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June 2019

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The Atlas Copco logo is located in the top right corner, featuring the company name in a white serif font between two horizontal white bars on a teal background.A white van with "Sales Service Parts" printed on the side. The van also features the phone number "800-258-9898" and the website "atlas-copco.com/careers". A man in a grey Atlas Copco uniform is standing next to the van, holding the door handle. The van has a display of various Atlas Copco air tools on its side.

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A large blue diagonal overlay covers the bottom half of the image. It contains a white technical drawing of a circular mechanical part with various dimensions and labels. The text "Atlas Copco – doing more for you!" is written in white over this drawing.

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What does that mean? It's simple. Atlas Copco goes further, bringing innovation to every aspect of our offering to you—and that extends far beyond products. Every compressor, dryer, vacuum pump, blower, control, and service visit is stamped with this promise.

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FROM THE EDITOR

Chemical Plants



Has your plant had a compressed air system assessment done? I highly recommend every facility unlock the energy savings and reliability improvements these assessments always discover. There are many fantastic organizations out there performing them. Please let me know if you are unsure who to turn to.

Quality, Safety and Reliability

We have an excellent system assessment success story for you about a major U.S. automotive plant. VPIstruments and ALD, Inc. teamed up to deliver \$600,000 in yearly energy savings. As often happens with assessments, not only is energy saved but reliability is improved. In this case, they turned off an air compressor and improved plant air reliability by turning it into a back-up air compressor!

Compressed air quality testing is widely practiced in the pharmaceutical and semiconductor industries. We'd like to see this practice extended more broadly into the food industry. Maria Sandoval, from Trace Analytics, has provided us a technically strong article on the aseptic technique in microbiological compressed air testing.

Productivity, Sustainability & Energy Conservation

The Tennessee Department of Environment and Conservation is a Supporting Organization of the 2019 Best Practices Expo & Conference. We have written an article spotlighting their wonderful Tennessee Green Star Partnership program connecting leaders in manufacturing sustainability. Participating are 54 manufacturers who work on saving energy and reducing pollution from air, water and/or land.

Does your plant have an Energy Management System? Bo Kuraa writes us from Denmark with an excellent article describing ISO 50001:2018. He says it provides a strategic tool to help manage the performance of energy-consuming equipment, including compressed air systems.

Ron Marshall provides us with a "Tale of Two Cities" comparing two compressed air systems where he performed system assessments. One system has fixed-speed air compressors while the other has VSD air compressors. Take a look to read about the waste discovered in one of the systems.

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

ROD SMITH, Editor

tel: 412-980-9901, rod@airbestpractices.com



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INDUSTRY NEWS

Kaeser Celebrates 100 Years of Innovation

Kaeser Kompressoren is celebrating its centennial year! Established in 1919 as a machine workshop in Coburg, Germany by Carl Kaeser, Sr., the company has grown into a leading compressor manufacturer and global compressed air systems provider. Its reputation and success is built on a firm foundation of innovation, ingenuity, efficiency, and reliability.

Kaeser began manufacturing reciprocating compressors in 1948. Under the leadership of the founder's son Carl Kaeser, Jr, Kaeser introduced the Sigma Profile™ rotary screw aircend in 1975 which greatly advanced energy efficiency in compressed air systems. Launching

the PC-based Sigma Control™ compressor controller in 1998 and introducing the comprehensive Sigma Air Manager™ in 2001, Kaeser led the industry in modern controls, paving the way for the integration of compressed air systems with Industrie 4.0 and advancing the industrial Internet of Things (IoT).

Today, Kaeser has over 6000 employees around the world, whose commitment, skill, and drive for customer satisfaction are second to none.

In addition to major events planned in Germany, Kaeser subsidiaries and partners in over 100 countries throughout the world will be commemorating this important milestone with local events for employees and partners.

An important part of the celebration will be a campaign of “100 Good Deeds.” Kaeser employees will donate their time and energy to support local charitable activities. These efforts mirror the Kaeser family’s long-standing commitment to the local communities where they do business.

A special 100 year anniversary website has been established to share more insight into Kaeser’s rich heritage and the celebrations around the world. Visit www.kaeser-tradition-innovation.com/en.

For more information, visit us.kaeser.com or call (877) 417-3527.

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 www.us.kaeser.com.



Kaeser Kompressoren is Celebrating its Centennial Year



Aerial View of Kaeser Kompressoren in Coburg, Germany

Finally, a better way to save on compressed air



Quickly find compressed air, gas and vacuum leaks—the invisible energy thief

Did you know that compressed air can account for 40 % of wasted electricity?* Locating leaks in compressed air, gas and vacuum systems has been time-consuming and tedious—until now.

With the NEW Fluke ii900 Sonic Industrial Imager your maintenance team can quickly pinpoint the location of compressed air, gas and vacuum leaks in a matter of minutes.



How much could you save if you could see leaks?
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*Source: Compressed Air and Gas Institute (CAGI)
Infrared images are for illustration purposes and may not have been taken by the models shown.

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Ingersoll Rand and Gardner Denver Merge

Gardner Denver Holdings, Inc. (NYSE:GDI) and Ingersoll-Rand plc (NYSE:IR) announced that they have entered into a definitive agreement pursuant to which Ingersoll Rand will separate its Industrial segment (“Ingersoll Rand Industrial”) by way of a spin-off to Ingersoll Rand’s shareholders and then combine it with Gardner Denver, creating a global leader in mission-critical flow creation and industrial technologies (“IndustrialCo”). The HVAC and transport refrigeration assets of the current Ingersoll Rand will become a pure play global leader in climate control solutions for buildings, homes and transportation (“ClimateCo”).

IndustrialCo will be composed of the entirety of Gardner Denver and Ingersoll Rand Industrial, including, subject to closing, Ingersoll Rand’s pending acquisition of Precision Flow Systems (“PFS”), which is expected to close by mid-2019. Gardner Denver’s CEO, Vicente Reynal, and executives from both companies, will lead IndustrialCo. IndustrialCo is expected to be called Ingersoll Rand and trade under Ingersoll Rand’s existing ticker (NYSE: IR). IndustrialCo will operate a diverse portfolio of iconic brands, including Gardner Denver. The Board of IndustrialCo will be led by Gardner Denver Chairman Peter Stavros. Michael W. Lamach, Ingersoll Rand’s Chairman and CEO, along with the current Ingersoll Rand executive team, will continue to lead ClimateCo, which is expected to be renamed.

Under the terms of the agreement, which has been unanimously approved by the Boards of Directors of Ingersoll Rand and Gardner Denver, at the time of close, ClimateCo will receive \$1.9 billion in cash from Ingersoll

Rand Industrial that will be funded by newly-issued debt assumed by Gardner Denver in the merger. Upon close of the transaction, existing Ingersoll Rand shareholders will receive 50.1% of the shares of IndustrialCo on a fully diluted basis, valued at approximately \$5.8 billion. Existing Gardner Denver shareholders will retain 49.9% of the shares of IndustrialCo on a fully diluted basis. The transaction is expected to be tax-free to Ingersoll Rand and Gardner Denver’s respective shareholders for U.S. federal income tax purposes.

“This transaction will create a global leader in mission-critical flow creation and industrial technologies, and accelerate both companies’ strategic priorities of deploying talent, driving growth, expanding margins through increased efficiencies and allocating capital effectively,” said Vicente Reynal. “Gardner Denver and Ingersoll Rand’s Industrial business have a combined history of over 300 years, and are both renowned for our commitment to operational excellence, innovation and quality.”

Vicente Reynal added, “Together we believe we will create meaningful value for shareholders through our increased scale and reach, unmatched portfolio of iconic brands, highly compelling service and aftermarket platform, exposure to diverse and attractive end markets and geographies and the expected realization of significant synergies. We look forward to combining the strengths and talents of our teams, and providing our customers with more comprehensive solutions and broader, industry-leading product, service and aftermarket offerings.”

“Ingersoll Rand has a long track record of top-tier financial performance,” said Mike Lamach. “This transaction presents a compelling



opportunity to unlock significant value for all of our stakeholders through the formation of two global leaders in their respective sectors. In addition to owning one hundred percent of the ClimateCo, our shareholders will also benefit from majority ownership of IndustrialCo and the significant synergies expected to be unlocked as a result of the combination.”

Mike Lamach added, “As a pure play global leader in the climate control solutions markets, we will leverage our leading brands, outstanding sales and service channels and our proven business operating system to capitalize on global sustainability megatrends that play directly to our strengths: reducing energy demand and greenhouse gas emissions and improving efficiency in buildings, homes and transportation. With greater focus, more targeted investments and a simplified business model, we believe our new company will continue to drive above GDP growth and deliver value for shareholders, customers and employees.”

Following the close of the transaction, IndustrialCo intends to grant all employees of the combined company – who are not already equity eligible – with an equity award in IndustrialCo. The total amount of these awards will be approximately \$150 million.

“In the same spirit in which we granted stock to our employees during Gardner Denver’s IPO, we feel strongly that all employees of IndustrialCo should be owners of their business,” said Peter Stavros. “We believe in fostering an ownership mentality, and that this drives motivation and engagement, something that has been clear in Gardner Denver’s strong performance. We look forward to offering this equity award to all eligible employees of the combined company and working together to drive the business forward to create value for all of our shareholders.”

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Key Strategic & Financial Benefits For IndustrialCo

IndustrialCo brings together two highly complementary, premium industrial companies with strong operating platforms and exposure to attractive secular growth trends and diverse end markets. IndustrialCo is expected to benefit from:

- An **experienced management team and the combined talents and skills** of Ingersoll Rand and Gardner Denver team members with a continued strong focus on culture and employee engagement;
- **2019E pro forma revenue of approximately \$6.6 billion and adjusted EBITDA of approximately \$1.6 billion** (including identified cost synergies to be realized);
- Ingersoll Rand Industrial valued at approximately 11x 2019E **adjusted EBITDA pre-synergies**;
- **Generation of long-term shareholder value** through significant expected synergies and revenue growth opportunities;
- Annualized cost synergies of approximately \$250 million expected to be achieved by the end of year three following the close of the transaction through efficiencies in manufacturing, supply chain and procurement and structural overhead;
- Meaningful opportunity to drive incremental revenue growth by leveraging a broader portfolio of technologies, service capabilities and geographic expertise;
- Opportunity to enhance customer value and accelerate margin expansion through increased efficiencies by leveraging Gardner Denver's execution excellence practices and Ingersoll Rand's business operating system.
- **More comprehensive solutions** and an industry-leading product, service and aftermarket portfolio;
- **Greater scale and reach through leading brands** with strong global footprint across North America, Europe, Asia Pacific and Latin America;
- **Exposure to diverse and attractive end markets**;
- **Balanced industrial portfolio** with 90% of revenue having a GDP+ growth profile and 10% of revenue driven by upstream energy activity;
- **Continued execution on successful Club Car growth strategies** in low-speed, electric vehicle end markets linked to sustainability trends.
- **Approximately 40% recurring pro forma revenue and long-term growth opportunities**, driven by highly compelling services and aftermarket platforms;
- **Strong cash flow generation**, supporting a balanced and effective capital allocation strategy;
- Pro forma net leverage ratio of approximately 1.9x, inclusive of approximately \$250M cost synergies expected to be achieved by the end of year three following the close of the transaction, allows for continued balance sheet flexibility;
- Low capital intensity of ~2% capex as a percentage of sales facilitates enhanced opportunities to strategically allocate capital and generate strong free cash flow conversion.

For more information, visit www.ingersollrand.com or visit www.gardnerdenver.com

Tamturbo and Sulzer Team Up with Oil-Free Air Compressors

The two companies announced, in March 2019, an agreement to supply high-speed air compressor technology together to Sulzer's main customer segments globally. These markets, such as pulp and paper, sugar and starch, fertilizer and chemical processing which need intrinsically safe oil-free air, can now benefit from the high-speed technology for industrial level air pressures. This technology will replace existing technologies such as oil-free screw compressors in these applications. Sulzer is known for supplying low-pressure high-speed blower units to applications such as wastewater treatment.

Tamturbo, established in 2010, has been operating in the industrial oil-free compressed air market with its Touch-Free™ technology. The company launched the product line in the USA at the AICD 2018. Read a story about Tamturbo here (<https://www.airbestpractices.com/technology/air-compressors/oil-free-turbo-air-compressors-finland>). The high-efficiency turbo compressors developed and manufactured by Tamturbo produce oil-free air without any risk of oil contaminating product, air network or condensate water. Compressors operate over a wide capacity and pressure range from 40 to 130 PSI at the lowest possible total cost of ownership. Tamturbo has been on the market since 2016 with own operations in Europe and US and global network of distribution partners. The company has units operating in multiple continents.

Sulzer, a global giant in pumping solutions, services for rotating equipment, and separation, mixing and application technologies, has used high-speed technology in its low pressure products successfully for more than 20 years. The low pressure HST™ turbo compressor is the market leader e.g. in wastewater treatment applications. With this cooperation, the same technological



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D-Series, 15-40 HP shown above

Engineered to be both dependable and versatile, the D-Series (15-40 hp) industrial electric direct drive rotary screw air compressor is one of many energy-efficient solutions developed by Sullivan-Palatek. These machines are ideal for smaller industrial settings such as automotive shops, small machining facilities, and fabrication facilities.

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transformation which has happened in the low-pressure blower market since 1996 is now applied to Sulzer industrial air compression. The HSR line of high-speed turbo compressors, was launched by Sulzer in December 2018, builds on this advanced technology (www.sulzer.com/hsr). Sulzer has a presence in around 50 countries globally.

The core of the cooperation agreement is the high-speed technology with active magnetic bearings. The units also use VSD's and advanced control technologies to optimize unit efficiency. The advanced flow dynamic optimization ensures no energy is wasted. Standard features include heat recovery for savings on supplemental energy costs and remote monitoring.

The companies emphasize the lowest total cost of ownership, lowest environmental impact and the highest quality of 100% oil-free compressed air. The technology provides benefits in electrical efficiency, which does not deteriorate during use and a wide turndown range. Critical in industrial applications, the technology offers maintenance-free operation

and high reliability. The first Sulzer HST's were delivered in 1996 and have now been operating in aeration applications for more than two decades with little need for service or maintenance.

"The cooperation with Sulzer to transform the industrial air compressor market by combining our accumulated capabilities will bring financial, environmental and reliability benefits to customers globally. We see strong potential in accelerating the technology disruption with Tamturbo's sustainable products also in the industrial medium-pressure compressor market." Says Olli Kuismanen from Tamturbo in the press release.

"This cooperation will increase overall market penetration of Tamturbo's efficient technology. Tamturbo's different sales channels will benefit from the increased awareness and therefore will accelerate their sales and therefore their customers' savings. We believe this will create a snowball effect in the adoption of this technology," predicts Hannu Heinonen, Vice President for the Americas at Tamturbo.



Tamturbo and Sulzer are teaming up to supply 100 psi (7 bar) oil-free air compressors.

“We are happy to provide the necessary backbone and muscle to our customers’ effort to save energy, provide safe and clean air to the processes, and to make sure that unnecessary breakdowns and hefty maintenance bills are history in the field of oil-free compressed air.” Saku Vanhala, Product Portfolio Manager at Sulzer.

About Tamturbo

Tamturbo was founded in 2010 around the idea that the world needs a more environmentally friendly alternative to producing compressed air. Our unique technological advances has brought to life a range of compressors that far surpasses the legacy technologies both in performance and in significantly lower life cycle cost. Our technology is delivered globally in cooperation with multiple channel partners. Our 100% Oil-Free units with years in 24/7 operation have proven full reliability and zero maintenance without any risks of compressed air contamination. In the end, we provide exactly what the customers need – Just Air. www.tamturbo.com

About Sulzer

Sulzer’s core strengths are flow control and applicators. We specialize in pumping solutions and services for rotating equipment, as well as separation, mixing and application technology. Our customers benefit from a network of over 180 production and service sites in 50 countries around the world. Sulzer has been headquartered in Winterthur, Switzerland, since 1834. In 2018, we achieved sales of more than CHF 3.4 billion with around 15,500 employees. Our shares are traded on the SIX Swiss Exchange (SIX: SUN). www.sulzer.com

For more information contact Hannu Heinonen, VP Americas, Tamturbo Inc.

Tel: 314.662.0188, email: hannu.heinonen@tamturbo.com



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PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

Shining the Spotlight on Manufacturing SUSTAINABILITY IN TENNESSEE

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

► Peer-to-peer learning is widely accepted as an effective strategy for transferring knowledge and ensuring it's put to good use. It's also a strategy that works in Tennessee where manufacturers in a wide range of industries throughout the state are sharing knowledge and gaining recognition for taking the lead in environmental sustainability.

Information sharing and recognition among manufacturers statewide is occurring thanks to the Tennessee Green Star Partnership (TGSP) program, which connects leaders in manufacturing sustainability in the state looking to implement or improve efforts to save energy and reduce or eliminate pollution from air, water and/or land.

Facilitated by the Tennessee Department of Environment and Conservation (TDEC), the TGSP program is a success by virtually every measure. During TDEC's fiscal years 2017-2018, participating TGSP members have reduced energy use by 144,925 MWh for a savings of \$23,645,267. Additionally, members reduced solid waste by 294,049 tons.

Committed to Environmental Stewardship

In all, 54 manufacturers participate in the TGSP program. The companies include those in the automotive, food, and building products industries, and range from small manufacturers to major global brands,



Kendra Abkowitz, Assistant Commissioner for The Office of Policy and Sustainable Practices, Tennessee Department of Environment and Conservation (TDEC).



“TGSP manufacturers go above and beyond what the state and federal government require to protect and improve the quality of Tennessee’s air, land, and water.”

— Kendra Abkowitz, Assistant Commissioner for The Office of Policy and Sustainable Practices, Tennessee Department of Environment and Conservation (TDEC).



Kathy Glapa, TDEC Office of Policy and Sustainable Practices, and Program Manager for the Tennessee Green Star Partnership program.

including Bridgestone Americas, Nissan, Unilever, Frito-Lay, and General Motors.

Regardless of company size, TDEC Assistant Commissioner for the Office of Policy and Sustainable Practices Kendra Abkowitz said all voluntarily became TGSP members and have committed to environmental stewardship.

“TGSP manufacturers go above and beyond what the state and federal government require to protect and improve the quality of Tennessee’s air, land, and water,” said Abkowitz. “The TGSP program provides an opportunity for these companies to learn from each other, and importantly, celebrate their efforts to further the health and well-being of Tennesseans – and stimulate economic development.”

The TDEC Office of Policy and Sustainable Practices oversees the TGSP program. The program is partially funded through an Environmental Protection Agency (EPA) Pollution Prevention Grant designed to assist with the implementation of pollution prevention, as well as technical assistance services and/or training for manufacturers. The grant also supports projects that reduce or eliminate pollution.

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SHINING THE SPOTLIGHT ON MANUFACTURING SUSTAINABILITY IN TENNESSEE

Manufacturers who participate are required to operate under an active ISO 14001 certification, or an equivalent environmental management system. Member companies must also have a minimum of three years of environmental compliance with TDEC regulations.

Qualifications aside, companies involved in the program are those who believe strongly in sustainability and are proven leaders in environmental best practices, said Kathy Glapa of the Office of Policy and Sustainable Practices. Glapa also serves as the Program Manager for TGSP.

Success in Sustainability Abounds

Virtually every TGSP member manufacturer implements numerous ongoing initiatives as part of their commitment to environmental stewardship. Here are just a few examples of projects implemented and initiatives TGSP has promoted:

SumiRiko Tennessee, Inc.

The company manufactures anti-vibration, high-pressure hoses, and soundproofing products for the automotive industry. Among its sustainability projects, it installed a better system of monitoring and controlling 13 air compressors at its plants in Tazewell and Midway, Tennessee.

With the new system, the company no longer needs to run all of its air compressors continuously to maintain air pressure. Instead, SumiRiko Tennessee has the ability to start and stop its air compressors to supply air where and when needed at the proper pressure. The system also helps the company track energy consumption of its compressed air system. As a result, it saves \$140,000 per year in energy costs.

ABC INOAC Exterior Systems, LLC

A Tier-1 automotive supplier of exterior plastic molded components, ABC INOAC Exterior Systems, LLC, implemented various energy savings measures in 2018 at its facility in Livingston, Tennessee.

Among its projects were the replacement of three air compressors and a 350-ton

chiller with more efficient equipment. The manufacturer also replaced low efficiency bulbs with LED lighting. The updates resulted in \$31,000 in savings in only four months.

American Snuff Company

American Snuff Co., Memphis, Tennessee, has become one of the most sustainable companies in Tennessee in recent years. The company is the nation's second largest manufacturer of smokeless tobacco products.

American Snuff implemented a compost program that allowed it to achieve a nearly 90% diversion rate of production waste to landfills. Among other projects, it also invested in a water treatment system that has saved nearly 2 millions of gallons of fresh water and 34,000 kWh of energy since the system was implemented.

DENSO Manufacturing of Tennessee

At its Maryville, Tennessee, facility, more than 3,600 DENSO employees manufacture starters; alternators; instrument clusters including motherboards; keyless entry; air bag sensors; and heads-up displays.

As a company that embraces innovation, DENSO replaced refrigerant used to cool 21 compressor-driven HVAC units with chilled water. Doing so dictated the installation of a unique ice-chilled water plant, which has all of the components found in a traditional chilled water plant, plus a series of ice storage tanks.

“These companies take the lead because they know it makes good business sense and it’s the right thing to do,” Glapa said. “Our goal is to support these achievements versus serving as a regulatory arm of the government.”

The ice-chilled water plant creates ice for storage in insulated tanks during off-peak electrical demand periods at night. The water from the HVAC systems is then cooled during the day by running water around the ice. The result is a 40% reduction in the cost of cooling, which is addition to the elimination of refrigerants.

Nissan North America

Yet another major manufacturer and environmental leader in Tennessee is Nissan North America, which produces more than 650,000 vehicles per year at its operation in Smyrna, Tennessee. It also operates powertrain facility in Decherd, Tennessee.

Unlike before, much of the water within the Smyrna facility is now re-circulated due to the installation of additional filtration, as well as a system that redirects water used for rinsing vehicles back to the start of the metal paint pretreat process. Treated wastewater from the wastewater pretreatment facility is also used for process mixing, as well as seal cooling in pumps. In Decherd, an additional Reverse Osmosis unit was installed to capture reject water from the primary system and filter water for blending in other operations.

In all, Nissan North America has reduced water consumption by over 90 million gallons per year through these initiatives.

Winning Combination: Education and Networking

There are multiple ways TGSP facilitates the sharing of successes and sustainability best practices for the purposes of learning – and more. Efforts include an annual roundtable, summer workshops, webinars and videoconferences.

Topics of focus used for educational purposes throughout each year are determined based on the roundtable discussions, as well as TGSP’s annual survey of over 600 Tennessee manufacturers. Members also submit quarterly and annual reports to TGSP, which provide additional insights for topics of focus.

The program’s in-person workshops give members the opportunity to learn from experts in various areas of sustainability, as well as

representatives from other TDEC organizations and partner organizations that support environmental stewardship. Examples include the state’s Office of Energy Programs, the Division of Solid Waste Management, and the Tennessee Technological University Industrial Assessment Center (TTU-IAC). TTU-IAC provides manufacturers with free energy, productivity, and waste assessments, including best practices for compressed air systems, and blowers and vacuum, as well as cooling towers and chillers.

The workshops also serve as networking opportunities where participants can share contact information and practical and helpful ideas that work. It’s not unusual for environmental leaders in different companies to follow up with each other and form long-lasting relationships after making a connection through TGSP.

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Presenter Loran Circle, Senior Consultant, Circle Training & Consulting
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Presenter Tom Taranto, Owner, Data Power Services
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Sizing and Operating Vacuum Pumps

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Presenter Tom Taranto, Owner, Data Power Services
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Presenter Ross Orr, Systems Engineer, Compressor Energy Services
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SHINING THE SPOTLIGHT ON MANUFACTURING SUSTAINABILITY IN TENNESSEE

In addition to in-person workshops, TGSP’s webinars cover a host of topics associated with sustainability, as well as methods and programs companies have used to implement best practices.

Highlighting Manufacturer Successes

Another significant component of TGSP’s effort involves the development of written articles to help educate manufacturers about sustainability best practices and help them gain recognition for their programs.

TGSP-produced articles are published on the organization’s website and describe members’ successful initiatives to save energy and reduce, or eliminate pollution. (See sidebar article for examples.) TGSP also shares the articles

through social media and other media outlets, including those of state and environmental organizations.

Yet TGSP can’t do it alone, which is why it encourages members to apply for various state awards that recognize those who are making a difference in the world of sustainability. Examples include the Tennessee Governor’s Environmental Stewardship Award, as well as recognition available through organizations like the Tennessee Recycling Coalition and the Tennessee Chamber of Commerce and Industry.

“What really drives the TGSP program is that we celebrate how manufacturers

throughout the state of Tennessee do more than anything the EPA or TDEC ask them to do as far as regulations,” said Glapa. “We have 7,000 manufacturers in Tennessee who can benefit from hearing and learning about these efforts. The idea behind TGSP is to give manufacturers who are environmental leaders a place to shine.” **BP**

For more information about the Tennessee Green Star Partnership program, visit <https://www.tn.gov/environment/program-areas/osp-policy-and-sustainable-practices/business-and-private-sector/green-star-partnership.html>.

All photos courtesy of the Tennessee Department of Environment and Conservation’s Office of Policy and Sustainable Practices.

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QUALITY, SAFETY & RELIABILITY



AUTOMAKER SAVES \$600,000 YEARLY IN ENERGY COSTS & Improves Compressed Air System Reliability

By Pascal van Putten, VPIstruments, and Tyler Costa, ALD, Inc.

► An advanced car manufacturing plant in the Western half of the U.S. is living up to its goal for a greener future, thanks to an extensive compressed air system audit followed by the implementation of advanced control technology and airflow meters for ongoing monitoring

and measurement to ensure continued system efficiency.

The project, which also involved the addition of a booster air compressor and receiver tank – along with the installation of an

important pressure control valve – gives the automaker the ability to run fewer centrifugal air compressors during peak production. In so doing, the plant saves nearly 6.1 million kWh and more than \$600,000 per year in energy costs. The project also qualified for



“The project also qualified for a \$369,374 rebate from the local utility, resulting in a six-month project payback – all while improving system reliability.”

— Pascal van Putten, VPIstruments, and Tyler Costa, ALD, Inc.

a \$369,374 rebate from the local utility, resulting in a six-month project payback – all while improving system reliability.

Centrifugal Air Compressors Power Production

Compressed air is at the heart of production at the manufacturing plant, which spans 115 acres. Compressed air powers pneumatics used to control robots in addition to powering conveyors, and packaging equipment. It is also used extensively in painting, stamping and plastics molding operations.

Before the compressed air system upgrade, the plant operated seven centrifugal air compressors located in a central Power House. The air compressors include six 1,250 horsepower (hp) centrifugal air compressors and one 700-hp machine. The system also included eight refrigerated dryers, as well as four 2,500-gallon receiver tanks and one 5,000-gallon tank.

The air compressor models and ratings are as follows:

MODEL	MAX PRESSURE	CAPACITY	NUMBER OF UNITS	HP
Model 1	143 Psig	3,723 CFM	3	1250
Model 2		4,523 CFM	1	1250
Model 3		2,612 CFM	1	700
Model 4		4,546 CFM	2	1250

The automotive manufacturer initiated an internal effort in 2016 to achieve energy savings and increase the efficiency of its compressed air system, which at the time cost \$1.6 million per year to operate. The complexity of centrifugal air compressors, as well as the method of controlling them, led the company to seek the support of experts in compressed air systems.



A total of seven Ingersoll Rand centrifugal air compressors are used to power production at a automotive plant spanning 115 acres.

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AUTOMAKER SAVES \$600,000 YEARLY IN ENERGY COSTS & IMPROVES COMPRESSED AIR SYSTEM RELIABILITY

Audit Shows Significant Centrifugal Air Compressor Blow-off

The first step toward achieving plant goals involved a comprehensive audit of the compressed air system by iZ Systems in partnership with ALD, Inc.

To conduct the audit, the team exported data from the plant's SCADA monitoring system including motor amps, discharge pressure, inlet valve and the blow-off position of each air compressor to determine different operating profiles of the system. In addition, pressure loggers were placed downstream of the air compressors and throughout the campus to monitor pressure fluctuations and to see how the air compressors responded to changes in demand.

The audit showed the seven 1,250 hp air compressors running on a simple local pressure control system. The controls were not capable

of managing the inlet valves and blow off valves discreetly, which leads to PID hunt. As a result, the machines were blowing off a significant amount of compressed air in all operating conditions to protect from surging, which resulted in unloading and loss of plant pressure. Also discovered during the course of the audit were two unique demand periods:

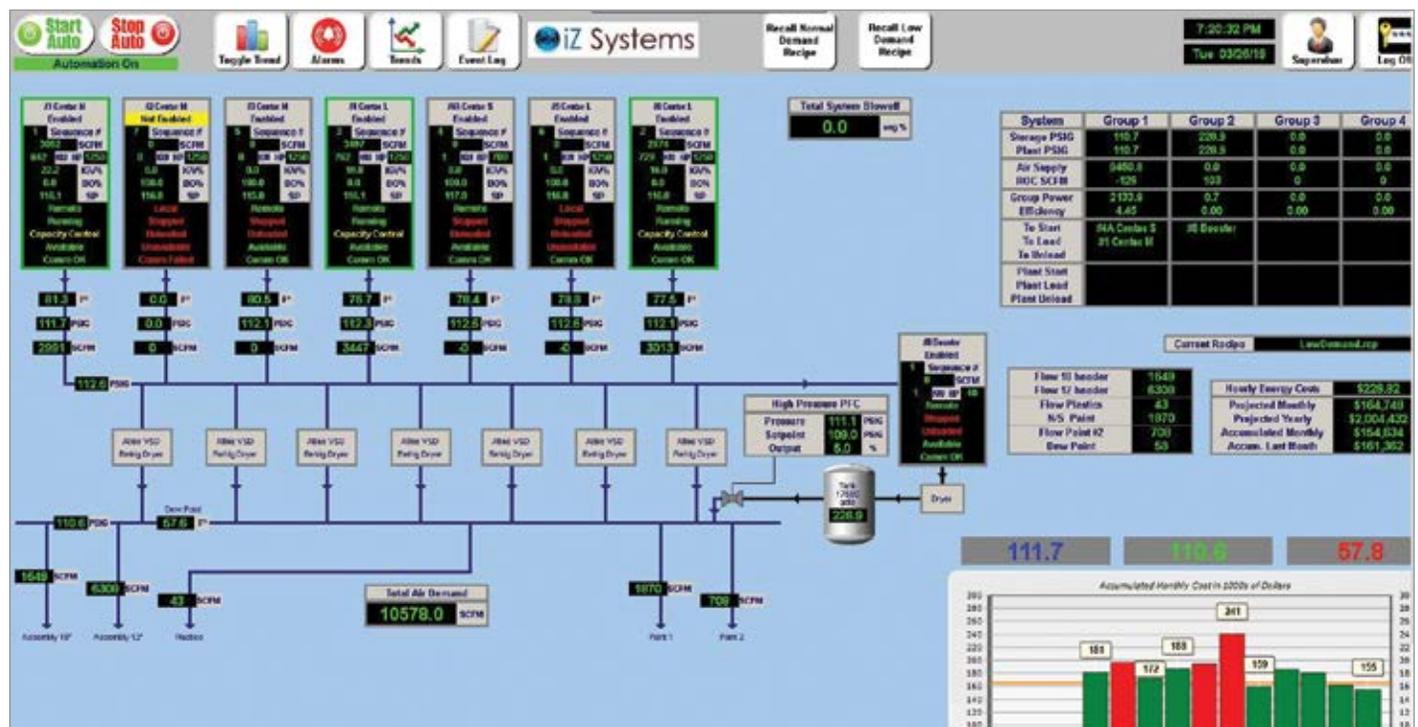
- Normal demand: three air compressors are online and operating to maintain production pressure for approximately 5,200 hours per year.
- Low demand/weekends: three air compressors remain online, while not needed during low-demand periods for approximately 1,688 hours per year – in addition to handling a weekend load of 1,872 hours per year.

Based on data gathered during a two-week audit period, the team recommended the installation of an automated compressed air system control and monitoring solution, which sequences the operation of the air compressors to match actual demand.

The audit also showed the plant could reduce peak demand with equipment upgrades, which primarily consisted of a booster air compressor together with a larger receiver tank. The team also recommended the installation of VPI Instruments' VPFlowScope DP airflow meters in the discharge line of each air compressor for accurate airflow measurement and ongoing monitoring.

Extensive Data Collection Required for Energy Rebate

Knowing the project qualified for a substantial utility rebate, the team submitted its audit report to the local utility for review. In



The upgraded compressed air system includes an air booster and large receiver tank. A control valve downstream of the storage tank allows air to be released into the system, resulting in faster system response and one less air compressor needed to meet peak demand.

In addition to their approval process, the Utilities Commission reviewed the audit in parallel to validate the audit methods and energy savings calculations.

More than a year later, the utility approved the project rebate, but required the plant to first install the automated compressed air control system and record four weeks of additional baseline data to further validate the ability to achieve the projected energy savings. Utility commission officials were pleased the team planned to install new meters to gain an accurate comparison of airflow supplied to production versus using older airflow meters already installed on the plant's compressed air distribution system.

Next, the team installed the iZ Systems Compressed Air Automation and Data Acquisition System at the plant. The technology communicates directly with each air compressor's main panel and can also acquire data from the air compressor Modbus outputs, or any combination of external sensors for continuous monitoring of the entire compressed air system. The control system enables full control over all air compressors, which is key to optimization of compressed air supply to match the demand profile. The Automation Platform can also be accessed remotely to optimize the air compressor control sequence, if required.

Importantly, data secured using the new system over the four-week period further validated the potential energy savings.

Improving Compressed Air System Responsiveness

Another key issue addressed at the plant was the existing compressed air system's inability to effectively manage peak demand events. Specifically, a spike in air demand would cause a pressure drop because the centrifugal air



A VPI Instruments' VPFlowScope DP airflow meter installed on each centrifugal air compressor gives the plant the ability to monitor each unit, which in turn, allows decision-makers to improve system efficiencies and maintenance.



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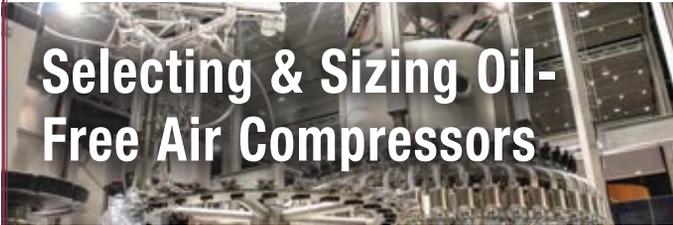
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Tom Taranto,
Owner, Data
Power Services.

Our first **Sponsor Speaker** is Leo Di Bello, Product Marketing Manager – Medium Pressure Oil-free Screw Compressors, Atlas Copco Compressors. His presentation is titled, “Five Common Pitfalls When Selecting and Sizing an Oil-free Compressor.” This presentation will show practical examples of common pitfalls we see when sizing oil-free compressors and, importantly, how to take steps to avoid them.



Leo Di Bello,
Product Marketing
Manager –
Medium Pressure
Oil-free Screw
Compressors,
Atlas Copco
Compressors.

Our second **Sponsor Speaker** is Tim Albers, Director of Product Management, Nidec Motor Corporation. His presentation is titled, “Choosing the Right Compressor Motor.” There are many factors to consider when choosing the right motor for an air compressor application. This presentation will focus on the critical characteristics for design of electric motors used on centrifugal and screw air compressors. Critical design points include fixed or variable speed, winding and bearing temperature, voltage tolerances, efficiency levels, starting methods and starting characteristics and many other specifications depending on the end application and environmental conditions.



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compressors would ramp up too late. This happened because the peak events were too short for the machines to quickly react to increased demand. Further, the situation created a peak in pressure followed by air compressor blow-off.

To increase compressed air system response time, the team installed a booster air compressor together with a 17,500-gallon receiver tank capable of storing compressed air at 250 psi. Given that plant pressure is around 100 psi and tank pressure 250 psi – and the fact that air is stored off line – the storage tank differs from a normal storage tank connected to the main header at plant pressure.

By increasing the pressure in the storage tank, the capacity of the compressed air storage system is more than doubled. The upgraded system also includes the use of a crossover pressure flow control valve, which is controlled by iZ Systems’ automation platform. The valve releases air from the storage tank into the main supply line when peak demand occurs. In so doing, the plant only needs to run two or three air compressors rather than four units to meet peak demand for air.

This upgraded system also virtually eliminates blow off from the centrifugal air compressors. In the event of an air compressor failure, the offline boosted storage system provides peak demand flow for over 10 minutes, which gives the automation platform enough time to automatically bring a backup unit online without interruption to plant production.

Differential Airflow Meters Track Machine Efficiency

Another key aspect of the upgraded compressed air system is the ability to continuously monitor and adjust the system as air demand changes for any number of reasons, such as when the maintenance staff repairs air leaks. Ongoing monitoring of demand in airflow also allows decisions to be made regarding changes to the air compressor control algorithm for system optimization.

At the plant, each air compressor is fitted with differential pressure airflow meters, VPFlowScope DP, to measure bi-directional airflow, pressure and temperature. The plant, which appreciated the ease of installation of the new airflow meters, can now track the efficiency of each machine. If issues are detected, such as clogged inlet filters or reverse flow, plant staff can take immediate action and avoid wasted energy and associated costs. The plant can also detect when a non-return valve in the air compressor is leaking to prevent reverse flow.

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In addition, the maintenance team uses a clamp-on ultrasonic transit time flow meter to regularly check the cooling water supply to each air compressor. Improper cooling can dramatically decrease the efficiency of the compressed air system.

Energy Savings and Reliability Equal a Win

The automotive manufacturer initiated its compressed air system upgrade project shortly after utility approval of the audit in November 2018. Implementation of the compressed air automation and data acquisition platform in combination with the upgrades to the system reduces the facility's annual energy consumption by 6,098,619 kWh per year, resulting in yearly savings of \$600,000. With the utility incentive of \$369,374, the project delivered a simple payback of six months.

In addition to achieving the goal of energy efficiency, the project improved the reliability of the compressed air system since the plant needs to run one less centrifugal air compressor to meet peak demand, which means the same air compressor is free to serve as a backup unit. The offline boosted storage system also further enhances system reliability since it is designed to supply enough air to support the plant needs until the backup air compressor comes online to replace a failed air compressor. **BP**

About the Authors

Pascal van Putten is CEO and founder of VPIInstruments and has 20 years of experience in flow measurement, compressed air monitoring and industrial energy management. Tyler Cost is Vice President of Operations, ALD, Inc. In the last 10 years he has completed hundreds of compressed air system audits for a wide range of industries.

About VPIInstruments

VPIInstruments offers industrial customers easy insight into energy flows. Founded in 1999, it provides complete solutions for monitoring compressed air flow, gas flow and electric energy consumption. Its products can be found all over the world and in a wide range of industrial markets, such as automotive, glass manufacturing, metal processing, food and beverage and consumer goods. For more information, visit www.vpinstruments.com.

About ALD, Inc.

ALD, Inc. is the largest compressed air and industrial vacuum audit and technical services firm on the West Coast of the United States. It provides professional compressed air system services with unbiased audit recommendations aimed at maximizing the value of the production throughput. ALD offers turnkey project solutions, and also has contracts and relationships with all major California and Arizona utility companies to offer significant compressed air incentives. For more information, visit www.airleakdetection.net.

About iZ Systems

iZ Systems has been a worldwide leaders in auditing and design of compressed air and vacuum systems since the 1980's. The company, which has locations throughout the United States, holds a number of copyrights and patents for advanced logic in compressed air automation. The iZ Compressed Air Automation and Data Acquisition System has built-in data acquisition and provides on-line support for system tuning and management, while providing centrifugal air compressor load sharing technology and pressure flow control compatibility. To learn more, visit www.izsystems.com.

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QUALITY, SAFETY & RELIABILITY

HOW TO IMPLEMENT ASEPTIC TECHNIQUE in Microbiological Compressed Air Testing

By Maria Sandoval, Trace Analytics

► Introduction

In modern and industrial work settings, people spend more than 90% of their time in enclosed spaces, such as warehouses, office buildings and factories. In most indoor environments, the air contains a variety of chemical and microbial particles, commonly defined as indoor pollutants, which can severely affect human health and product quality¹. Industries like food and beverage, medical devices and pharmaceutical manufacturers rely on their scheduled compliance testing to confirm the presence or absence of issues in workflow pipelines that are detrimental to the daily output and safety of the product. If contaminants are in the ambient air, whether

indoors or outdoors, then you can be assured that they are also on your clothes, body, and equipment. A problem arises when certain pollutants like bacteria, yeast and molds cross contaminate regulatory and compliance tests like microbial testing of compressed air systems. Aseptic technique is a practice designed to thwart these effects.

The International Organization for Standardization (ISO) and the United States Pharmacopeia (USP) include in each microbial procedural section the use of aseptic technique while testing. The technique is used to avoid cross contaminating the tested compressed air sample with that of the pollutants on yourself and the surrounding environment.

If not conducted properly, false positives will occur and can often result in system failures, accumulative costs, and maintenance or retesting fees. This article will focus on understanding the development, implementation, and importance of aseptic technique for compressed air microbial testing.

Evaluate the Sample Location

Understanding aseptic technique requires an understanding of how microorganisms interact with dynamic environments. These environments include the ambient air near the compressor and point-of-use, the sampling equipment, and finally the sampling technician themselves. Depending on where



“If not conducted properly, false positives will occur and can often result in system failures, accumulative costs, and maintenance or retesting fees.”

— Maria Sandoval, Trace Analytics

the compressor is located, it will pull in ambient air of variable quality. The system then compresses that air, sends it into a storage tank and then distributes it through a filter and dryer system (not required, but highly recommended) before it is used in the field. Once the air is distributed through a pipe or tube line to its point-of-use, the system can be tested for microbial contamination. If the environment around the point-of-use sampling area is filled with dust or other types of particulate matter, there is a large probability that those particles in the ambient air will cross contaminate the microbial test at the time of sample taking. For example, facilities that sort, clean, or package certain goods that result in a high degree of flocculate material like flour, sand, dust etc., can find that taking a simple microbiological test is next to impossible due to the surrounding environment. The particulate matter acts as a vehicle to the bacteria, yeast or mold and carries it to a new location. This can include the agarose plate used for sampling. Microbes are very small and can easily travel from one environment to another. Something as simple as a sneeze can send millions of bacteria across the room. Doing a risk assessment of areas with this high level of particulate matter in the ambient air is a great way to evaluate whether the point-of-use is a required point of testing. If the degree of cross contamination is very likely to yield inaccurate results due to the inability to sample with a certain degree of cleanliness, preloading the sampler in a more “clean” area might be necessary. This can help to achieve more reflective results of the point-of-use. Due to strict regulations and compliance procedures, pharmaceutical and medical device operations will likely not run into these types of issues.

Evaluate Yourself

The primary goal of aseptic technique is to eliminate the potential of cross contaminating

microbiological samples with outside microbes. The biggest problem is that the human body is full of beneficial and potentially pathogenic microbes. These reside inside and outside the individual. A few simple pieces of personal protective equipment and some disinfectant can help prevent cross-contamination.

Gloves

The first and generally most effective pieces of PPE are clean, fitted examination gloves (mechanics or cloth gloves are not the same). Loose latex or nitrile from the fingers of a poor fitting glove can touch the surface of the agarose plate and contaminate it. Examination gloves produce an inorganic barrier between yourself and the sampling media (usually non-selective agarose). The Centers for Disease

Control and Prevention states that keeping hands clean is one of the most important steps we can take to avoid spreading germs to others and multiple surfaces². Microbes can get onto hands after people use the toilet, handle raw meats, touch mucosal membranes, practice poor hygiene, and handle other contaminated objects (doors, knobs, tables). Protecting your compressed air microbial sample from yourself is the best way to ensure accurate results on your report. Once your gloves are on and sprayed with a disinfectant (ethanol, bleach or isopropanol alcohol), refrain from touching any surfaces other than the work surface. People generally touch their eyes, nose, and mouth without even realizing it. If there is a potential of cross contamination, change gloves or clean the surface of the gloves prior to moving forward.

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Lab Coat/Apron

It is also important to consider your clothes and arms as a potential source of contamination. A clean, fitted, washable or disposable lab coat is another necessary form of PPE to eliminate any microbes that land or live on your clothes and skin from shedding onto the agarose plate during testing and movements during sampling setup. These lab coats need to be cleaned; a dirty lab coat/apron is as useful as no lab coat at all.

Additionally, should there be a spill (alcohol or disinfectant) or the agarose plate is dropped on your body, the lab coat will keep you clean.

Facemask

People generally don't realize how many microbes occupy the space in their mouths and nose. There are so many microbes in the human mouth that there is a study named after it: the human oral microbiome³. A single mouth can be home to more than 6 billion bacteria, an impressive number when

compared to the 7.3 billion people populating the Earth. Every time we speak, cough, sneeze, exhale a breath, saliva and microbes leave our mouth and nose. Most of these droplets degrade enough that the microbes can't survive in them long, but studies have shown that after a sneeze, microbes can survive in the bioaerosol (the liquid of the sneeze or cough) for up to 45 minutes⁴. Because of this, it's important to cover your nose and mouth when opening microbial plates like agarose.

Table 1: Aseptic Technique Scoring Rubric for Compressed Air Microbial Sampling

Component	Likely to Cause Contamination	Needs Improvement	Acceptable
Personal Protective Equipment (PPE)	<ul style="list-style-type: none"> Not wearing a lab coat Not wearing gloves, soiled gloves, ill-fitted gloves Touching face, clothes, and unclean surfaces 	<ul style="list-style-type: none"> If long hair or facial hair is present and not using a hair net or beard net 	<ul style="list-style-type: none"> Wearing a clean lab coat and clean fitted gloves with a face mask
Disinfecting Workstations	<ul style="list-style-type: none"> Dusty table top Dirty work station Dirty equipment cart 	<ul style="list-style-type: none"> Using non-alcohol or non-bleach based cleaning agent Cosmetically dusting workspace 	<ul style="list-style-type: none"> Cleaning the surface that holds the impaction sampler with 70% Ethanol or Isopropanol or bleach before equipment assembly and sampling
Manipulation of Equipment and Consumables	<ul style="list-style-type: none"> Not storing agarose plates at required OEM temperature 	<ul style="list-style-type: none"> Assembling the impaction sampler without gloves 	<ul style="list-style-type: none"> Always keep agarose plates at OEM temperatures (cooler with ice pack) Always use a clean disinfected or sterile hose in between points-of-use
Utilizing Equipment	<ul style="list-style-type: none"> Opening petri dishes with dirty, soiled gloves Not cleaning petri dish holder on equipment Putting contact plates lid face up 	<ul style="list-style-type: none"> Using non-alcohol or non-bleach based cleaning agent 	<ul style="list-style-type: none"> Always open plates with clean, disinfected gloves Make sure the petri dish base holder is cleaned between petri dishes Acceptable air pressure and flow Placing petri dish lid inside sterile bag or on disinfected surface face down
Inspecting Product	<ul style="list-style-type: none"> Cutting the agar when taking off the lid inappropriately Dirty gloves when putting back on 	<ul style="list-style-type: none"> Allowing parafilm to become in contact with a soiled surface 	<ul style="list-style-type: none"> Closing the petri dish without disturbing the agarose surface Parafilm plate Making sure the impacted surface has dimpling on impaction samples
Packaging Samples	<ul style="list-style-type: none"> Not keeping sampled agarose plates at refrigerated temperature Not bubble wrapping and securing the plates if shipping to 3rd party lab 	<ul style="list-style-type: none"> Using solid plastic ice packs instead of flexible ice packs. Too much pressure will crack the plate 	<ul style="list-style-type: none"> Securely bubble wrapped petri dishes Making sure ice packs are frozen at time of shipment Burst-proof shipping boxes Plates shipped inside sterile packaging

Disinfectant

Disinfectants are solutions that act to eliminate or reduce harmful microorganisms from objects or surfaces. This is different from a sterilization process, which kills all microorganisms. Alcohol has been used as a disinfectant for centuries. The most common of the alcohol-based sanitizers are ethanol and isopropanol alcohol. Due to the structure of some microorganisms, like bacteria, exposure to a solution of 70% ethanol or isopropanol alcohol will result in the outer cell membrane of the organisms to degrade, fall apart, and ultimately die. This does not happen as efficiently with alcohol concentrations above or below 70%. Solutions of 10% bleach (sodium hypochlorite) act like alcohol by degrading proteins of the microorganisms which results in cellular death. The simple act of spraying the surface of gloves, work table, and inside of the impaction sampler is enough to properly clean between points-of-use for accurate results.

These essential PPE items are necessary to avoid cross contamination when testing compressed air microbial samples using aseptic technique. If the technician has a beard or long hair, hairnets are always recommended. Eye protection is important for protecting eyes while using disinfectant sprays and preparing the compressed air for sampling.

Training Aseptic Technique

Adequate aseptic technique training includes many components. These include preparing the environment for testing, personal preparation, and product manipulation⁵. Table 1 is an adaptation of Brown's chart that outlines a training rubric for compressed air (impaction sampler) microbial testing in adherence to ISO 8573-7. The purpose of the training rubric is to allow for performance scoring and identification of particular areas to focus

retraining on in the future. The table contains the component being evaluated, ratings based upon criteria descriptions, and their likelihood to cause contamination, need improvement or be acceptable in practice.

The components that need to be evaluated include personal protective equipment, disinfectant and cleaning protocol, manipulation of sampling equipment, utilization of equipment, inspecting final product, and packaging the final sample for shipment or processing. These all encompass the aseptic technique protocol that will limit or eliminate any cross-contaminating variables from the sampling equipment to the plate analysis. The rubric should be read in full and adapted to fit the sampling equipment being used. Much of the protocol is broad enough to be implemented universally

and by all skill levels. It is recommended that a baseline of the technician's skill be performed after an aseptic technique discussion is given and understood. This baseline will give the trainer an idea of what skills need improvement or concepts need clarification. As most cleaning and laborious protocols have degradation over time, it is recommended that a biannual assessment be conducted to evaluate technique over time.

Microorganisms in compressed air systems can indicate a potential presence of pathogens associated with wastewater near intake pumps, poor preventative maintenance of piping distribution, and loss of protocol integrity. Thorough, documented training is critical when it comes to making sure personnel are adequately prepared to sample microbiological organisms from any facility system.

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HOW TO IMPLEMENT ASEPTIC TECHNIQUE IN MICROBIOLOGICAL COMPRESSED AIR TESTING

Compressed air systems are unique; ISO and USP have select protocols specifically designed for the analysis of microbial contaminants, which utilize negative controls, blinds, and aseptic technique. When properly done, the results paint a clear image of the sampling day. If ISO 8573-7 is followed verbatim, there exists a sterility blank (a negative control that accompanies the test samples but is never opened), two blinds that test the aseptic technique of the technician, before and after sampling, and the actual point-of-use sample. Should any of the ISO 8573-7 blinds contain contamination, there is little confidence as to which system contaminated the test plates, should the test plate have contamination

as well (the ambient environment or the compressed air). More specifically, if a before blind is contaminated with 2 colony forming units (CFU) and the point-of-use test plate is contaminated with 1 CFU, while the after blind is clear of observable contamination, there would now exist a level of scrutiny that must be placed on that point-of-use's data. There can be no assurances that the contamination on the test plate is not the same as the contamination on the before blind. Likewise, if the blinds are contaminated but the compressed air sample is not, the aseptic training of the sampling technician should be reassessed and evaluated. The ideal situation is clean blinds and an under-limit test plate report.

In summary, there is no substitution for proper training of personnel for aseptic technique. The microbial results can indicate whether protocol was adequately followed or if retraining needs to occur. In either case, documentation and biannual training assessments can aid in maintaining technique and accurate compressed air microbial reports. The cost of contaminated blinds and compressed air microbial samples can result in retesting fees and labor costs, false positives that result in potential point-of-use shut downs and decrease in product integrity if a recall is issued. **BP**

About the Author

Maria Sandoval has over 15 years of experience in Microbiology and Molecular Biology. Her field work includes analyzing extremophiles isolated from the depths of Lake Baikal in Russia to the 50km exclusion zone of Chernobyl. Additionally, she's worked alongside the CDC with DSHS analyzing and diagnosing patient microflora. Her tenure with the Lawrence Berkeley National Laboratory, Department of State Health Services and the University of Texas MD Anderson Cancer Center has made her a leading expert in microbial testing. As Trace Analytics' Microbiologist and Lab Director, she is responsible for microbial testing and procedural development.

Trace Analytics is an A2LA accredited laboratory specializing in compressed air and gas testing for food and beverage manufacturing facilities. Using ISO 8573 sampling and analytical methods, their laboratory tests for particles (0.5-5 microns), water, oil aerosol, oil vapor, and microbial contaminants found in compressed air. For over 29 years, they've upheld the highest industry standards of health and safety, delivering uncompromising quality worldwide in accordance with ISO, SQF, BRC, and FDA requirements. Visit www.AirCheckLab.com

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COMPRESSED AIR AND ENERGY MANAGEMENT Systems Based on ISO 50001: What You Need to Know

By Bo Kuraa, Enersize

► An Energy Management System (EnMS) according to ISO 50001:2018 provides companies with a strategic tool to help manage the performance of energy-consuming equipment, including compressed air systems. Improved performance of a compressed air system, in turn, can go a long way toward lowering energy costs and improving system uptime, both of which provide the ability to reduce the company's carbon footprint. Here's a look at the standard and important considerations involved in the implementation of an EnMS for a compressed air system according to ISO 50001.

A Framework for Energy Management

ISO 50001:2018 is based on the management system model of continuous improvement and is also used for other well-known standards, such as ISO 9001 (quality management) or ISO 14001 (environmental management). This makes it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management.

The standard provides a framework of requirements for organizations to:

- Develop a policy for more efficient use of energy.
- Fix targets and objectives to meet the policy.
- Use data to better understand and make decisions about energy use.
- Measure the results.
- Review how well the policy works.
- Continually improve the EnMS.

From a more practical perspective, you could say ISO 50001 consists of about 20 pages of "common sense" and it is a "one size fits all" standard. So every company that consumes energy should implement EnMS according to ISO 50001 from the biggest global corporates to the smallest workshops. The intention is of course to implement a system adjusted to the size and the activity level of the individual

company. In other words, there will be a relatively huge difference between "big" and "small" companies concerning the complexity of the systems, although the standard is the same.

An EnMS according to ISO 50001 can in very many countries be certified. Some bigger companies may have a certified ISO 9001 system in place, but this does not exclude other companies from picking the "best" parts of the standard that bring energy savings, along with a lower carbon footprint. However, it is very much recommended to follow the standard in detail concerning the parts you implement, if/when you later decide to go for an ISO 50001 certificate.

The ISO 50001 standard includes a term called Significant Energy Use (SEU). In short, SEU addresses energy-consuming equipment that consumes a significant part of the total energy of the company and/or offers a considerable potential for improvement in energy performance. In that sense, a compressed air system fits extremely well into SEU (ISO

50001). As in many companies, compressed air consumes 5 to 15 percent of the total electricity consumption of the company and generally offers potential projects with a payback time within three to nine months, which is often referred to as “low hanging fruit.”

Start with Mapping for EnMS Implementation

Of course, implementation of EnMS requires resources to implement, but in the beginning it is often about top management’s decision to start the process, while also making time, data and staff available, than it is about big investments. Generally, it is more about the need to change the culture in the company, including an understanding of energy and energy services, as well as production process demand. It is also about the decision to commit to continuous improvement, including monitoring of energy-consuming equipment, and training of staff at different levels, including operators, maintenance teams etc.

Once you have decided to call your compressed air system a SEU, a good place to start with EnMS implementation in accordance with ISO 50001 is to map your compressed air system. You may have diagrams about the system available, but it is a good idea to check if these diagrams are in accordance with reality; alternatively create some new ones if they do not exist, or they have not been updated for a long time.

Mapping should also include location of the equipment (air compressors, dryers, filters, storage), nameplate data about the equipment and pipe sizes. Do you have flow meters and/or energy records available? Maybe not, but you usually have some pressure gauges available (e.g. at the storage), and via the individual air compressor controls, access to data about total and loaded hours of operation (fixed speed screw air compressors) and the pressure settings of the air compressors.

Energy Baseline: An Important Reference Point

If you before considered compressed air to be just a source of energy supplied via e.g. a 4-inch pipe through the wall, you will probably (after a mapping) be surprised about a few things. This includes how expensive it is to generate compressed air from an energy point of view, and how complex it can be to operate and maintain air generating equipment, compressed air treatment equipment and pneumatic equipment in general – the “efficient way.”

If you only have limited knowledge about your compressed air system, it is very much recommended to get some help in the beginning. Finding an experienced compressed air consultant is the safest way of getting a good

result. Make sure the audit or the review of the system includes the demand side of the system, **NOT** only the compressed air station! If you do not include the demand side, you may end up in a situation, where you generate compressed air the most efficient way possible and then waste half of it by leaks, inappropriate use of compressed air and artificial demand, just to mention some demand-side issues.

You will probably know much more about your compressed air system after a review, so after this initial approach you may feel tempted to take immediate action to save some energy. Specifically, you may be inclined to pick low-hanging fruit that allows most plants to achieve an energy savings potential of more than 5% – and in many cases – as much as 10 to 30 percent with an acceptable payback time.

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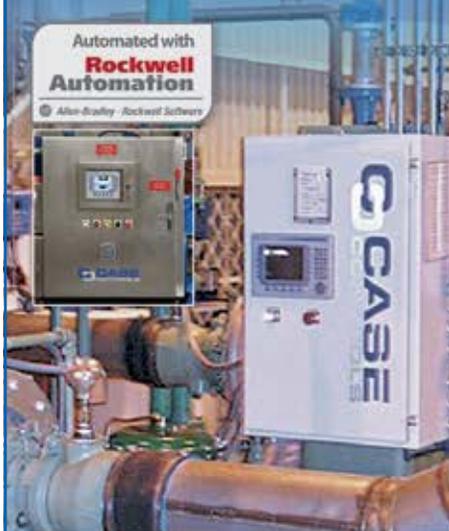
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COMPRESSED AIR AND ENERGY MANAGEMENT SYSTEMS BASED ON ISO 50001: WHAT YOU NEED TO KNOW

But before you get addicted to “easy savings,” an important consideration is to develop an Energy Baseline (EnB). This will create a reference point to evaluate projects or actions you implement. An EnB will also make it easy to document the results of your efforts and avoid investments in expensive projects that do not bring the expected savings. In addition, this contributes to continuous support from top management, which is very much needed in relation to effective operation of an EnMS.

Continuous Improvement Calls for Key Performance Indicators

You can start from scratch concerning EnMS according to ISO 50001 and with compressed air as a SEU, but the term “continuous improvement” in the standard commits you to demonstrate the energy performance of the company. This creates the need for Key Performance Indicators (KPI’s), which in the standard, are called Energy Performance Indicators (EnPI’s.) You will also need to

develop your “data collection,” possibly starting from the beginning and looking at data recorded manually, but evolving to something better and probably more sophisticated. Of course, any energy monitoring system should be able to “pay for itself” in a reasonable time through the energy savings achieved.

When it comes to compressed air, you may need to operate using more KPI’s. For example:

- **Total Energy Consumption:** The energy consumption in kWh of a compressed air system on a monthly basis, e.g. [kWh comp. air/month].
- **Total Energy Consumption (compressed air):** In this example, it is influenced by a relevant variable (could be production output) that impacts the energy performance and routinely changes, as shown in Figure 1.

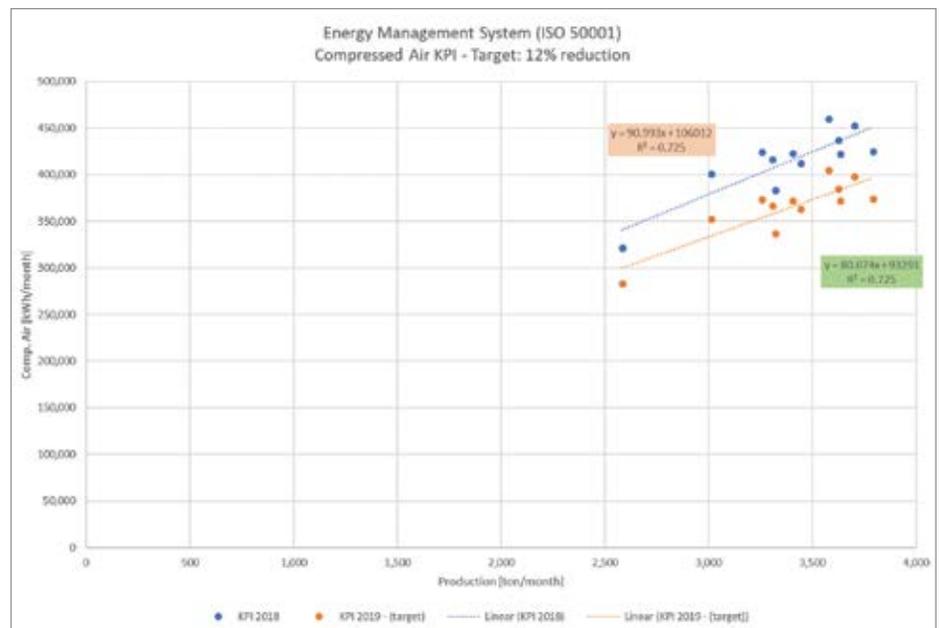


Figure 1. Shown is the correlation between production measured in tons/month and the consumption of compressed air measured in kWh/month in a one-year period. The equations depict targeted reduction in energy use by 12% through measures such as the repair of the compressed air leaks. When 2019 has passed, it will be easy to document whether the actions performed were sufficient, or whether maintenance needs to be further improved.

- **Specific Energy Consumption (production):** This metric is the ratio of compressed air energy consumption divided by some specific production output, e.g. [kWh comp. air/tons of production] on a monthly basis.
- **Specific Energy Consumption (compressed air):** This metric is the ratio of compressed air energy consumption divided by the compressed air output, e.g. [kWh/Nm³].
- **Portion of Non-productive Usage:** This is the proportion of the airflow during non-productive periods divided by the average airflow, calculated in percent [%].

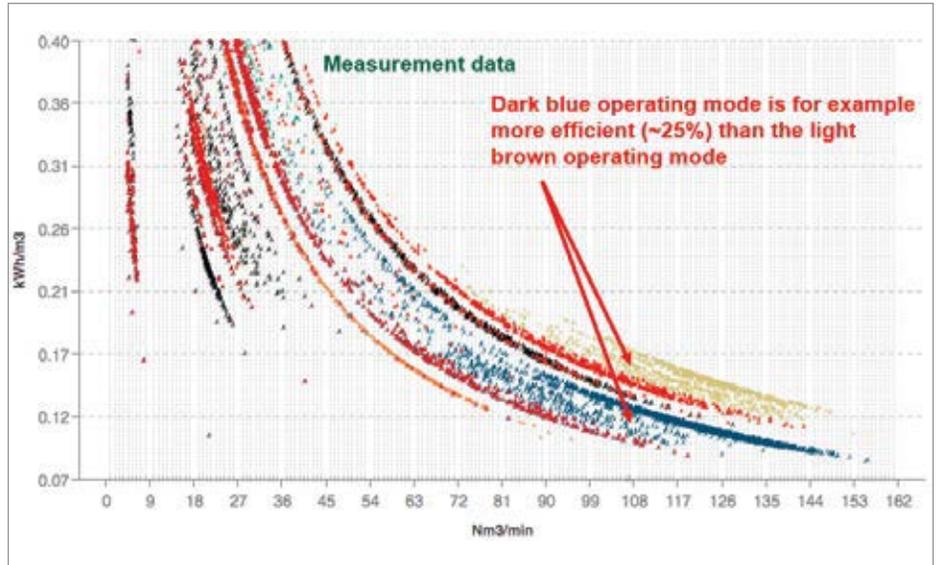


Figure 2. Depicted is a more advanced monitoring system where the different air compressor combinations are represented by different colors. Real-time data shows, for example, that with a demand for compressed air of approximately 108 m³/min, there is room for an improvement of up to 25% in the SEC, however, only at certain times. The solutions can be different, for example, with the implementation of a master control system and/or variable speed drive technology, or perhaps just a simple improvement of air compressor settings.

Monitoring Systems Provide KPI Visualization

An obvious question for many is why there needs to be more than one KPI/EnPI. The answer to question is best described by example.

Imagine you have performed a compressed air leak survey and subsequently fixed some leaks in your compressed air system, which reduced demand for compressed air by 12%. This action will of course reduce the total energy consumed by the air compressors, but your air compressors may now operate more part loaded, and the SEC (compressed air) may increase, indicating there is a further room for improvements, such as the need to operate your air compressors differently, install a master controller, or invest in Variable Speed Drive (VSD) technology, etc.

In the long run you will probably find it valuable to use a monitoring system to keep an eye on compressed air system performance. A monitoring system allows you to visualize KPI's in an appropriate way, including pressure dewpoint etc. The system will also be able to

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divide compressed air costs into different cost centers, or production departments. A clarification of the consumption of energy services usually brings more awareness – and with that, energy savings.

ISO 50005 Standard Under Development

A new EnMS standard for small and medium-sized enterprises (SMEs) is under development, called ISO 50005. The standard is intended to make it easier for SMEs to introduce energy management systems. The standard, which is also referred to as a guide, suggests you implement energy management systems step by step, depending on how mature your business is.

The company itself must assess how mature it is based on a maturity model the standard specifies. The model gives guidelines from the starting point to the full implementation of energy management; this in step with the stages of maturity in your company.

ISO 50005 is to become part of a larger ISO family of energy management standards and is expected to be completed in two to three years. As such, it is not expected to change anything in the approach to compressed air efficiency, only to make it more manageable for SMEs to implement an EnMS. **BP**

About the Author

Bo Kuraa is Vice President Technical, Enersize, tel: +45 51254920, email: bo.kuraa@enersize.com.

About Enersize

With its proprietary patent-pending automated software for leakage management, data collection and analysis, Enersize can provide 10 to 50 percent energy savings in industrial compressed air systems. Through the recently acquired LEAQS system, the company has access to more than 9,000 leakage management projects, and is associated more than 4,000 customers worldwide. The company is headquartered in Helsinki, Finland. For more information, visit www.enersize.com.

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PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION

A Tale of Two Cities - Comparison of FIXED-SPEED AND VSD COMPRESSED AIR SYSTEMS

By Ron Marshall, Marshall Compressed Air Consulting

► It is an amazing fact that some compressed air systems run so very efficiently, yet others are so wasteful. In this day and age with all the awareness out there on the Internet, in addition to numerous training sessions offered, it is a source of amazement that some systems are still needlessly wasting thousands of dollars in annual electricity and maintenance costs.

In the words of author Charles Dickens, “It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness....”.

That phrase best describes what we experience as compressed air consultants and our examination of two compressed air systems in two different cities. One operates at a mail sorting facility in one city with very poor efficiency, while another at a separate mail sorting facility is of a much better design. The difference in annual operating costs is striking. One system has air compressors twice the size of the other, yet most surprisingly the biggest system uses much less energy.

Check-valve Protected Air Compressors Create Trouble

The compressed air system at the mail sorting facility has been in service since the 90’s. Two older 50-horsepower (hp) air-cooled fixed-speed lubricated air compressors are

housed in the equipment room of the facility. The air compressors duty cycle alternates between one another on a set schedule. A 240-gallon wet storage receiver is used to help with air compressor control, with the air flowing through the receiver to a non-cycling refrigerated air dryer and system filters before finally being passed to the plant.

Each air compressor is check-valve protected, a feature typically seen in older installations where previous air compressors were reciprocating rotary screw air compressors. Check valves were often installed on reciprocating units so system pressure would not cause problems when starting the air compressors. Since modern screw-type machines have check valves built into them, the presence of these extra units actually causes problems in coordinating air compressor control, since it is difficult for local air compressor controls to “see” the actual system pressure through the check valves. Given this situation, the second air compressor at the facility had to be manually stopped making it unavailable to start should the primary air compressor shut down, reducing reliability.

Assessment Shows High Power Consumption

At the start of the compressed air system assessment the customer was asked if they

knew how much compressed air they were using. They had no idea because there were no flow measuring instruments. Therefore, a flow meter was purchased for the job and left in place for future use.

Since the system control storage was very small, and the air compressor controls were poor, the air compressors ran in a combination of modulation and load/unload. Power monitors were placed on the air compressors, as well

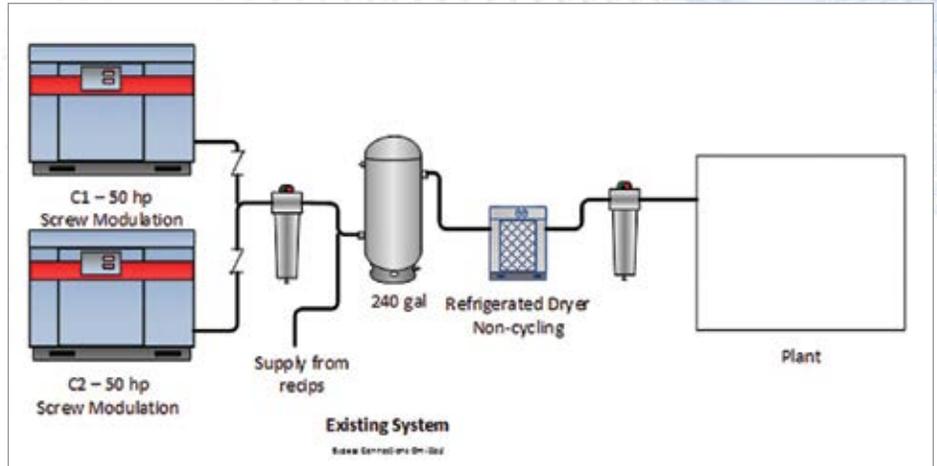


Installed in a hot boiler room, this modulating rotary screw air compressor consumed excessive power and required air conditioning to keep it running.

as various points in the system to measure pressure and on the flow meter. Data analysis showed the following results:

The data showed this system was very lightly loaded compared to the full capacity of the air compressors, with compressed air flows at about an average of 34 cfm. The power consumption was considerably higher than expected, however, averaging about 36.5 kW. The calculated specific power, including the dryer was 107 kW per 100 cfm, an extremely poor value for a system. Expected specific power for smaller systems should be in the range of 21 to 23 kW per 100 cfm. This shows a very high potential for savings on the production side of the compressed air system.

This system had operating problems because it was installed in a hot boiler room where



Shown in the compressed air system arrangement at the facility with two 50-hp air compressors.

the air-cooled air compressors would often overheat. This high temperature overloaded the air dryer and allowed moisture to form in downstream piping. The problem had become so troublesome that air conditioned

air was directed into the air compressor coolers, reducing air compressor operating temperatures, but adding significant cost to the compressed air system.

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A TALE OF TWO CITIES – COMPARISON OF FIXED-SPEED AND VSD COMPRESSED AIR SYSTEMS

One additional problem with this system was bypass piping. The bypass lines for system filters and the air dryer were run under the devices forming low spots in the air compressor room header. Since the compressed air flowing past the bypass lines is 100% saturated, having low spots allowed moisture to form in the bypass loops. In fact, the bypass loops were completely full of water when tested. Every time the filter and dryer bypass loops were opened to perform system maintenance a slug of water would flow into the system, contaminating downstream devices.

Similar Operation, Much Less Power Consumption

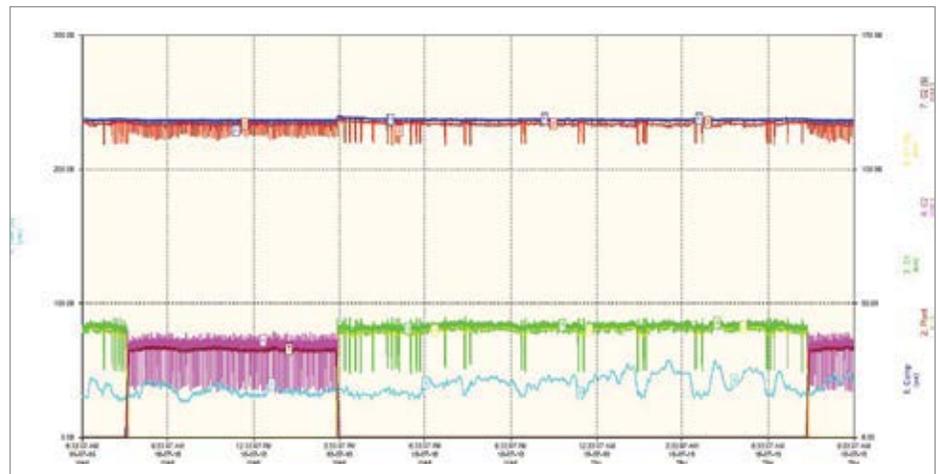
The second compressed air system, located in a different city, was used in the very same way on almost identical facility loads. In mail

sorting facilities the compressed air demanded by the sorting machines has greatly reduced as technology changed to high-speed sorters, requiring fewer humans and much less compressed air.

This second system consisted of two 100 hp air-cooled Variable Speed Drive (VSD) lubricated air compressors installed in a separate well-ventilated room of the facility. The air compressors duty alternates between one or the other on a set schedule. A 1,550-gallon wet dry storage receiver was installed to help with the air compressor control, with the air first flowing through a cycling thermal mass refrigerated air dryer, and through low differential mist eliminator system filters, as well as a pressure flow controller set to 90 psi, before finally being passed to the plant. Each air compressor

	Total Hours	Flow cfm	Sp Power kW/100	Ave kW	Total kWh	Total Cost
C1	1840	11	68.2	7.5	65,700	\$ 4,926
C2	6920	23	119.1	27.4	240,024	\$ 17,997
Dryer	8760			1.6	14,366	\$ 1,077
Total	8760	34	107.5	36.5	320,090	\$ 24,000

Table 1: Total annual cost to operate the compressed air system is \$24,000.



Shown is a typical 24-hour pressure/power/flow profile. Even though both air compressors are the same make and model, the one used most consumes more power (yellow line) under similar loading conditions than the other (lower red line).

is placed in lead position by changing the pressure settings every week. One unit carries the load, while the other provides back-up protection should the lead air compressor fail.

A full compressed air audit was not done on this site, so no flow meter was installed, but flows can be calculated based on air compressor duty. Since the plant flows are low, these air compressors operate start/stop below minimum speed.

The data showed these 480 cfm-rated air compressors produce air only 20% of the time and the remaining time they sit in standby duty. It was very unsettling walking into a clean cool and quiet air compressor room where all the air compressors have automatically turned off in a facility that operates twenty four hours a day, seven days a week. Average power was measured at 6.4 kW while producing 21 cfm of compressed air. This system specific power worked out to 30 kW per cfm including the air dryer, which is not optimum, but it consumes considerably less power than the system designed in the same manner as the first facility. Total power consumption worked to a projected 56,000 kWh per year costing about \$2,800 per year in electrical charges. This system, despite having a capacity twice as large as the older facility, consumes five times less power.

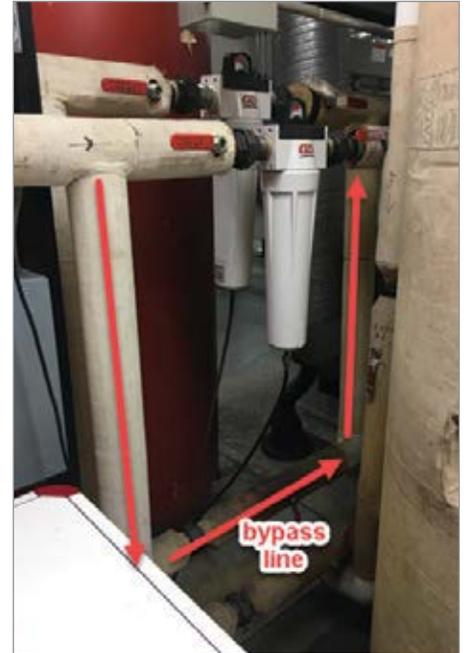
Addressing the Issue of Oversized Air Compressors

This newer system is greatly oversized, and air compressor experts will be horrified to see the system operating well below minimum speed, a less desirable operating regime for VSD air compressors.

It is because this system is oversized that specific power is much higher than optimum range of between 21 and 23 kW per 100 cfm. But, it beats the alternative of having rapidly cycling undersized fixed speed air compressors operating mostly unloaded. Manufacturers

advise VSD operation under minimum speed should be avoided because in this range there is not enough heat generated to boil off the water from the air compressor lubricant that forms because of condensation during air compression. In hot humid environments this can be a problem. Luckily, this facility is cool and dry, and very good maintenance is performed on the air compressors. The system has been operating this way for over ten years with no major problems. Due to the large storage capacity, and wider than normal start/stop pressure band, the air compressors run for a significant period of time when they start, allowing internal temperatures to build up to near normal.

As is very often the case a customer does not know what exact size their air compressor should be when they build a facility. In this



A poor bypass installation allowed water to collect in bypass pipes.

Accelerate Uptime

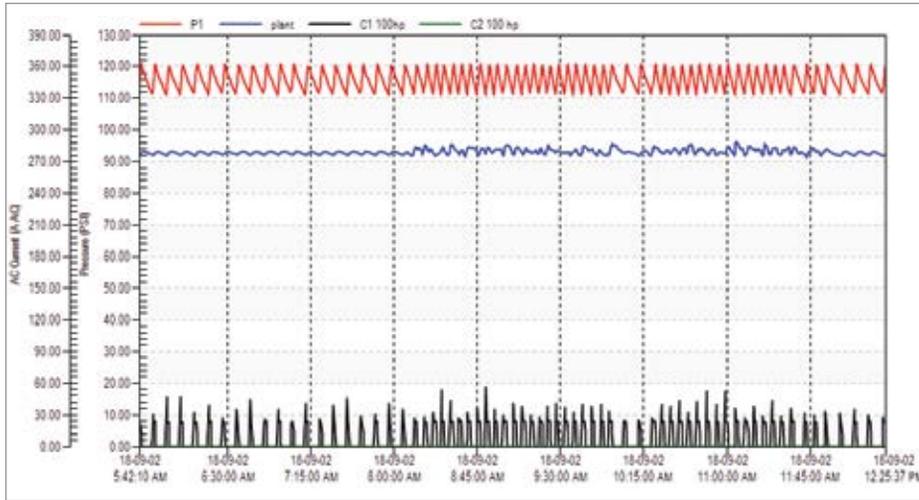
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A TALE OF TWO CITIES – COMPARISON OF FIXED-SPEED AND VSD COMPRESSED AIR SYSTEMS



The facility's VSD units are shown operating in start/stop mode, which reduces power consumption.



The display panel of the cycling air dryer reports an average energy savings of 93%.

case, due to the size of the building, and based on historical data the system was estimated at needing 100 hp of capacity. But changes in technology in the end-use equipment greatly reduced the actual requirement.

When this system was purchased and installed, the local power utility got involved and persuaded the customer to purchase VSD air compressors, as well as an efficient dryer, and a very large storage and a pressure regulating device to lower plant pressure. The utility was not successful in persuading the customer to reduce the size of the equipment, but it is because this very efficient equipment was installed that the final operating costs were so low. In ten years each compressor has only operated an average of about 1,300 hours per year, minimizing the maintenance costs.

Energy Savings of 87 Percent Possible

The first compressed air system has some significant problems and high potential for future savings. Recommendations to improve the system included the need to right-size the air compressors reduce discharge pressure closer to flow control valve setting, and reduce leaks. Specific improvement measures were as follows:

1. Install a new VSD lubricated air compressor with cycling dryer (and 660 gallons storage).
2. Reduce air compressor discharge pressure.
3. Remove (or do not install) air compressor check valves.

4. Improve air compressor ventilation.
5. Reconfigure filter and dryer bypass lines.
6. Use remote sensing on air compressor pressure sensing.
7. Install airless condensate drains on air compressors, dryers, filters, receivers.
8. Implement or install air compressor efficiency monitoring.
9. Repair 10 cfm in leaks.

Projected savings for these measures would save 277,000 kWh and reduce electrical costs by 87%. The potential savings for these measures should be expected to bring the system specific power down to normal levels. However, since the air compressor is only consuming \$2,800 in annual costs even the projected 45% savings for these measures would only gain a financial saving of about \$1,600 per year.

Mapping Out a Path

The comparison of these two compressed air systems shows the extreme difference in operating costs of a well designed system compared to a poorly operating system. The choice of air compressor size, system storage, dryer and filter type, and operating pressures can cause a big difference in the end result. Will you have the best of times, or the worst of times with your compressed air experience? It's up to you to map out that path. Or to borrow from Dickens again, you might be able to say to yourself "It is a far, far better thing that I do, than I have ever done ...". **BP**

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

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Gardner Denver Enhances L and LRS Product Lines

Gardner Denver has enhanced its L and LRS Series air compressors to combine simplicity with cutting-edge technology to provide consistent, high quality air.

The 125 to 180 hp air compressors now feature state-of-the-art color touch screen controllers and a 575V configuration in the 90-132 kW LRS models, offering superior serviceability and exceptional performance in the large horsepower end of the market.

About Gardner Denver

Gardner Denver (NYSE: GDI) is a leading global provider of mission-critical flow control and compression equipment and associated aftermarket parts, consumables and services, selling across multiple attractive end-markets within the industrial, energy and medical industries. Its broad and complete range of air compressor, pump, vacuum and blower products and services, along with its application expertise and over 155 years of engineering heritage, allows Gardner Denver to provide differentiated product and service offerings for its customers' specific uses. Gardner Denver supports its customers through its global geographic footprint of 40 key manufacturing facilities, more than 30 complementary service and repair centers across six continents, and approximately 6,500 employees world-wide. For more news and information on Gardner Denver, please visit www.gardnerdenver.com.



Gardner Denver L and LRS Series 125 to 180 hp air compressors feature state-of-the-art color touch screen controllers.

New AIRMATICS™ Cloud-Based Air Compressor Monitoring Solution

AIRMATICS™, a simple cloud-based air compressor monitoring, performance and control solution that provides real time data, analytics and insights at the push of a button, has been launched by EnerAir Solutions Inc., the United States subsidiary of global compressor management specialists, CMC.

AIRMATICS™ is capable of managing an infinite number of locally interconnected fixed speed, variable speed or variable output air compressors by responding to feedback in real-time and automatically adjusting settings and performance levels accordingly.

The latest innovation from the Belgium-based firm, which has spent the last 30 years designing and manufacturing compressed air controller, performance and monitoring solutions for manufacturers worldwide, launches as its C.O.O. reveals the company's plans to 'simplify air compressor performance and management technology in a complex industrial world'.

The claim has been reinforced with the launch of the AIRMATICS™ *Configurator* – an easy-to-use automated quote generator, which provides those interested in AIRMATICS™ with a detailed quote for integrating the technology within their existing network of air compressors, regardless of brand or age, in less than two minutes.

Nicolas De Deken, C.O.O. at EnerAir Solutions Inc., explains: "With AIRMATICS™, we not only want to simplify the process of compressed air performance monitoring and management, but we also want to provide customers, be they factory owners, facilities managers or distributors, with an Industry 4.0 solution that enables 360-degree visibility of an air compressor network at any given time and from anywhere. AIRMATICS™ takes air compressor performance monitoring and management into the 21st century by providing users with real time intelligence on their entire compressor assets' performance and health, all whilst creating efficiencies and reducing wear and tear."

The AIRMATICS™ portfolio is made up of three principle products including AIR-TAG, SMART-TAG and an asset COMMAND & CONTROL platform. AIR-TAG and SMART-TAG deliver asset tagging functionality, providing users with the ability to monitor the performance of their air compressors both locally and remotely via the cloud.

TECHNOLOGY PICKS



AIRMATICS™ has been launched by EnerAir Solutions Inc., the United States subsidiary of global air compressor management specialists, CMC.

Through the product's asset COMMAND & CONTROL capability, AIRMATICS™ is able to use data and intelligence gleaned through asset tagging to make decisions and operational adjustments, all at a local level, relating to multiple compressors in order to get the best performance from each asset.

Jay Hackney, Plant Manager at U.S. Cotton, one of the first AIRMATICS™ customers, adds: "Our key goals are to cut energy costs, reduce our carbon footprint and spend less time manually monitoring and adjusting compressors during run time in order to boost performance and increase the longevity of our assets. AIRMATICS™ takes away this concern by automatically doing it for us, which enables the team to focus on other critical day-to-day operational tasks."

AIRMATICS™ now forms part of EnerAir's broader compressed air management portfolio, which also includes AIRMASTER™, the manufacturer of embedded air compressor controls for original equipment manufacturers.

Those wishing to access the AIRMATICS™ Compressor Configurator can do so by visiting www.airmatics.eu. For more information on EnerAir visit www.enerair.com.

VPInstruments Launches the VP Dew Point Sensor

VPInstruments has launched the VP Dew Point Sensor: the smart dew point sensor for compressed air and industrial gases. Its large measurement range, -94 °F to +140 °F (-70 °C to +60 °C), enables one single product for monitoring the dew point of both refrigerant and desiccant type air dryers.

The VP Dew Point Sensor features a robust sensor that fully withstands getting wet and that is highly resistant to particulate contamination, oil vapor and most chemicals. Its long-term high performance is achieved with state-of-the-art polymer technology. Thanks to the built-in offset calibration algorithm, performance at low dew points is optimized.

The dew point sensor enables monitoring of both dew point and temperature simultaneously in VPVision and other energy management systems, thanks to its RS485 (Modbus RTU) output. The sensor also features a 4..20 mA output, that can be connected in parallel e.g. to an external display. With the built-in alarm function, you can make alarms visible in your management software for instance for dryer failure or water carry over. The alarm is also visible via the LED on the VP Dew Point Sensor itself.

Prolong the lifetime of your equipment, reduce maintenance costs and prevent production losses: guard your dew point with the smart VP Dew Point Sensor!



The VP Dew Point Sensor

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

About VPIstruments

VPIstruments offers industrial customers easy insight into energy flows. We believe that industrial energy monitoring should be easy and effortless, to enable insight, savings and optimization. VPIstruments' flow meters are calibrated on state-of-the-art calibration facility. Our calibration equipment is maintained under our ISO 9001 Quality Management System and is traceable to National Standards. VPIstruments' products are recommended by leading energy professionals worldwide and offer the most complete measurement solution for compressed air flow, gas flow and electric energy consumption. Our monitoring software, VPIvision, can be used for all utilities, and enables you to see where, when and how much you can save. Let us open your eyes and start saving energy. For more information, visit www.vpinstruments.com.

Festo Unveils Hygienic Pneumatic Components

Festo recently unveiled pneumatic valves, cylinders, and air-preparation systems that meet Food Safety Modernization Act (FSMA) good manufacturing practices for safely handling, manufacturing, and packing food.

The company's MPA-C valve terminal, which is rated IP69K, can be mounted directly on a machine – no cabinet required. The valve is designed for efficient cleaning and feature FDA-compliant materials and NSF-H1 lubrication.



Festo's MPA-C valve terminal is designed for efficient cleaning.

Contact Rod Smith for ad rates: rod@airbestpractices.com, Tel: 412-980-9901

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rod@airbestpractices.com
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The stainless steel CRDSNU cylinder conforms to “clean design” criteria and offers efficient cleaning. A thread-less bearing cap and the elimination of adjusting screws through self-adjusting cushioning reduces the risk of contamination. The cylinder’s FDA compliant NSF-H1 lubricating grease and dry-run wiper seals make it ideal for hygienic production in aggressive environments. With no cushioning adjustment required, this round pneumatic cylinder reduces installation time.

The pre-configured MS-Series compressed air preparation units ensure clean air is utilized on a machine, Filtration is available for 99.9999% efficiency and air qualities of 1:4:2 or better can be achieved in accordance with the ISO 8573-1:2010 standard.

Festo also offers clean-design fittings and a range of tubing types – rated for hygienic operations and harsh environments. PUN-H and PTFEN tubing are ideally suited for use in the food industry. Both are resistant to cleaning agents, microbes, and hydrolysis and are FDA compliant.

Festo’s single Motion Terminal is capable of replacing 50 different components through the download of various combinations of apps. Festo developed the Motion Terminal to seamlessly integrate computational algorithms and physical components. As an Industry 4.0 solution, this new cyber-physical system enables scalability and cloud-based predictive analytics.

Festo field sales engineers help OEMs select the right products for food-safe processing and packaging machines and consult on subassemblies and panel building opportunities for bringing those machines to market faster and at less cost. For poultry, red meat, pork, and seafood



The CRDSNU cylinder from Festo conforms to clean design criteria.

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processors, Festo field sales engineers consult to ensure the proper products are utilized for the application.

About Festo

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

Compressed Air Guns Reduce Sound Level by Half

Noise is often referred to as one of the biggest health and safety problems in industry. One contributing factor is compressed air. Compressed air is used in almost all manufacturing industries for, among other things, cleaning. A well-known British food company could, by replacing its compressed air guns, more than half the noise level in the daily cleaning process. The result was a noticeably better work environment.

There are a lot of risks in the manufacturing industry that effect the working environment and the workers health. One of the most occurring risks is noise levels. A well known food company made sound level measurements and acknowledged that their daily cleaning process, with compressed air guns, generated noise levels above 100 dB(A).

An operation often causing high sound levels and an unsafe working environment, that is seldom acknowledged, is compressed air blowing. Compressed air is used in the production process for cleaning drying and

transporting. In the case of the British food company, compressed air was used daily to clean the production area. The blowing generated very loud sound levels, since the air guns only had open pipes and were not equipped with air nozzles, says Vinod Kumar, business development at Silvent Birmingham.

Quiet air guns an efficient but unknown solution

To solve the problem, the company decided to install quiet air guns from Silvent. The choice became Pro One, developed to combine both quiet and efficient blowing with compressed air. To document the work environment changes, new sound level measurements were carried out after the installation. It turned out the food company, through this action, managed to lower the noise level by more than 20 dB (A). This resulted in a noticeable lowering of the sound and a big impact on the working environment, since the ear perceives a lowering by 10 dB(A) as a halving of the sound.



Safety First: a quiet compressed air gun from Silvent

Companies commonly believe compressed air blowing should be noisy. But, a high sound level does not mean an efficient blowing force. Often, the operator is surprised by the fact that a quiet air gun can do the same job as a loud air gun. Then, it is good to demonstrate that it actually is possible to combine a quiet, safe and efficient blowing with compressed air, says Vinod Kumar, business development at Silvent Birmingham.

The Silvent Pro One air gun not only lowered the sound level by 50%, it also improved the safety for the operators, since the air gun minimizes the risk of air embolism and fulfills the safety demands from OSHA and SUVA.

Silvent has, since the founding in 1989, worked to lower the sound level and improve the energy efficiency when blowing with compressed air. The last years, Silvent has noticed a positive trend. Like the British food company, a lot of industries choose to work more actively to improve the work environment for their employees.

About Silvent

Silvent helps manufacturers with energy optimization and improved working environment. The headquarters are located in Borås, which is where all research and development takes place. The company has unique expertise in the area of compressed air dynamics. Silvent's products and customized solutions for blowing with compressed air are used by leading manufacturers and brands worldwide. Today, Silvent's products are available in 77 countries, and in 2016 the company's sales brought in SEK 125 million. Silvent is part of the Lifco group which are listed on Nasdaq Stockholm. For more information, visit www.silvent.com.

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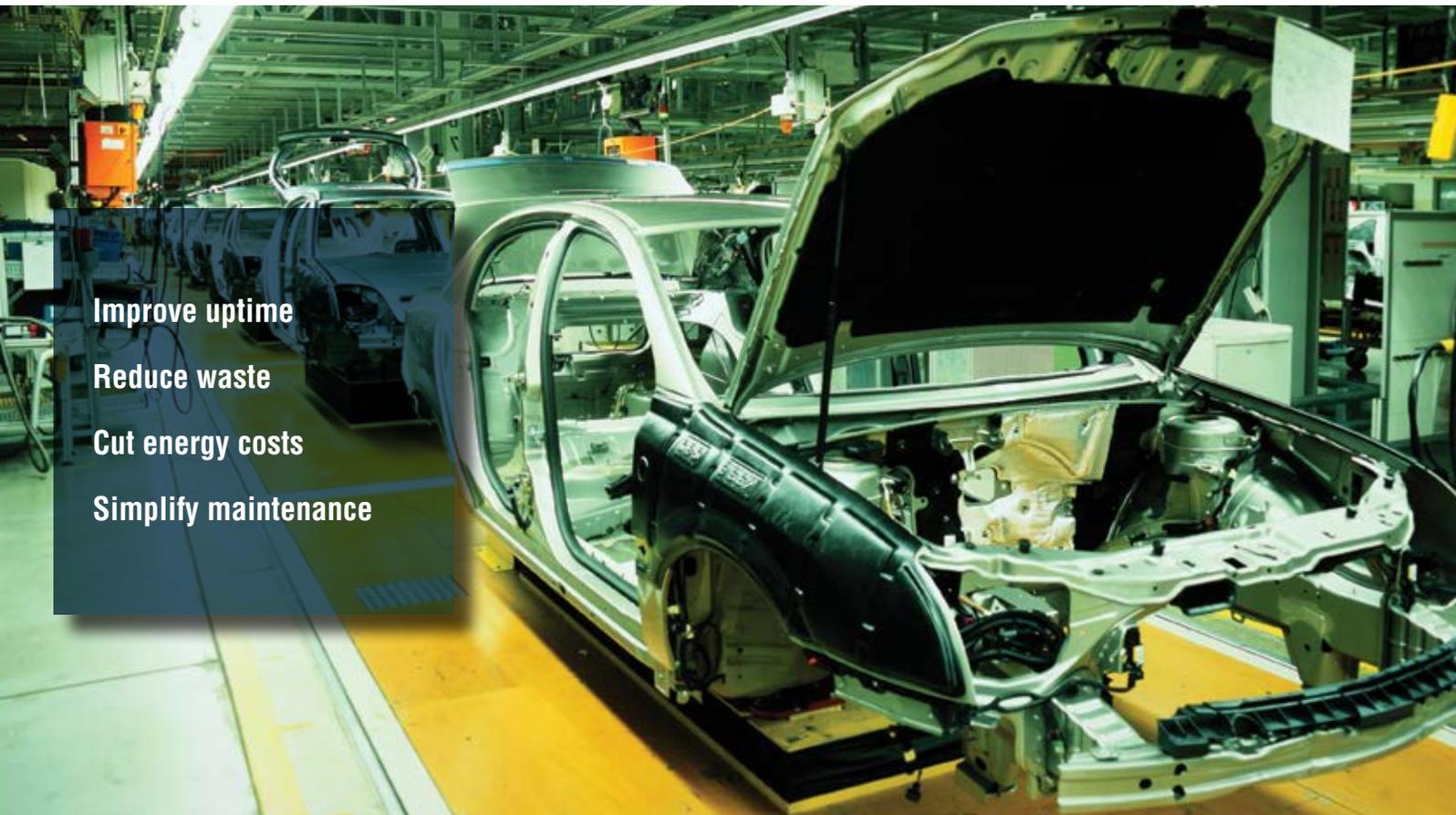
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