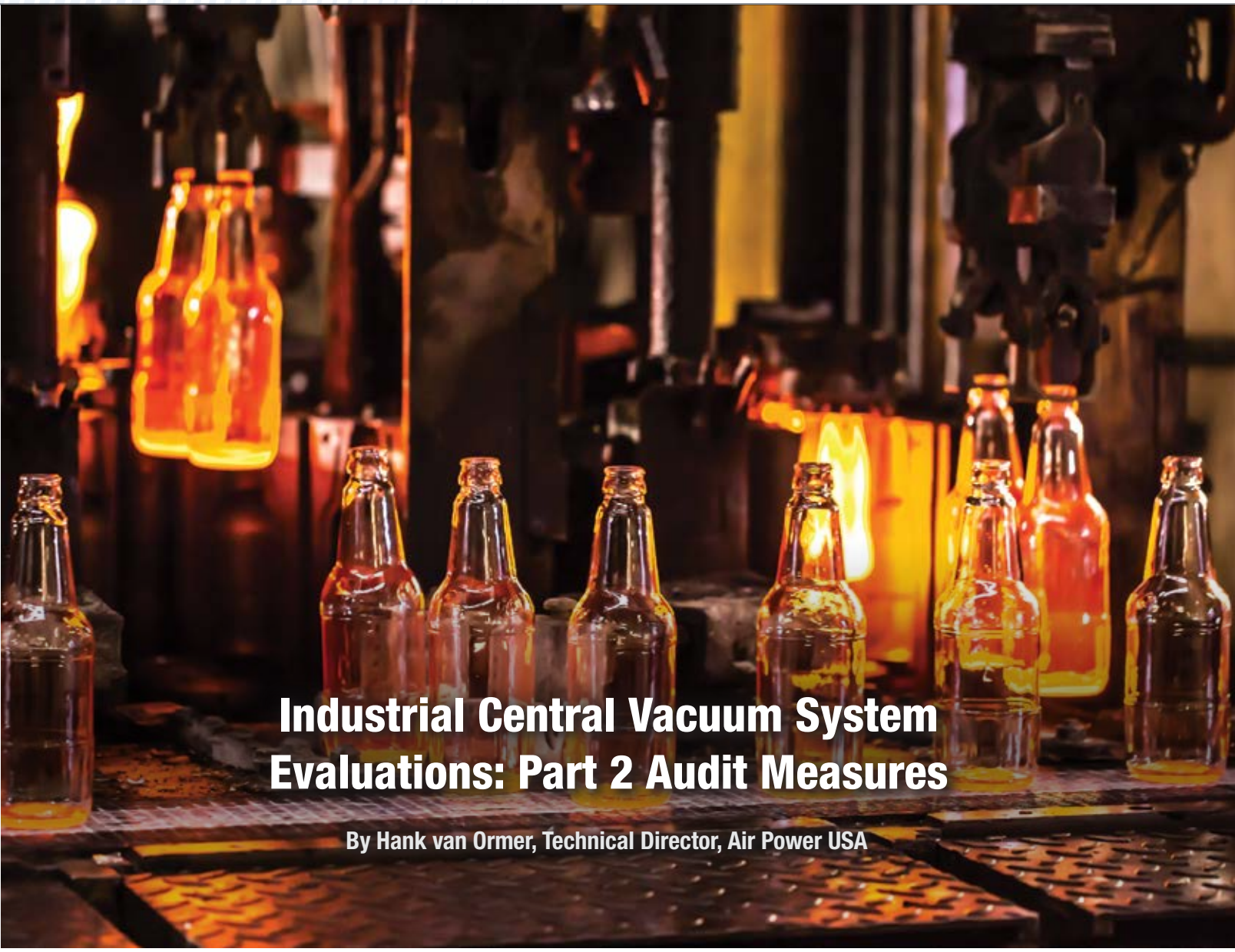

Industrial Central Vacuum System Evaluations: Part 2 Audit Measures

By Hank van Ormer, Technical Director, Air Power USA

Vacuum System Leaks, Piping and Pressure Drop

Operating the vacuum system at higher levels (then necessary) affects the needed volumetric flow to compensate for leaks. This required compensation of volume (ACFM) must be added to the nominal production flow demand. The ambient air leak into the system will expand to the highest vacuum level, which is known as the "Expansion Ratio."

Audit Proposed Action Plan

- Review all the operating components at the system points specified; measure the pressure drop – HgAbs with the same gauge.
  - Main header to system
  - Entry to specific points/components
- List all components with their pressure drop (from measured HgAbs) and entry to pump. Start with highest ΔP at the top to the lowest ΔP at the bottom; create a priority list from worst to best.
- Check all running logs for total system maintenance with special attention given to the In and Out of the vacuum piping.
  - Vent lines (not fouled), vent (filter) with liquid-sealed or oil-sealed rotary screw
  - Check the pump discharge or vent line
  - Check proper draining and maintain filters, separators, etc.

Some of The Best Vacuum System Targets for Review

- Piping diameter is the most common problem in vacuum systems; often this is a "multi-issue" problem – size, configuration, long runs, connectors.

Industrial Central Vacuum System Evaluations: Part 2 Audit Measures

- Never run smaller pipe than the discharge size of the vacuum pump inlet
- Longer runs require larger diameter piping

- For multiple pump systems, calculate the total ACFM HgV possible in each sector and then size accordingly.
  - Where converging flows come together from multiple supplies – be sure all connections are not restrictive **(no 90˚ elbows);** use only long ells and sweeps (no **TEE** connections), long sweep lateral 30˚–45˚ entry.

Audit Measure Summary

- Short straight runs minimize the use of elbows; when necessary, use long radius elbows, not 90°.

- If there are inlet filters are on the vacuum pump – they should be carefully monitored and changed as needed. They create pressure drop when new and even more when fouled.

- In the pump inlet is preceded by filters, mist eliminators, and/or separator – be sure these are working well, and are sized for the proper air velocity, and can be effectively drained and maintained.

- Vacuum pump controls – technology today offers many very effective control systems, particularly for multiple pump systems and deliver a very effective and efficient vacuum flow within the pump(s) operating range, which allows the pump(s) to operate properly.
  - If the pump is not operating properly, contact the equipment supplier or consultant for evaluation.

- Leak Study – locate, tag, and estimate size of leak. The most used method to find and evaluate leaks is an Ultrasonic Detector and/or tracer gas.

Identifying the Potential Energy Savings by Vacuum Leak Repairs

In many plants, the vacuum system is overlooked during the energy savings analysis. There are several reasons for this. Often relative to refrigeration and/or compressed air baseline horsepower, the energy use is small. Few plant personnel understand vacuum, particularly their operation relative to energy cost. There is a similar lack of knowledge of the various methods of delivering vacuum and the appropriate application and selection of each. Vacuum leaks are not as obvious or intrusive as steam, air, or hydraulic leaks.

In many facilities, there are at least two separate vacuum systems used in production. Large central vacuum system processes, such as IS machines used in glass container manufacturing forming, are an example where vacuum is usually supplied by at least two larger vacuum pumps with one running at a time for production, and the other being used as a back-up/swing unit. There may also be a separate vacuum system dedicated to production lines and product handling.

Example of a Vacuum Leak Creating an Energy Savings Opportunities

This example consists of two large rotary ball valves, at a glass container plant (Figure 1), which are leaking about 35 cfm total (left side valve 20 cfm, right valve 15 cfm). They are automatic valves which open as the switch is made from one unit to the other to break the "dead head." The switch is implemented manually by an operator as required.

The operating cost and pertinent data of these leaks is calculated below:

- Ambient Pressure – 30" HgAbs.

- Total Vacuum Level reached with leaks – 23" HgAbs.

TABLE 1: VACUUM SYSTEM PRESSURE LOSS/LEAKS INCREASE THE REQUIRED VOLUME FLOW (ACFM) TO HOLD THE TARGETED VACUUM LEVEL

ACFM Required by Production Process @ 20" HgV	Pressure Drop in Distribution System	Required Vacuum Level at Vacuum Pump	ACFM Required to Compensate for Pressure Drop
100	1" Hg	21" Hg	111
100	2" Hg	22" Hg	125
100	3" Hg	23" Hg	142
100	**4" Hg**	**24" Hg**	**166**
100	5" Hg	25" Hg	200
100	6" Hg	26" Hg	250
100	7" Hg	27" Hg	333

A pressure loss of 4" Hg in a 24" HgV system will require an approximate 50% increase in ACFM flow to hold the target pressure.

- Target Vacuum level – 30" HgAbs
- Make up ACFM to reach – 30"- 23" = 7"
- Expansion Ratio – 30" *HgAbs* ÷ 7 = 4.286
- Vacuum pump holds 23" HgAbs. With 35 acfm leak x Expansion factor = 150 scfm (35 x 4.286=150 *acfm*) continually to hold Target Pressure of 30" HgAbs. (Note: This target is not fully reachable with the equipment on site). However, the plant wants as low a pressure as they can obtain. The location is almost at sea level.

True running average acfm/hp for the central pump is 12.5 scfm/hp.

- 150 *acfm* ÷ 12 *acfm\hp* = 12.5 - *hp* = 9.3214 *kW*
- 9.3214kW x 8,760 x 0.88kWh = $7,185/yr project savings ($300 project cost)

Audit Action: Construct appropriate covers to seal the leaks, such as heavy rubber or similar materials. These will have to be removed at switchover time and then reinstalled.

Vacuum Audit Measures Summary

Vacuum systems will provide better performance if you practice the following tips:

1. Minimize bends in the piping playout. Every bend, every change in direction, etc., adds to pressure drop.
2. Whenever elbows are required, use long-radius instead of short-radius ones to reduce pressure drop.

Figure 1: Example Vacuum System Leak Locations. These two large rotary ball valves, at a glass container plant, are leaking about 35 cfm total (left-side valve 20 cfm, right-side valve 15 cfm).

3. Whenever two lines come together, use a wye instead of a tee to lower pressure drop.
4. Make sure the overall pressure drop of the piping (furthest use point to the source of vacuum) does not exceed 10% of the operating pressure.
5. Be sure to use threaded connections in medium to high vacuum systems, and flanges properly sealed. If you must use threaded connections, be sure they are properly sealed.
6. Vacuum systems are a large source of leaks. Always remember that whatever leaks into the vacuum system expands greatly. Two ways to lessen the impact of threads are to use a sealer in the gaps of normal NPT threads or use NPT "fine cut" threads.
7. Tighten flanges, regardless of type, by working in turn on "opposites" or "facing" bolts, not clockwise or counterclockwise in succession.
8. Check every elastomer (gasket, O-ring, etc.). Each should be "hard" (greater than 90 durometer) to eliminate leaks arising from pressure cycling (up, down, up, etc.).
9. Keep the rate-of-rise over 24 hours of the piping system to 10% or less of the operating pressure and test regularly. BP

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

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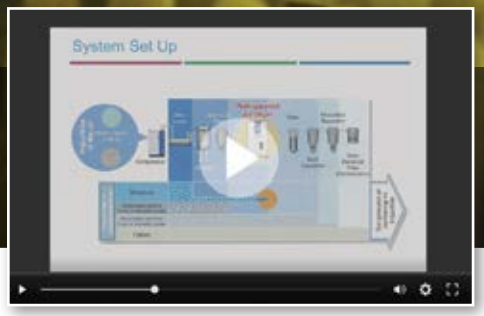

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COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

Edmac Moves West Coast Branch

Edmac has announced its west coast branch has completed the move to a larger warehouse, in Fullerton CA. Edmac continues to grow, driven by its commitment to get compressor service providers the right parts, fast. Will-calls, shipping and receiving all now have dedicated truck and drive-up docks in the back of the building for easy access. The same great team will be there to help you with your compressor system needs. The larger warehouse has given Edmac the opportunity to increase stock levels of the products you need every day and expand its offering of dryers, air tanks and descaler chemicals through new, national vendor partnerships. Edmac will always push to improve its business and keep its focus on providing the best support to you, our highest priority.

Edmac, www.edmac.com

New Donaldson Filtration Service Features

Donaldson Company, Inc., a leading worldwide manufacturer of innovative filtration products and solutions, has added three new features to iCue Connected Filtration Service's continually evolving list of performance monitoring and data acquisition capabilities. The subscription-based iCue service remotely monitors a facility's dust collection equipment and provides operational insights directly to end users. This information can help manufacturers reduce unplanned downtime, support efficient maintenance and operations, and automatically capture compliance and sustainability data. The three new features are the eighth release of the ongoing capability and improvement updates to the service since its launch 24 months ago. The iCue Connected Filtration Service can be retrofitted to most existing Donaldson and non- Donaldson dust collectors and is provided free of charge for six months on select Donaldson dust collector models sold in Europe, Canada and the United States.

Donaldson Company, Inc. www.donaldson.com

UCA Welcomes Katherine Ricker as Controller

Universal Compressed Air, a Pennsylvania-based provider of innovative compressed air systems welcomes Katherine Ricker as their Controller. Reporting to Rick Kowey, Senior VP and COO, Katherine will lead UCA's accounting, administrative and human resource functions. Katherine has over 15 years of experience in the accounting & finance industry. Katherine began her career at a public CPA firm, Stortz & Associates – Northampton, before moving into the financial industry at The Investment Center, Inc. where she was the head of the accounting dept and Human Resource Manager. Most recently, Katherine was the Financial Controller at a local non-profit, Via of the Lehigh Valley. Katherine holds a Bachelor's degree from DeSales University in both Accounting & Finance. She is currently enrolled in their Master of Business Administration (MBA) program with a concentration in accounting.

Universal Compressed Air, https://UniversalCompressedAir.com/

HBM Holdings Acquires Control Devices

HBM Holdings has acquired Control Devices, LLC of Fenton, MO. Control Devices, a portfolio company of Goldner Hawn founded in 1963, is a leading designer and manufacturer of highly engineered flow-control products utilized in niche applications across a diverse array of end markets. The acquisition expands HBM's portfolio in the industrial components space, adding Control Devices to the existing roster of Mississippi Lime Company, Aerofil Technology, HarperLove, and Schafer Industries. "Control Devices' application engineering expertise, design content, and proven growth strategy make them an outstanding fit for the HBM portfolio," said Anderson Fincher, CEO of HBM. "We see a terrific opportunity to support the management team in accelerating growth for the company as HBM builds in this market and expands further into the industrial components space."

Control Devices, https://www.cdivalve.com/

BLOWER & VACUUM INDUSTRY & TECHNOLOGY NEWS

Busch Presents Award to Quantafuel ASA

The "Innovation in Vacuum Busch Award 2020" has been presented to the Norwegian company Quantafuel ASA. By employing Busch's DOLPHIN liquid ring vacuum pumps, Quantafuel has developed technology that is contributing to solving the global waste problem by upgrading plastic waste into valuable products. Busch Vacuum Solutions presents its innovation award every year. This honor is awarded to individuals or businesses who come up with particularly innovative ways to apply vacuum technology and benefit the human world and the environment as a result. The "Innovation in Vacuum Busch Award" was first presented back in 2013 to mark Busch's 50th anniversary. Quantafuel develops technology that is contributing to solving the global waste problem. In collaboration with dedicated partners, they have achieved the combined goals of recycling low-quality plastic and sustainable waste management.

Busch Vacuum Solutions, www.buschusa.com

Howden Acquires Spencer Turbine

Howden Group, a leading global provider of mission critical air and gas handling products, technologies and services, has completed its fifth acquisition of 2021 with the purchase of Spencer Turbine. The Spencer Turbine Company, based in Windsor, CT, USA, is an independent manufacturer of high-quality solutions for air and gas handling. Its vacuum systems, gas pressure boosters and industrial blowers are designed to high quality standards and to withstand extreme conditions, ensuring their long term performance. This latest acquisition aligns well with Howden's strategy, further expanding its capability in industrial and wastewater treatment markets in North America and offering added growth opportunities for Spencer Turbine's products in China, South America and Europe. The addition of Spencer Turbine's product range increases options for Howden's customers, while the Spencer Turbine business will benefit from access to Howden's distribution network and global experts.

Howden, www.howden.com

Pfeiffer Vacuum OmniControl Universal Control Unit

The new OmniControl unit allows the comprehensive control of a complete vacuum system using just one device. It combines the control of the total pressure with the control of the pumps. The unit communicates with products that support the Pfeiffer Vacuum RS-485 protocol. This makes it possible to exchange and process data between various Pfeiffer Vacuum products without any difficulty and without having to invest in additional devices. Optional gauges from the ActiveLine range can also be connected. The 3.5" touch screen with an intuitive user interface ensures easy and convenient control of the vacuum system. For example, a button for switching the devices on and off can be added. The total pressure and the pump parameters can be displayed at the same time.

Pfeiffer Vacuum, www.pfeiffer-vacuum.com

Leybold Small High Vacuum System

With the TURBOLAB Core, vacuum specialist Leybold is launching a small plug-and-play high vacuum pumping system for research and laboratory and industrial applications. Within the TURBOLAB series, the compact tabletop unit fills the gap for entry-level vacuum needs that require a clean, dry, stable high and ultra-high vacuum. The TURBOLAB series is now available in a total of five variants featuring TURBOVAC 90 i and 250 i backed by DIVAC 1.4 and now covers the complete application spectrum for R&D and analytical applications. The ergonomic, cost-effective system is made up of proven Leybold components: including the oil- and maintenance-free TURBOVAC i turbomolecular pump, the DIVAC 1.4 dry diaphragm backing pump and a simple controller. This provides users with the benefit of easy serviceability.

Leybold, www.leybold.com

BLOWER & VACUUM INDUSTRY & TECHNOLOGY NEWS

Edwards Opens Lab at Hillsboro Innovation Center

Edwards has opened a state-of-the-art chemical laboratory at its Innovation Center in Hillsboro, OR. The lab will provide a venue for Edwards experts to work directly with customer personnel to solve critical problems presented by rapidly changing materials and manufacturing processes. Positioning these resources close to the customer will foster early collaboration and innovation, and put safe, effective solutions into the customer's hands faster. "Almost everything that goes through the process chamber comes out through our equipment," said Kurtis Fairley, Innovation Center Manager. "Mishandling those materials or allowing the wrong ones to mix can exact significant penalties, in downtime, product loss, and health and safety risks to fab personnel. The challenge only increases as the pace of development accelerates.

Edwards, www.edwardsvacuum.com

Brown and Caldwell Utility Optimization with BC:Opta™

Leading environmental engineering and construction firm Brown and Caldwell announced the launch of BC:Opta™, its unique approach to utility optimization for a more effective future. Faced with challenges from aging assets, drought, storm surges, and increasing regulations to replacing skills of a retiring workforce and budget limitations, improving utility performance for short- and long-term success is an ongoing prospect for utilities. The BC:Opta approach encompasses a three-part framework: people+technology+adoption, beginning with Brown and Caldwell's deep subject matter expertise and, if applicable, employing proven or innovative technologies. The key step involves empowering a utility's lasting adoption of an optimized solution to fully realize immediate impacts and improved performance. Powered by process and utility performance expertise; and often supported by advanced analytics, automation technologies, and digital twins.

Brown and Caldwell, www.brownandcaldwell.com.

Lontra Signs Brabazon as Distributor

Lontra Limited, the developer, manufacturer, and exporter of high value industrial machinery for critical industries, is pleased to announce that it has signed Brabazon Pump, Compressor & Vacuum, as a distributor. Brabazon is the Mid-West's largest distributor of Compressor, Pump and Vacuum products. Brabazon will distribute Lontra's energy saving LP2 blower product within Illinois, Wisconsin, Minnesota and Missouri. Lontra has already secured the distribution of their products in North America with additional coverage in Indiana, Ohio, Pennsylvania, Kentucky and Florida, Colorado, Wyoming, New Mexico and Nebraska. The LP2 blower features Lontra's award-winning Blade Compressor® technology: a patent protected, compact, rotary compressor providing significant improvements in efficiency and reliability for applications in energy intensive industries such as wastewater treatment, pneumatic conveying, and industrial compressed air.

Lontra, www.lontra.co.uk

WELTEC BIOPOWER Announces Bristola as US Service Partner

German biogas plant manufacturer WELTEC BIOPOWER announced the agreement of a Service Partnership in the USA, with Bristola, based centrally in Des Moines (Iowa). The common goal is to promote the expansion of renewable energies by building and servicing efficient biogas plants. Both companies have over 20 years of experience in the industry. During this time, WELTEC has designed and built over 350 biogas and RNG plants in 25 countries around the world. WELTEC BIOPOWER had already successfully entered the US market in 2006 with the construction of two biogas plants in Wisconsin, both successfully converting dairy manures to electricity for over a decade. For some time now, the production of carbon negative RNG from manures and waste materials has been enjoying a major boom in the USA.

WELTEC, www.weltec-biopower.de

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CHILLER & COOLING INDUSTRY & TECHNOLOGY NEWS

Enhanced Chiller Controller

Symbio 800 equipment controls, previously available only on Trane IntelliPak units, are now available on multiple Trane systems. Trane's Symbio 800 portfolio of industry-leading equipment controllers is designed to improve the customer experience throughout the equipment life cycle by providing connectivity, flexibility, and serviceability. These factory-mounted controllers save installation time while offering secure remote connectivity, wireless building communications, and integration with your building management system. Symbio 800 offers open standard protocols to provide a wide range of enhanced monitoring and advanced interfaces to heating, ventilation and air conditioning equipment. The Ascend Air-Cooled Chiller, Model ACR, Trane's high-energy efficiency chiller with screw compression is now enabled with the Symbio 800 controller, for optimum unit performance, efficiency and connectivity.

Trane, www.trane.com.

Danfoss Breaks Ground on New Turbocor Plant

Danfoss announced the groundbreaking on its new manufacturing facility in Tallahassee, Florida. The 167,000 square-foot building, scheduled for completion in early 2023, will host state-of-the-art manufacturing for the VTX line and two TT/TG lines for Danfoss' Turbocor compressors. The new facility will triple current manufacturing capacity to meet a fast-growing demand from the American, European and Asian Pacific markets for cooling and heating high efficiency compressors. Once manufacturing operations are moved to the new building, the existing 70,000 square-foot building will be converted to an Oil-Free Technology Center, housing R&D activities including pilot productions of new cooling technologies and services. Turbocor compressors use magnetic-bearing technology instead of oil and provide a low-carbon and ultra-low GWP cooling option for commercial air conditioning and refrigeration units.

Danfoss, www.danfoss.com

New VRF Touchscreen Controller

Carrier recently launched a new Toshiba Carrier touchscreen controller in North America for variable refrigerant flow systems, capable of connecting up to 128 indoor units to one easy-to-use interface. This new touchscreen controller allows building managers to access their entire VRF system from one central location, eliminating the need to monitor units individually. The seven-inch color touchscreen provides an attractive menu with intuitive navigation that allows for advanced scheduling for indoor and outdoor units to maximize comfort and energy savings. Plus, the compact touchscreen control features an innovative user interface providing a seamless and simple experience. In addition, the new Toshiba Carrier touchscreen controller features a USB port that allows building managers to export system data directly from the hub. With this feature, users can analyze alarm outputs and troubleshoot a myriad of issues easily and efficiently.

Carrier, www.carrier.com

Daikin Applied Acquires Dynamic Controls

Daikin Applied announced the acquisition of Dynamic Controls, Inc., a St. Louis-based building systems integrator supporting the facility management, engineering and construction communities with locations across the Midwest and Rocky Mountains regions. The move brings a new set of capabilities to Daikin Applied, a division of Daikin Industries, Ltd., the world's largest heating, ventilation and air-conditioning manufacturer. Daikin Applied has a legacy of designing and delivering innovative HVAC solutions that not only provide unmatched comfort, but address larger societal needs like improving air quality and cutting carbon emissions. Its offerings include equipment, services and controls for commercial and industrial facilities. With Dynamic Controls' integration expertise, Daikin Applied will link these HVAC technologies with other building systems, such as security, life safety and energy management.

Daikin Applied, www.daikinapplied.com

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