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January/February 2019

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- 26 Central Vacuum Supply for Efficient Cheese Packaging

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INDUSTRIAL BLOWER & VACUUM SYSTEMS

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AERATION BLOWER SYSTEMS

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FROM THE EDITOR



Low-pressure is a relative term. For the average industrial air compressor person, accustomed to 100 psig (7 bar) plant air, low-pressure represents the range from 20 to 65 psig (1.4 to 4.4 bar). How many of these applications are using 100 psig air wastefully regulated down? Our readers indicate this is an opportunity. I wonder if the introduction of easy-to-install aluminum piping systems, will encourage the installation of more sub-systems (based on optimized pressure and air quality) in plants.

Industrial Blower & Vacuum Systems

Atlas Copco seems to think this is an area of opportunity for plants to improve efficiency and safety. Our own Mike Grennier interviews Deepak Vetal, their National Sales Manager for Blowers and Low-Pressure Compressors. The discussion focuses on the applications in the food industry and why oil-free technologies, at low-pressure, are gaining acceptance.

Meanwhile vacuum is trending towards centralization of systems. Uli Merkle, from Busch Vacuum Pumps and Systems, provides us with a case study at DMK Deutsches Milchkontor. One of 26 plants, this site produces sliced cheese and Mozzarella. A Busch centralized vacuum system supplies both the packaging lines and the thermoforming machines.

Aeration Blower Systems

The Sni-A-Bar Municipal Wastewater Treatment Plant serves the cities of Blue Springs and Grain Valley, Missouri, in the greater Kansas City area. In 2013 the plant underwent an expansion to increase average design capacity to 10 million gallons per day (MGD) with peak capability of 36 MGD. In this case study, we learn how they adjusted their blower strategy and partnered with Inovair to replace 4 fixed-speed rotary lobe blowers for the aeration system with 4 VFD integrally geared centrifugal blowers. The new blowers, along with improvements in blower controls, reduced annual energy use by 442,664 kWh and peak electrical demand by 48.76 kW, which translates to an annual energy reduction of 37 percent.

For those of you out there sizing aeration blowers, you'll greatly appreciate Tom Jenkins' latest article titled, "Pay Close Attention to Turndown to Achieve Blower System Optimization." As usual, it's highly technical and a real resource for those of you making these critical sizing selections — which ultimately determine energy consumption and reliability.

Lastly, we have announced the 2019 Best Practices Expo & Conference, October 13-16, 2019 at the Music City Convention Center in Nashville, TN. Please consider registering for the event!

Thank you for investing your time and efforts into
Blower & Vacuum Best Practices.

ROD SMITH

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BLOWER & VACUUM TECHNOLOGY PICKS

Pfeiffer Vacuum Introduces Pascal 2021 HW Two-stage Rotary Vane Pump

Pfeiffer Vacuum's new Pascal 2021 HW two-stage rotary vane pump, offering the highest vapor capacity in its class, is ideally suited for all applications where water vapor is expected, such as low temperature sterilization and drying.

With an optimized design and gas ballast system, the Pascal 2021 HW unit pumps large volumes of vapor without condensation inside the pump, in turn, preventing accumulation of fluid that would adversely affect the service life of the pump and the oil. Thanks to materials used, the pump also resists aggressive chemicals such as hydrogen peroxide. Additionally, it is ready to deliver vapor in just a few minutes due to a customized temperature management. The pump also has a safety device that impedes the ingress of water into functional sections if the steam capacity is inadvertently exceeded.

With accessories such as an oil mist filter and inlet traps, the pump can be adapted to most processes. With its compactness, the Pascal

2021 HW is also ideal for installation into equipment. An oil drain valve simplifies the maintenance in confined spaces. The single-phase universal motor allows for operation almost everywhere in the world.

The proven service concept of the Pascal Series makes maintenance predictable and ensures a constantly high availability. Using different operating fluids allow maintenance intervals to be extended.

About Pfeiffer Vacuum

Pfeiffer Vacuum (stock exchange symbol PFV, ISIN DE0006916604) is one of the world's leading providers of vacuum solutions. In addition to a full range of hybrid and magnetically levitated turbopumps, the product portfolio comprises backing pumps, leak detectors, measurement and analysis devices, components, as well as vacuum chambers and systems.

Ever since the invention of the turbopump by Pfeiffer Vacuum, the company has stood for innovative solutions and high-tech products

that are used in the markets of Analytics, Industry, Research & Development, Coating and Semiconductor. Founded in 1890, Pfeiffer Vacuum is active throughout the world today. The company employs a workforce of some 3,000 people and has more than 20 subsidiaries. For more information, visit www.pfeiffer-vacuum.com.

Sulzer Adds HST™ 30 to HST Line of High-Speed Turbocompressors

Sulzer announced the addition of the HST™ 30 Turbocompressor to the HST™ line of high-speed turbocompressors. With maximum input power of 300 kW and a maximum flow of 12,000 Nm³/h (400 hp, 7,600 scfm), the HST 30 turbocompressor offers more flow and pressure at a significantly higher efficiency than its predecessor, providing significant savings in the energy consumed by low-pressure air compression in both wastewater treatment and industrial processes.

With the addition of the HST 30 model, Sulzer offers the best efficiency for an even wider range of flow and pressure. The new turbocompressor builds on field-proven technologies of the previous Sulzer third generation high-speed turbocompressors. It incorporates both near-silent operation, uniquely efficient air compression, and an advanced but easy-to-use control system.

The HST 30 turbocompressor features updated versions of the active magnetic bearings that are becoming the industry's first choice in this size range. It also includes a new permanent magnet motor design, built specifically for this duty. The machine is cooled with air only, meaning there is no liquid to mix, fill up, check, or exchange. There is nothing that can leak, freeze, or boil off.



The Pascal 2021 HW two-stage rotary vane pump.

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The HST™ 30 Turbocompressor.

All cooling air filters are well protected by the front door, but can easily be exchanged in seconds. Thanks to the horizontal shaft and inlet direction, the replacement of integrally geared turbos and multistage centrifugal machines is straightforward. It also provides a flexible pipework configuration. With filter boxes for wall or floor mounting, as well as silencers and valves for all relevant flange sizes, the HST 30 turbocompressor is one of the most flexible machines of its kind both for new builds and replacements.

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. Intensive research and development in fluid dynamics, process-oriented products, and

special materials, as well as reliable service solutions, help the company maintain its leading position in its focus market segments. Our customers benefit from a network of over 180 production and service sites around the world. In 2017, we achieved sales of roughly CHF 3 billion with around 14,700 employees. Our shares are traded on the SIX Swiss Exchange (SIX: SUN). For more information, visit www.sulzer.com.

Edwards Launches nES EX Series Single-Stage ATEX-Certified Rotary Vane Vacuum Pumps

Edwards has launched the nES EX series single stage rotary vane vacuum pumps. This generation of pumps represents the next advancement in oil sealed rotary vane pump technology suitable for use in explosive environments.

The nES EX series are specifically designed to be capable of handling gases and are ideally suited to operate in environments where a potentially explosive atmosphere can be present, especially in chemical processing industries.

“The nES EX is a response to increasing customer demand for a stable, safe and compact vacuum pump that is low on maintenance and high on productivity”, said Jerry Cooke, Product Manager, Edwards. “Motorized pumps are certified to ATEX directive 2014/34/EU and we have bare shaft pumps available for local configuration to support US and other global markets.”

Available in six variants, the nES EX 40-630 series’ pump mechanism is designed with attention to detail that guarantees a class-leading ultimate vacuum level without pressure fluctuations. A variety of sensors on the pump offer easy readings for pump temperature, oil pressure and oil levels. While they are suitable for a wide range of industries including pharmaceutical, automotive and degassing, they are particularly suited to the demanding applications in the chemical processing industries.

“The nES EX series gives us the ability to serve a wide range of applications with a competitive edge in the chemical sector,” said Owain Charles, Global Marketing Manager, Edwards. “It is also in line



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with one of our key promises to engineer environments where innovation thrives. The nES EX series is a perfect example of our commitment and long-term responsibility to our customers, their work environment and the people who operate our products,” he continued.

Innovations such as the integrated oil mist filter are effective in preventing oil mist from being exhausted into the environment and the optimized oil return system ensures high performance with fewer oil changes. Keeping user-serviceability, easy access and high reliability in mind, the nES EX series of rotary vane pumps offer cleaner and safer real-world operations.

For further information about Edwards products please visit www.edwardsvacuum.com.

About Edwards

Edwards is a leading developer and manufacturer of sophisticated vacuum products, exhaust management systems and related value-added services. These are integral to manufacturing processes for semiconductors, flat panel displays, LEDs and solar cells; are used within an increasingly diverse range of industrial processes including power, glass and other coating applications, steel and other metallurgy, pharmaceutical and chemical; and for both scientific instruments and a wide range of R&D applications.

Edwards has over 4,000 employees worldwide engaged in the design, manufacture and support of high technology vacuum and exhaust management equipment. Edwards has state-of-the-art manufacturing facilities in Europe, Asia and North America.

Gardner Denver Introduces New Model to CycloBlower H.E. Series

Featuring a patented 3 x 5 helical screw rotor profile, the new 250CDL750 blower is ideally suited to a wide range of applications, including wastewater treatment, pneumatic conveying, plastic molding and handling, and chemical, industrial and food processing.

The 250CDL750 model can produce flow ranges up to 6,200 CFM, pressures up to 36 PSI, and vacuum up to 22" Hg and is available with both dual splash lubrication or force feed lubrication. Force feed lubrication is required for pressures above 20 PSI and vacuum beyond 18" Hg.

The CycloBlower H.E. comes standard as a bottom discharge configuration with English ANSI flanges and food grade P.T.F.E coated rotors. An extensive selection of options includes a top discharge configuration, food

grade P.T.F.E coated cylinder, RTD ports, and metric flanges.

Meanwhile, the system's O-ring seals provide durable protection, without the need for gaskets, and its helical timing gears ensure the machine operates smoothly and quietly at all times. Offered with a robust ductile iron shaft and housing, the technology is built to last, helping to improve an operator's whole life costs even further.

The technology – which is the only rotary screw bare blower available on the market – can be retrofitted to existing units as well, offering operators the opportunity to upgrade their current blower systems. Other optional extras include, graphite air seals for high-pressure applications, and a low, medium and high-pressure discharge cylinder. Standard components also include high-quality Inpro/Seal premium oil seals and piston-ring air seals.



The patented 3 x 5 helical screw rotor profile of the new Gardner Denver CycloBlower H.E. Model 250CDL750.

For more information, please visit <http://www.gardnerdenver.com/en/gdproducts/products/blowers/helical-screw-technology/cycloblower-he>.

About the Gardner Denver Industrials Segment

The Gardner Denver Industrials Segment delivers the broadest range of compressors and vacuum products, in a wide array of technologies, to end-user and OEM customers worldwide in the industries it serves. The Segment provides reliable and energy-efficient equipment that is put to work in a multitude of manufacturing and process applications. Products ranging from versatile low- to

high-pressure compressors to customized blowers and vacuum pumps serve industries including general manufacturing, automotive, and wastewater treatment, as well as food & beverage, plastics, and power generation. The Segment's global offering also includes a comprehensive suite of aftermarket services to complement its products.

Gardner Denver Industrials Segment, part of Gardner Denver, Inc., is headquartered in Milwaukee, Wisconsin, USA. Gardner Denver was founded in 1859 and today has approximately 6,700 employees in more than 30 countries. For further information, please visit www.gardnerdenver.com/industrials.

Sentinel™ PRO Provides Easy Monitoring of Water and Wastewater Facilities

The Sentinel™ PRO system from Sensaphone® provides water and wastewater facility operators 24/7 remote monitoring, data acquisition and real-time visibility of all sites from a user-friendly cloud-based dashboard. The system is ideal for water and wastewater professionals because it easily integrates devices, polls Modbus registers from other equipment and immediately delivers critical system-wide information.

The Sentinel PRO system seamlessly interfaces with any water/wastewater processing equipment that uses a PLC with Modbus

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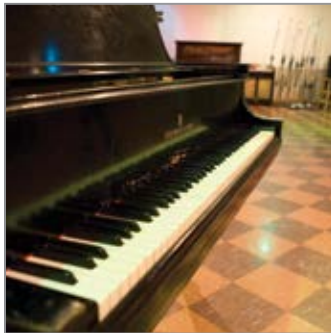
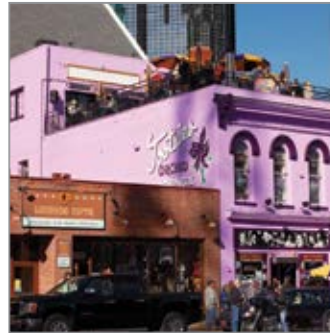
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sensors. Supporting both Modbus RTU-485 and TCP protocols, the system can monitor up to 64 Modbus registers and 12 different digital or analog status conditions – including power, pump status, tank level, turbidity, flow rate, pressure, temperature, humidity and water leaks.

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For remote locations without Internet or Ethernet connectivity, a 4G cellular Sentinel PRO system is available that communicates through AT&T or Verizon networks.

About Sensaphone

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Sensaphone's Sentinel Pro System for water and wastewater facilities.

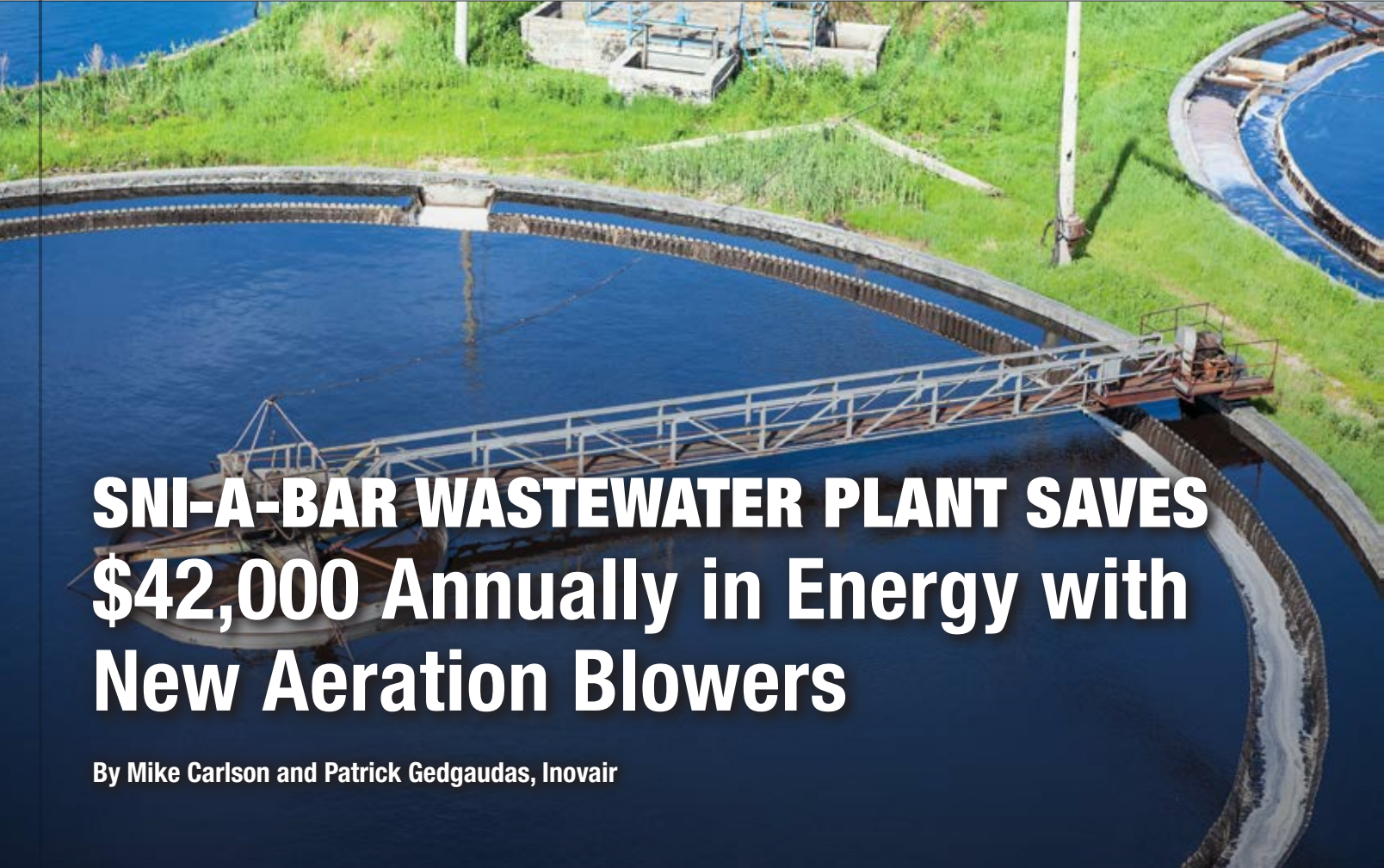
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SNI-A-BAR WASTEWATER PLANT SAVES \$42,000 Annually in Energy with New Aeration Blowers

By Mike Carlson and Patrick Gedgaudas, Inovair

► After auditing and field-testing, the Sni-A-Bar Municipal Wastewater Plant in Blue Springs, Missouri, partnered with Inovair to replace 4 fixed-speed rotary lobe blowers on its aeration system with 4 Variable Frequency Drive (VFD), integrally geared centrifugal blowers. The new blowers, along with improvements in blower controls, reduces

annual energy use by 442,664 kWh and peak electrical demand by 48.76 kW, which translates to an annual energy reduction of 37 percent and anticipated savings of \$42,000 per year. Additionally, a rebate of \$45,799 from the local utility resulted in a payback of less than six years.

Background

The Sni-A-Bar Municipal Wastewater Treatment Plant serves the cities of Blue Springs and Grain Valley, Missouri, in the greater Kansas City area. In 2013 the plant underwent an expansion to increase average design capacity to 10 million gallons per



“I was very impressed with the efficiency of these units. The Inovair blowers provided more airflow with reduced kW consumption and maintained a more consistent DO level.”

— Jesse Cox, Superior Electrical Contractors (SEC)

day (MGD) with peak capability of 36 MGD. Additionally, it improved discharged effluent quality to comply with increasingly stringent environmental requirements. The expansion involved construction of two aeration basins with fine-bubble diffusers. The basins were also equipped with five 150 horsepower (hp) rotary lobe aeration blower packages with two blowers per basin and a single redundant blower for serving either basin.

The aeration basins operate in parallel with a nitrification/de-nitrification cycle, aerated for five hours and un-aerated for one hour. During the aeration cycle for each basin, a lead blower is brought online and runs continuously, and after 10 minutes of aeration, the lag blower is cycled on and off based on Dissolved Oxygen level (DO) readings. Specifically, it is turned on when DO drops below 1 ppm and off when DO rises above 2 ppm. A typical aeration cycle has the lag blower running for two to three hours in a five-hour period.

While the expansion left the plant with a much-improved effluent quality and increased capacity, the electrical cost associated the aeration blowers was significant. It is

commonly known that aeration blowers generally consume half or more of a plant's electrical energy, accounting for more than a quarter of its total operating budget.

Since the aeration basins already had fine-bubble diffusers for state-of-the-art oxygen transfer efficiency, the plant set its sites on

aeration blowers for the next area of efficiency gains. Additionally, with the DO logic cycling each lag blower six to 10 times in a six-hour period, the high quantity of blower starts was causing undue wear on the belt drive systems and turning into a maintenance headache, despite electronic soft-starters on each motor.



Figure 1: Shown is the Inovair IM prototype during installation. The customer-specified Variable Frequency Drives are visible in the background.

TABLE 1: ENERGY SAVINGS RESULTS ONLY REFLECT EFFICIENCY IMPROVEMENT SINCE NO SIGNIFICANT PROCESS CHANGES WERE MADE DURING THE TRIAL PERIOD.

Monitoring Period Start	1/20/2017	6/27/2017	7/11/2017
Monitoring Duration, hr	721.2	479.0	487.4
Basin 3: 2 x 150hp Rotary Lobe Blowers, kW-hr	77,924	39,689	55,272
Basin 2: 2 x 100hp Integrally Geared Centrifugal Blowers, kW-hr	56,777	26,799	44,607
Integrally Geared Savings, kW-hr/hr	29.3	26.9	21.9
Integrally Geared Savings, %	27%	32%	19%

SNI-A-BAR WASTEWATER PLANT SAVES \$42,000 ANNUALLY IN ENERGY WITH NEW AERATION BLOWERS

Audit Leads to Field Test

As a first step, the Inovair team performed an audit of the blowers and aeration system to determine the suitability of its new IM blowers for the Sni-A-Bar plant. A second step involved a field trial to demonstrate the actual in-field savings between the existing blowers and the IM blowers.

Measurements indicated that each rotary lobe blower consumed 99.8 kW of electrical input power to deliver 1,875 scfm at 9.5 psig line pressure. By comparison, testing of Inovair’s prototype IM blower at the company’s aerodynamic test cell showed the blower could deliver 1,875 scfm under the same conditions while only consuming 75.2 kW of electrical power, representing a 25 percent savings. Additionally, under worst-case design with

ambient conditions of 100 °F, testing showed the Inovair IM blower could deliver design flow of 1,875 scfm within the limits of a 100 hp motor.

Following the audit, the team planned a field demonstration of its prototype IM blower at the plant. It would be ideal to instrument and compare each blower’s wire to air performance continuously, but that wasn’t realistic with an operational plant. Instead, given the parallel operation of the plant’s two aeration basins, Basin 2 would be aerated exclusively by a pair of 100 hp Inovair IM units, while Basin 3 would remain unchanged and the electrical power going to each set of blowers would be monitored and compared over the testing duration. While it is difficult to compare any two aeration cycles as they are

offset by three hours and the product inflow varies throughout the day over a sufficient number of cycles, it is reasonable to assume the average aeration requirement of each basin is the same.

IM units feature a unique design that allows two modules to be stacked in a single unit. As such, the plant only needed to remove a single 150 hp blower to install both 100 hp Inovair units. Four original blowers remained in place during the trial and the plant was able to maintain operations uninterrupted throughout installation.

“There was no more electrical work needed than making sure it met the NEC guidelines,” said Jesse Cox, of Superior Electrical Contractors (SEC) who handled the electrical portion of the installation.

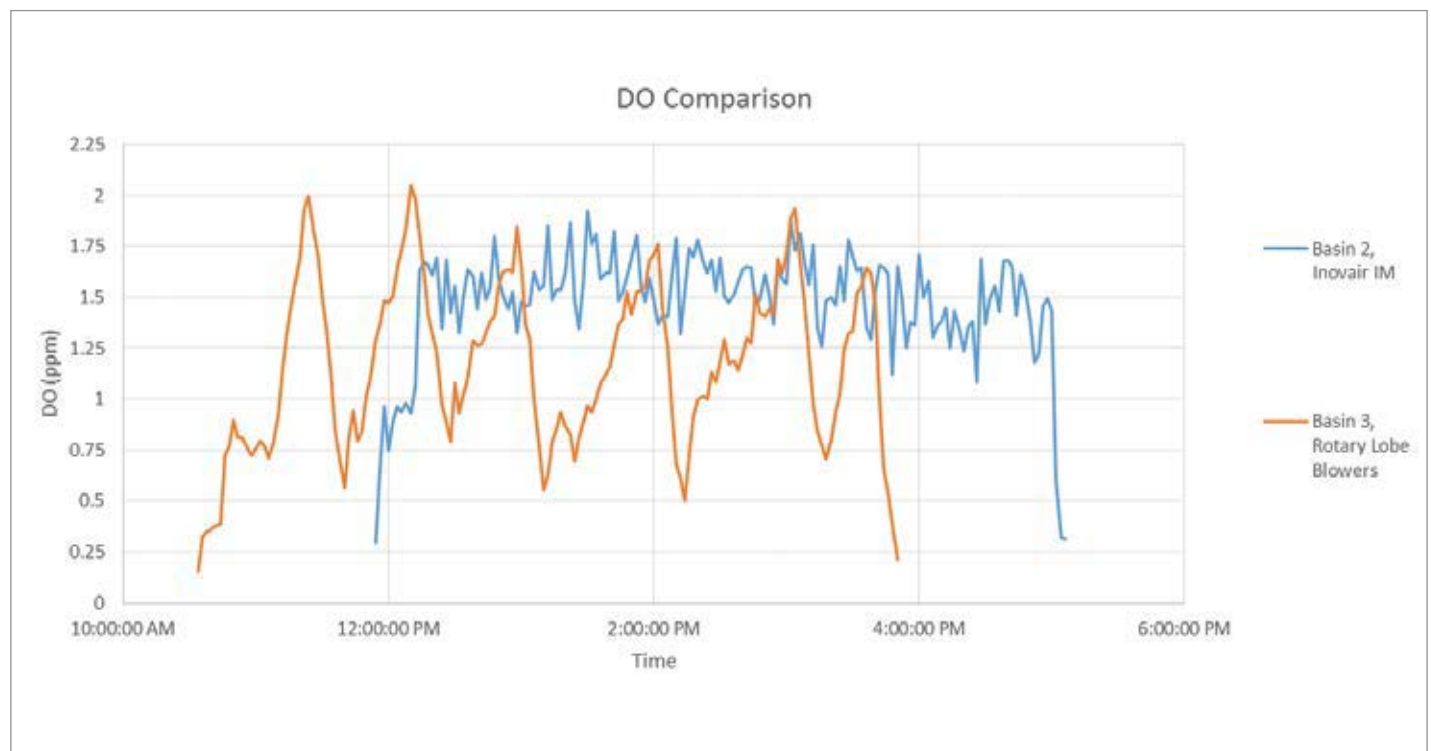


Figure 2: Shown are typical DO levels after refinement of the new blowers’ DO feedback system and a reduction in setpoint to 1.5 ppm. Average DO levels were 1.49 ppm in Basin 2 and 1.18 ppm in Basin 3.

Inovair: A Division of Accessible Technologies, Inc.

Inovair is the industrial products division of Accessible Technologies, Inc. (ATI), which was founded in 1994 to expand the application of high efficiency centrifugal turbo blower technology within forced induction and industrial applications. ATI is also the parent company of ProCharger, which manufactures a line of centrifugal superchargers known for high efficiency, durability, and compact design. All Inovair and ProCharger products are designed, manufactured and serviced in Lenexa, Kansas.

The ProCharger superchargers feature in-house produced aircraft quality 7075-T6 billet aluminum machined impellers, and began delivering class leading results shortly after their introduction for automotive, marine and motorcycle applications. ProCharger is now the world's largest aftermarket supercharger company, and its most powerful racing models support over 3,600 hp with internal combustion engines. ProCharger compressors produced for supercharging range from 100 cfm and five psi to more than 6000 cfm and 60 psi, while gearcase speeds range from 30,000 to 130,000 rpm.

In 1999, ATI's first aircraft ground support equipment application resulted from partnering with a customer to win a U.S. Air Force contract using an off-the-shelf ProCharger model as the air source in a forced air deicing system. A self-contained Inovair model with a patented compound bearing system was later adapted to the aircraft deicing market, offering customers additional cost savings and efficiency. Later, Inovair began supplying compressors for HVAC

ground support carts used in military applications. Inovair is now the largest supplier of compressors for both forced air deicing and aircraft ground support equipment.

In 2011, Inovair began shipping its 2200R gearbox to customers. Applications ranged from pneumatic conveying of flour and other powders, to aircraft ground support, to municipal wastewater. To date, more than 2,000 Inovair blowers have been used in wastewater, industrial, and aerospace markets and over 50,000 ProCharger superchargers have shipped worldwide.

The Inovair Modular design bridges the technology gap between industrial stalwarts like the rotary lobe blower and technology-heavy offerings such as direct-drive, high-speed electric units that utilize foil-air or magnetic bearings to float their motor shaft and impeller rotor. The IM uses the 2200R gearbox, which combines a traditional user-serviceable oil system and off-the-shelf electric motor and variable frequency drive, with modern high-speed, high-efficiency aerodynamic components similar to the high-speed electric machines. In contrast to foil-air or magnetic bearings of high-speed permanent magnet centrifugal blowers, the 2200R gearbox utilizes oil lubricated journal and thrust bearings, known for decades and across many industries for their reliability and durability. The Inovair IM blower package directly couples the 2200R gearbox to the electric motor, and also features the ability to stack two modules into a single unit, resulting in reduced footprint and enhanced turndown capability.



Accessible Technologies Inc.'s main campus in Lenexa, Kansas.

SNI-A-BAR WASTEWATER PLANT SAVES \$42,000 ANNUALLY IN ENERGY WITH NEW AERATION BLOWERS

Field Test Results

With SEC performing several independent energy audits for Blue Springs over a six-month period, the results backed up lab predictions showing an average energy savings of 26 percent.

The trial demonstrated the opportunity to save nearly \$40,000 per year on electric costs. In addition, it qualified the project for a rebate

of \$45,799 from Kansas City Power and Light's Business Energy Efficiency Rebate program. The rebate offset the cost of replacing the plant's four rotary lobe blowers with Inovair IM units.

Blue Springs decided to purchase four 100 hp Inovair IM blower units, arranged in 2 stacks of 2 units each. The plan called for Basin 2 to remain aerated by the prototype IM stack. Basin 3 was scheduled for a production

IM stack in late spring of 2018. Given IM's configuration and compact footprint, the plant only needed to remove two existing blowers, maintaining three blowers as standby units with one blower dedicated to each basin and a swing blower that could serve either one.

Additional Testing and Analysis

A benefit of head-to-head field-testing is the simplicity of analysis since the basins can be

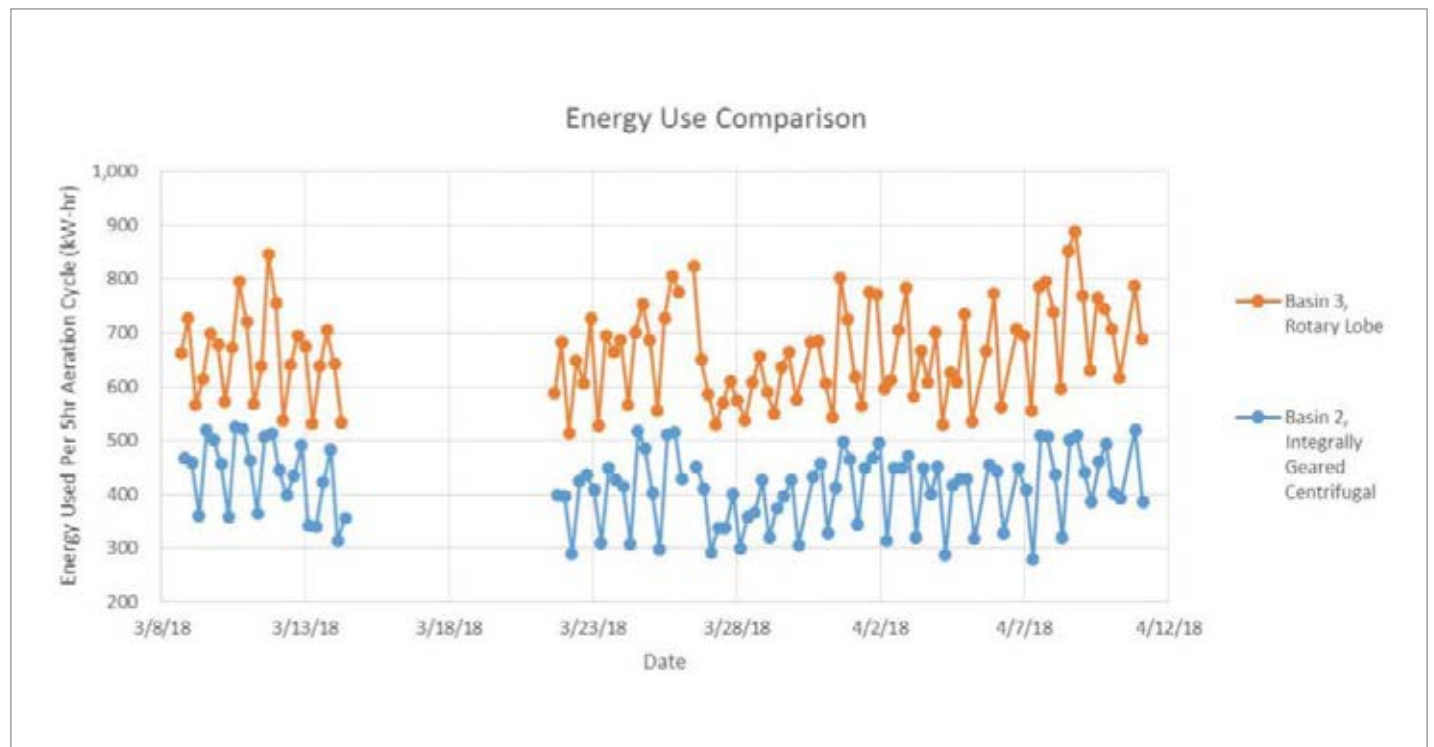


Figure 3: Real-time energy consumption for each six-hour hour cycle. Note the diurnal variation in demand. Ambient conditions and process flow are responsible for day-to-day variation in consumed energy.



“At this time we are conservatively estimating a savings of \$3,500 per month, or \$42,000 annually. We also achieved cost savings for maintenance, which we estimate to be \$2,500 annually.”

— Jeff Mock, Operations Manager for Blue Springs

observed receiving essentially the same product flow. DO levels can also be monitored in each basin and maintained within limits. Additionally, power monitors can be used to log total energy consumed by each set of blowers, eliminating the need for corrections to see the savings. However, digging into the data and design a little more, one large difference between the two basins is that the master controls on the IM blowers can control their flow output based on DO or other process feedback.

During the field trial, the IM blowers were set to run the lead blower at full capacity for 10 minutes, then bring the lag blower online and modulate flow of both blowers to maintain DO at the 2.0 parts per million (ppm) setpoint, while the original rotary lobe blowers cycle back and forth between 1 ppm and 2 ppm for an average DO level near 1.5 ppm. Thus the 26 percent energy savings was achieved with the new blowers maintaining a 2.0 ppm average DO level in Basin 2, while the rotary lobe blowers were maintaining approximately 1.5 ppm DO level in Basin 3.

By early 2018 Inovair had made some refinements to the DO control algorithm to improve airflow swings in DO and plant operators had sufficient confidence and experience with the blower's DO control scheme to begin turning DO setpoint down from 2 ppm to 1.5 ppm, more closely matching the average DO level achieved with the on-off cycling of the rotary lobe blowers.

Bringing the target DO level down reduced the needed airflow. The two basin's aeration blowers were power-logged for over 600 hours during a one-month period as shown in Figure 3. Total savings increased to 37 percent with the additional 11 percentage points in savings due to process improvement available from the variable airflow capability of the IM blowers.

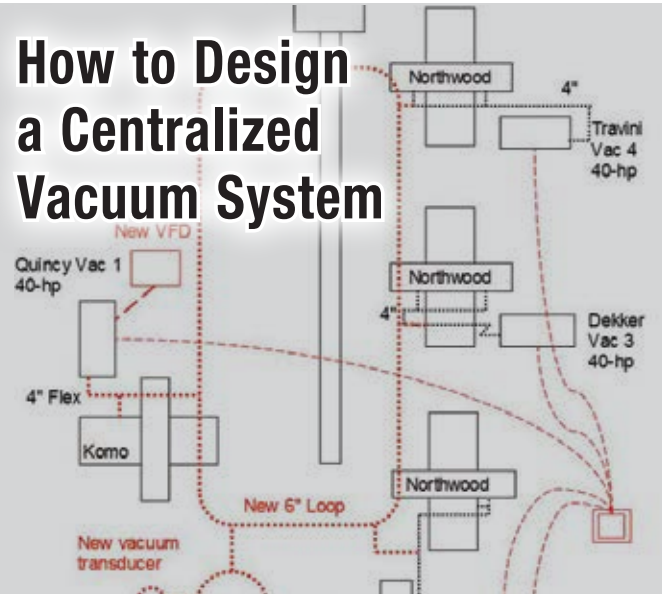
"At this time we are conservatively estimating a savings of \$3,500 per month, or \$42,000 annually. We also achieved cost savings for maintenance, which we estimate to be \$2,500 annually," said Jeff Mock, Operations Manager for Blue Springs.

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The IM unit on Basin 3 offers a more compact footprint and increased weather resistance compared to the prototype IM blower on Basin 2. Plant operators appreciate the sound level of less than 82 dBA.

Final Installation Results

In May of 2018, the team installed the IM stack on Basin 3. A comparison between the unit on Basin 3 and the prototype IM unit on Basin 2 showed an additional savings of approximately 10 percent. The additional savings are due to the blower on Basin 3 having a slightly increased flow capacity, resulting in greater efficiency at high flow, but slightly reduced turndown. This is in addition to improvements to the DO feedback control logic for an overall better match to this particular system.

“I was very impressed with the efficiency of these units. The Inovair blowers provided more airflow with reduced kW consumption and maintained a more consistent DO level,” said Cox, who has a long history of supporting Blue Springs’ electrical contracting needs.

Summarizing the project, Mock said, “Following a side by side evaluation comparing the energy consumption between the IM blowers and the positive displacement blowers, the Inovair blowers exceeded the anticipated energy savings. Along with the energy efficiency

we believe the operation and maintenance costs of the equipment will also result in additional savings. The entire Inovair team was extremely informative and helpful in bringing this project together. Their customer service prior to, during, and after the project was excellent.” **BP**

Mike Carlson, PE, is Lead Engineer at Inovair, and Patrick Gedgaudas, is Sales Director. For more information visit www.inovair.com.

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Delivering Oil-free, Low-Pressure Air in FOOD AND BEVERAGE APPLICATIONS

By Mike Grennier, Blower & Vacuum Best Practices Magazine

► Blower & Vacuum Best Practices interviewed Deepak Vetal, National Sales Manager, Blowers and Low-Pressure Compressors, Atlas Copco Compressors, LLC.

What low-pressure blower technologies does Atlas Copco offer for the food and industry?

We provide 100 percent oil-free blowers for working pressures up to 24 psig. Our product line consists of rotary screw blowers

for pressures up to 22 psig, centrifugal blowers for pressures up to 20 psig, multistage centrifugal blowers up to 24 psig, lobe blowers for pressures up to 15 psig and we also offer low-pressure single stage screw compressor for pressures up to 60 psig typically for dense



“The new blowers not only cope with the fluctuations in process air demand but also operate from 100% capacity down to 25% capacity with very little change in the specific power requirement.”

— Deepak Vetal, National Sales Manager, Blowers and Low-Pressure Compressors, Atlas Copco Compressors, LLC.

phase conveying and other applications which requires higher pressures.

Please describe the food and beverage market and where these blowers are commonly used.

To put it in perspective, the food and beverage industry accounted for 12 percent of the U.S. gross domestic product in 2017. The main subsegments that use low-pressure air for numerous applications in this industry include meat processing, poultry, dairy product manufacturing, preserved fruits and vegetables, as well as brewing and beverage processes.

The primary use of low-pressure air in this market is pneumatic conveying in both vacuum

and pressure. Many food manufacturers also operate wastewater treatment facilities independent from their municipalities to decontaminate process or sewage water and to treat organic waste.

There is growing demand in these areas for oil-free air and we see potential for growth for both blowers and vacuum.

Tell us about Atlas Copco's commitment to oil-free technologies.

Atlas Copco has been a pioneer in the development of oil-free air technology for more than 60 years and it has resulted in a wide range oil-free air compressor and blower solutions for applications where users simply

can't make compromises when it comes to clean, 100 percent oil-free air.

Frankly, why add lubricant to the system in an application when it has to be taken out? Why not just reduce the risk of contamination up front and the severe consequences that can follow, whether its spoiled or unsafe products, legal issues that can damage a brand or any number of issues? Knowing the compressed air is 100 percent oil-free provides users with peace of mind. Oil-free blowers and air compressors also help users achieve energy efficiency and meet increasing government regulations. Oil-free air can also help reduce the need for service and parts.



An Atlas Copco ZB oil-free, direct drive centrifugal blower.

DELIVERING OIL-FREE, LOW-PRESSURE AIR IN FOOD AND BEVERAGE APPLICATIONS

We know ISO 22000 certification is important in food and beverage applications. Can you tell us about that?

ISO 22000 is a food safety management system that can be applied to any organization in the food chain. It addresses three primary safety hazards in food and beverage manufacturing, which are biological, chemical and physical.

A company must demonstrate its ability to control these food safety hazards according to the standard. To say we support the standard is an understatement. Our oil-free production facility in Antwerp, Belgium, is ISO 22000-certified. At that plant, we manufacture oil-free air compressors, blowers and air treatment products.

What's involved in ISO 22000 Certification and what's the advantage to earning it?

I'll start with the benefits of the certification. It all goes back to consumers who continue to demand safe food, which will only increase with

time. Food processors are looking to suppliers throughout the food chain to provide them with safe ingredients. Being ISO 22000-certified demonstrates that a company has a food safety management system in place that meets the established standard for safety and quality.

There's a lot that goes into ISO 22000 since it incorporates proven Hazard Analysis and Critical Control Point (HACCP) principles and those of the Good Manufacturing Practice (GMP). Earning ISO 22000 Certification requires a documented food safety program to manage the processes throughout the facility. A company must also establish prerequisite programs to ensure a sanitary environment and institute an HACCP principal to identify, prevent and eliminates hazards.

Where does the ISO 8573-1 Class 0 standard come into play and how would you describe its importance in the food industry?

Anyone could say their blower or compressed air system delivers high quality air, but reality

dictates that everyone involved knows what that means.

ISO 8573-1:2010 specifies and defines three primary contaminant types as prevalent in a compressed air system. These are solid particulates, water and oil, in both aerosol and vapor form. Each is categorized and assigned a quality class ranging from Class 0, which is the most stringent, to Class 5, which is the most relaxed. The end user-user is responsible for defining the air quality required for their particular application or process.

The standard is important for many reasons, one of which is the fact that it establishes a common language for discussing clean, dry air based on clear specifications. Equally important, it gives end users the ability to select the right compressed air system components for their operation because it allows them to effectively compare technical data from one manufacturer to another.

You identified a range of applications for blowers in this industry. Where is process air commonly used?

The main applications are fermentation, which is a process for controlling bacteria growth; aeration, which involves mixing and agitation in the production process; cooling and drying of the end product; and transporting of materials and the end product.

Walk us through a fermentation application that uses oil-free blowers.

Most fermentation processes share similarities in that a tank is filled with liquid and is then aerated to support the growth of bacteria during fermentation involved in producing food ingredients such as citric acid, wine, and yogurt. Aeration represents



about 45 percent of the energy consumption of a typical fermentation plant.

And then you have aeration for wastewater treatment as you mentioned.

Wastewater is the one that most everyone is familiar with but there are other applications in the food industry, such as fish farming. Another example of aeration in combination with mixing is the process of foaming, which is when air is introduced into a product. Ice cream makers use this process to ensure the ice cream is easy to scoop. So those are just some examples, although most people don't often think of fish and ice cream as products that have anything in common, that's for sure.

So fermentation and aeration are big ones. What about applications like cooling and drying and conveying?

Cooling and drying is a great example since the air often comes into direct contact with products like baked goods as part of the dehumidifying and drying process, which is crucial for eliminating moisture that can cause bacterial growth. Air supplied by low-pressure blowers is one of several options used to cost-effectively dry end products.

Food companies also use oil-free air to pneumatically convey food ingredients, such as powdered milk and cocoa powder, from incoming tank trucks into the silos for temporary storage. By using oil-free air they can avoid oil contaminant mixing with the

powder and maintain its purity. This also prevents the potential for oil collecting on machines where equipment used in these areas, such as robotics arms.

How does the tank truck offloading process work with blowers?

Typically, the tanks on the trucks are pressurized with compressed air to convey the ingredients into the silo. Yet we're seeing a growing number of companies using stationary blowers for this application instead of the trucks' onboard air compressors.

Why would companies use stationary blowers for offloading ingredients?

There are multiple advantages to it, one of which is the ability to use a larger blower than



An Atlas Copco ZS energy efficient oil-free screw blower system.

DELIVERING OIL-FREE, LOW-PRESSURE AIR IN FOOD AND BEVERAGE APPLICATIONS

you typically find on tank trucks, which speeds productivity.

Using onboard air compressors also requires trucks to run, which creates exhaust fumes and is very noisy. A stationary blower virtually eliminates those issues, which creates better working conditions and is more environmentally friendly.

And don't forget product quality. A stationary blower system avoids sucking in the exhaust fumes reducing the product contamination.

There is clearly a wide range of applications, and they're not always obvious.

That's true. Food and beverage companies are finding many opportunities to address their goals, and many of them are critical.

Take fermentation for example. We worked with one of the United Kingdom's largest yeast producer's operation in Canada. The plant's 22-hour fermentation process cycle, which has fluctuating pressure and flow requirements, relies on a continuous supply of oil-free low-pressure air to deliver oxygen to the stock yeast. Any disruptions were not acceptable since any interruption in airflow to a fermentation vessel results in failure of an entire batch.

Knowing this, the plant took proactive approach and explored using rotary screw blower to replace some conventional lob-type blowers since they experienced reliability issues with them. They eventually upgraded this system with rotary screw blowers, which addressed the reliability issue and saved them energy costs.

What actually happened at the yeast plant? How did they realize energy savings?

We did the project in phases given the critical nature of application. First, we installed an oil-free rotary screw blower as a supplementary unit to the conventional blowers to evaluate its reliability and the potential for energy efficiency.

After 12 months of excellent performance, the plant chose to install a complete blower installation comprised of three fix-speed rotary machines and three variable-speed blowers to supply air at pressures between 2.9 psig and 16.9 psig on three of its six fermentation units.

The new blowers not only cope with the fluctuations in process air demand but also operate from 100% capacity down to 25% capacity with very little change in the specific power requirement. Now, the yeast producer expects to reduce its energy cost by at least 25 percent.

What's your advice for selecting blower technologies for food and beverage applications like these?

We always tell customers there is no single best technology. Choosing the best oil-free blower type begins with understanding the process and application. There are many factors to be considered, including capital cost, energy consumption, performance range, process requirements and maintenance.

The best advice is to work with a knowledgeable supplier to get a full understanding of the strengths of a given technology and deciding whether it's the right blower for a specific process. Working with a supplier that has multiple blower types is also a good idea because there isn't a bias toward one specific technology and allows ample opportunity to discuss all factors and questions that go into making the best choice.

Thank you for your insights. **BP**

For more information, please contact Deepak Vetal, National Sales Manager, Blowers and Low-Pressure Compressors, Atlas Copco Compressors, LLC, tel: 803 817-7248, email: deepak.vetal@us.atlascopco.com.

To read more **Blower Technology** articles, visit <http://blowervacuumbestpractices.com/technology>.



“Working with a supplier that has multiple blower types is also a good idea because there isn't a bias toward one specific technology and allows ample opportunity to discuss all factors and questions that go into making the best choice.”

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CENTRAL VACUUM SUPPLY for Efficient Cheese Packaging

By Uli Merkle, Busch Dienste GmbH

► DMK Deutsches Milchkontor GmbH produces sliced cheese and Mozzarella at its production facility in Georgsmarienhütte, Germany. The various types of sliced cheese and Mozzarella blocks are vacuum packed after processing in several packaging lines. The vacuum supply for the packaging machines is provided by a Busch centralized vacuum system, which supplies both the packaging lines and the thermoforming machines.

DMK Deutsches Milchkontor GmbH is one of the largest dairy companies in Germany,

employing more than 7,400 staff at 26 sites in ten federal states. The company was formed by the merger of Humana and Nordmilch, and processes milk from about 8,900 producers to manufacture 6.8 billion tons of high-quality cheese products per year. DMK customers include national and international retailing companies, food manufacturers, and large volume consumers. The company has a wide product portfolio, ranging from basic milk products and cheese to milk-based food manufacturing ingredients and baby food, ice cream and health food.

The production facility in Georgsmarienhütte manufactures mainly sliced cheese and Mozzarella in packaged portions. These products are distributed throughout Germany, and are also exported to other European countries. Other products include milk and whey concentrates, which are mostly used in-house for further processing. The site normally operates a three-shift system five days a week, and employs a total of 350 staff.

Various types of sliced cheese for end-consumers are packaged in three packaging



“After a year of operation, the centralization of the vacuum system had saved about 100,000 kW/h, reducing DMK’s energy costs by approximately 15,000 Euros.”

— Uli Merkle, Busch Dienste GmbH

lines by thermoforming machines, with products packed as both DMK and external brands. Two additional thermoforming machines package Mozzarella in 2.5 kg and 10 kg blocks for further processing by customers.

DMK conducts its energy management according to ISO 50001 standards, leading the company to seek a solution to reduce vacuum system energy consumption. All five thermoforming machines originally had two vacuum pumps each: one to form the foil into the mold, and one to extract air from the packaging chamber. The DMK energy manager Yvonne Gödeker wished to reduce the number of vacuum pumps, and relocate them away from the production area. The production area is air-conditioned, so heat emitted by vacuum pumps was causing increased

energy costs. She found competent partners at Busch, who recommended the installation of a centralized vacuum system. Busch was subsequently awarded the contract to design, build, install and commission this centralized vacuum system. System commissioning was completed on the 1st October 2014. After a year of operation (October 2015) the centralization of the vacuum system had saved about 100,000 kW/h, reducing DMK's energy costs by approximately 15,000 Euros.

This saving was achieved by a combination of factors, but mainly by the vacuum control system: only the vacuum pumps needed to meet current demand are in operation. Vacuum is supplied by a pipework system with three vacuum circuits:

1. Rough Vacuum

Several vacuum pumps maintain a permanent rough vacuum of between 30 and 40 mbar in the vacuum reservoirs and pipework system. This vacuum is available directly at the packaging point to evacuate the packaging to rough vacuum level. The medium vacuum circuit is then activated.

2. Medium Vacuum

The medium vacuum modules evacuate the packaging chamber and the packaging from rough vacuum level to the final package pressure of less than five mbar.



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CENTRAL VACUUM SUPPLY FOR EFFICIENT CHEESE PACKAGING

This two-stage evacuation has the advantage of speed: the final pressure is achieved rapidly, allowing short cycle times. The two-stage process is also the most energy-efficient way of achieving a vacuum of less than five mbar. Panda vacuum pumps in a medium vacuum unit are used as vacuum boosters.

3. Forming Vacuum

This vacuum circuit is used to form the plastic foil into trays. The vacuum level required is between 100 and 200 mbar.

A controller maintains the required vacuum level in all three vacuum circuits, matching the demand created by the individual packaging lines. Vacuum pumps are switched on or off as required, maintaining the desired pressure in the vacuum reservoirs.

The three packaging lines rarely require maximum pumping speed simultaneously, so in general only some of the vacuum pumps are in operation.

In the original decentralized vacuum system, both vacuum pumps were started with the packaging machine and ran continuously at full speed. This maximum output was dimensioned to meet the demand created by the shortest cycle time and largest packaging volume of the

machine. The new centralized vacuum system has drastically reduced the running time of individual vacuum pumps, which in conjunction with the two-stage package evacuation has resulted in massive energy savings.

The centralized vacuum system is located in an intermediate floor above the production and packaging areas. The relocation of vacuum pumps installed directly to the packaging machines prevents emitted heat from reaching the packaging machines and production area. In addition, no warm air from vacuum pump exhausts is given off to air-conditioned rooms. This has reduced the cooling required by the packaging machine tools, and air conditioning costs are also lower.



Figure 1: Cheese production at DMK in Georgsmarienhütte: packaging of sliced cheese with a thermoforming packaging machine.



Figure 2: Busch centralized vacuum system at DMK in Georgsmarienhütte.

As the centralized vacuum system is now located externally, it is no longer necessary for service personnel to enter the production area. Service technicians can carry out maintenance without interrupting production, as the system has a reserve vacuum unit. Starting this reserve unit allows the first unit to be disconnected from the network and maintenance tasks to be carried out. This has reduced expenditure, as no production time is lost and maintenance is no longer required on weekends when costs are higher. DMK has signed an all-inclusive service agreement

with Busch. This means Busch will provide a five-year warranty for the system, carry out all maintenance tasks, and take immediate remedial action if a fault should arise.

The DMK energy manager Yvonne Gödeker is completely satisfied with the selection of Busch as partner for the vacuum supply energy reduction project. Not only have the projected energy savings been achieved and exceeded, the entire project was carried out without technical difficulties from design, construction and installation to everyday operation. **BP**

For more information, contact Uli Merkle, Head of Marketing Services at Busch Dienste GmbH in Germany, part of the international group of Busch Vacuum Pumps and Systems, at uli.merkle@busch.de, or visit www.buschusa.com.

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PAY CLOSE ATTENTION TO TURNDOWN to Achieve Blower System Optimization

By Tom Jenkins, JenTech, Inc.



▶ Turndown designates the operating range of an aeration blower or a blower system – and it can often be the most important factor in determining the ability of a system to match process demand. It is also critical to the system’s energy optimization. Unfortunately, in designing blower systems and controls turndown is not always given the attention that its importance merits. Here’s a look at the critical nature of turndown in wastewater

treatment plants and recommendations for ensuring adequate turndown when utilizing Positive Displacement (PD) and centrifugal blowers.

Importance of Turndown

Turndown is usually expressed as a percentage. Greater turndown means more flexibility for operators in matching blower flow rate to process demand.

$$\text{Turndown\%} = (Q_{\text{max}} - Q_{\text{min}}) / Q_{\text{max}} \times 100$$

Where:

Q_{max} and Q_{min} = maximum and minimum safe airflow rates.

In municipal wastewater treatment plants, blower system capacity usually exceeds process demand. System designers must provide capacity for loading growth over a projected twenty-year life. The blower system design must



“Turndown is more important than efficiency in reducing power costs. Regardless of the blower system efficiency, excess airflow wastes power.”

— Tom Jenkins, JenTech, Inc.

meet the process needs at projected worst-case oxygen demand plus a reasonable factor of safety. It's common for a treatment plant to operate at one third of the designed average daily flow. Normal diurnal flow variations increase needed turndown. In most municipal treatment plants peak daytime loading is twice minimum nighttime loading.

Turndown is more important than efficiency in reducing power costs. Regardless of the blower system efficiency, excess airflow wastes power. A system with limited turndown simply can't take advantage of high efficiency blowers.

Operators need adequate turndown to maintain process performance. Nutrient removal processes for nitrogen and phosphorus require anoxic and/or anaerobic zones. Many of these processes recycle mixed liquor from

the effluent end of aeration basins to anoxic or anaerobic zones at the influent end. Excess dissolved oxygen in the recycle will impede developing anoxic and anaerobic conditions. The result is process failure.

System Turndown Recommendations

It is important to note that blower *system* turndown is the important factor. Individual blowers typically have a turndown of 40 to 60 percent – roughly a 2:1 ratio of maximum to minimum flow. This assumes blower airflow is modulated by using variable speed, throttling, or guide vanes. Varying the number of blowers while also modulating flow rate can provide high system turndown. If the turndown on individual blowers is 50% or more, stepless changes in air rate can be achieved when adding blowers.

The optimum design should include a minimum of 80% system turndown (5:1 max to min ratio). For most water resource recovery facilities (WRRF) this is the turndown needed to accommodate the combined effects of the difference between design and actual loading and diurnal variations. A system turndown of 88% (8:1 max to min ratio) is preferred. This provides additional flexibility for unusual demand fluctuations.

Most regulatory agencies require redundant blowers so that process performance can be maintained if there is a blower failure. Worst-case design airflow must be available with the largest blower out of service.

It's common to use two large blowers, each sized for 100% design capacity. Multiple small blowers provide better turndown. The capital

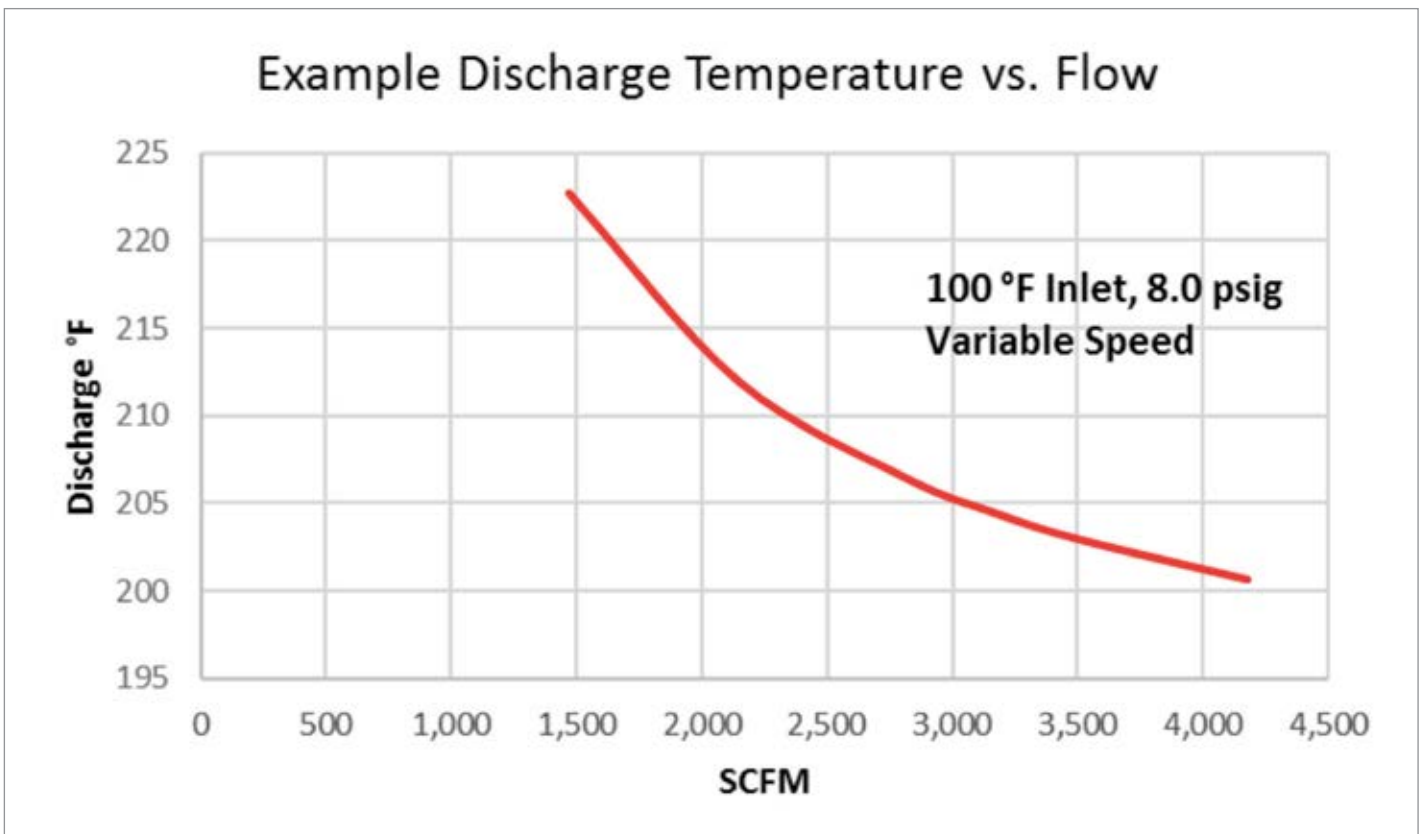


Figure 1: Shown is an example of temperature increase for PD blowers.

PAY CLOSE ATTENTION TO TURNDOWN TO ACHIEVE BLOWER SYSTEM OPTIMIZATION

savings achieved using a few large blowers is easily offset by the wasted energy from the inability to meet low process demand.

Four blowers sized to provide 33% of design flow each will generally provide 80% turndown. Two blowers providing 25% of design capacity combined with two blowers providing 50% capacity will provide 88% turndown, meeting the preferred goal.

Positive Displacement (PD) Blowers

The turndown for PD blowers is generally limited by heat buildup. This may be either in the motor or in the blower itself, depending on the operating characteristics of the system.

If discharge pressure is constant, PD blowers create a constant torque load on the motor. Since torque is proportional to current, motor amperage is also constant. The heat generated by the motor resistance, I²R heating, isn't reduced at lower speed, but the cooling airflow is. That means the motor temperature will rise.

Motors operated at high temperature experience insulation failure. NEMA insulation class refers to the allowable temperature rise above 40 °C (104 °F) ambient before insulation breaks down. For most ODP and TEFC motors, excess temperature occurs at rated torque and 50% of nominal speed.

Manufacturers rate motor insulation by temperature rise above allowable, but it is

more convenient for operators and engineers to have actual temperature limit values. For the most common insulation classes these are:

- Class B: 80 °C rise (max = 120 °C/248 °F)
- Class F: 105 °C rise (max = 145 °C/293 °F)
- Class H: 125 °C rise (max = 165 °C/329 °F)

Most motors are rated for service at 3,300 feet ASL altitude. At higher ambient temperatures, or higher elevations, the motor must be de-rated.

The blower itself also experiences an increase in operating temperature at lower speeds.

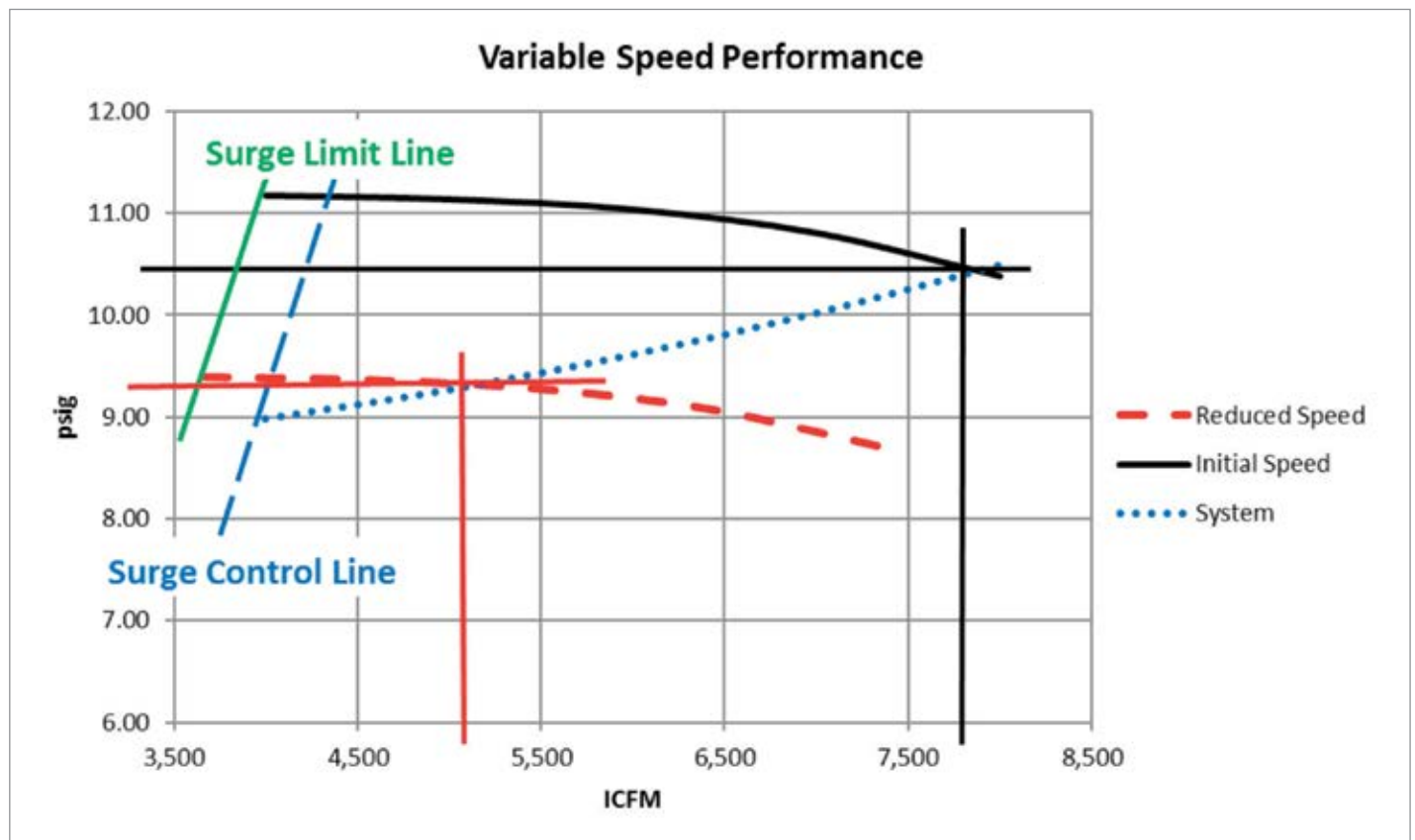


Figure 2: An example of surge limit and surge control lines for dynamic blowers.

For any type of blower the temperature of the discharge air can be calculated from known parameters:

$$T_d = T_i + (T_i \cdot [(p_d/p_i)^{(k-1)/k}] - 1) / \eta$$

Where:

- $T_{i,d}$ = inlet and discharge temperature, °R
- η = efficiency, decimal
- $p_{i,d}$ = inlet and discharge pressure, psia
- k = ratio of specific heats, dimensionless, ≈ 1.4

Internal air leakage from blower discharge back to the inlet, referred to as “slip”, is constant at a given pressure ratio. Mechanical losses from friction don’t change significantly with speed. The result is a decrease in blower efficiency at lower speed, creating higher discharge temperature. At lower speed there is also less air moving through the blower, so less heat is removed as illustrated in Figure 1. The heating is compounded by high inlet temperature.

Two factors establish the temperature limit for PD blowers. The first is the service temperature limit for blower lubricants and seals. Operation above 250 °F will usually cause failure. The limit should be verified with the manufacturer.

The second limit is based on the temperature differential between the inlet and discharge sides of the blower. Excess temperature differential can cause warping of the blower end plates. The result is metal-to-metal contact between the rotors and end plates, causing catastrophic damage.

The variation in efficiency with speed differs between lobe- and screw-type PD blowers. Lobe-type PD blowers generally have maximum efficiency at maximum speed. Screw-type units generally exhibit maximum efficiency near mid-range. It is common, therefore, for screw-type PDs to have better turndown than lobe-type PDs.

Advantages of Sophisticated Monitoring

Techniques for improving turndown for any blower entail replacing approximate or generalized limits with systems that allow for monitoring conditions that limit turndown. For example, it is common for blowers to operate at discharge pressures below the design point. This reduces torque, current, and I2R heating. Furthermore, the heat dissipation capacity of motors is better at normal operating temperatures than at 40 °C. By monitoring actual motor temperature the speed can be reduced until the temperature approaches unwanted values.

Similar considerations apply to monitoring blower discharge temperature and temperature differential. Because pressure ratios and inlet air temperatures are often lower than design values the generalized 50% speed limit doesn’t accurately correlate with potential damage.

Energy savings from increased turndown can easily offset the cost of more sophisticated monitoring, particularly on large blowers. The increased protection of sophisticated systems may also prevent catastrophic failure from unusual operating condition.

It is important to consider manufacturers’ limitations and recommendations in designing blower protection and turndown systems.

Centrifugal Blowers

The turndown limits for centrifugal (dynamic) blowers are more complex than those for PD blowers. Turndown may be based on blower temperature, but more frequently, the minimum flow rate is determined by surge.

Surge is a pulsating airflow that occurs at high discharge pressures and low flow rates. Prolonged operation in a surge conditions usually results in catastrophic failure. This can be the result of vibration in bearings, or high blower temperature. High impeller speeds generally increase sensitivity to surge.



“Techniques for extending turndown for centrifugal blowers include monitoring air, bearing, and lubrication system temperatures.”

— Tom Jenkins, JenTech, Inc.

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SUNDAY, OCTOBER 13, 2019

9:00AM–3:00PM Exhibitor-Only Pre-Registration
 9:00AM–6:00PM Exhibitor Move-In
 3:00PM–6:00PM Conference Registration Open
 6:00PM–8:00PM Welcome Reception

MONDAY, OCTOBER 14, 2019

7:00AM–11:00AM Exhibitor Registration and Move-in
 8:30AM–10:00AM Opening Session
 10:15AM–12:15PM Conference Session #1
12:00PM–6:00PM EXPO FLOOR OPEN
 1:30PM–2:30PM Energy Treasure Hunt Workshop #1
 2:45PM–4:45PM Conference Session #2
 TBD Networking Event!!

TUESDAY, OCTOBER 15, 2019

8:00AM–9:30AM Plenary Session
 9:45AM–11:45AM Conference Session #3
12:00PM–6:00PM EXPO FLOOR OPEN
 1:30PM–2:30PM Energy Treasure Hunt Workshop #2
 2:45PM–4:45PM Conference Session #4
 5:00PM Energy Treasure Hunt Raffle Winners
 Announced!!"

WEDNESDAY, OCTOBER 16, 2019

7:00AM–12:00PM Exhibitor Move-out
 8:00AM–10:00AM Conference Session #5
 10:15AM–12:15PM Conference Session #6

4 TRACKS PER CONFERENCE SESSION

TRACK 1:
COMPRESSED AIR SUPPLY STRATEGIES

TRACK 2:
COMPRESSED AIR DEMAND REDUCTION

TRACK 3:
BLOWER & VACUUM OPTIMIZATION

TRACK 4:
COOLING SYSTEMS & ENERGY MANAGEMENT



Registration

Conference registration includes, within the specified day, workshop and conference tracks, meals and expo hall access. **Register at www.cabpexpo.com**

	Before 9/13/19	After 9/13/19
Single Day Conference Pass	\$290	\$350

- October 14 Workshops, Lunch, Opening Session, Expo Hall & Evening Reception
- October 15-16 Breakfasts, Lunch, Conference Sessions, Expo Hall & Evening Reception

Full Conference Pass	\$550	\$675
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- October 14-16 all functions and meals

SPECIAL DISCOUNT: Register 4 and get 1 FREE!

2019 EXPO HALL OPEN HOURS	FREE
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- October 14-15 12:00 PM – 6:00 PM

PAY CLOSE ATTENTION TO TURNDOWN TO ACHIEVE BLOWER SYSTEM OPTIMIZATION

Blower performance curves identify a surge “point.” Operation at flow rates lower than that point may cause surge. Variable speed blower curves usually show the surge limit line, which represents the surge point as a function of speed. The surge control line may also be shown as illustrated in Figure 2. This represents the recommended minimum safe flow. Operating at flow rates lower than the surge control line triggers the surge control mechanism.

The designer should be aware that the occurrence of surge is variable with speed, inlet air conditions (especially temperature), control method, and discharge piping configuration. There should always be a margin of safety between the surge limit line and the surge control line.

Surge Control Measures

Surge control, or protection, can be implemented in many ways, including:

- Shut down the blower.
- Open a blow-off valve to reduce pressure and increase airflow.
- Modulate the blower to increase airflow.
- Use speed, guide vanes or throttling valves to modulate the blower.

One disadvantage of using blow-off valves for surge control is the reduction in discharge pressure, which may eliminate airflow to the process. A modulating blow-off valve can be used to maintain enough discharge pressure to provide air to the process while maintaining flow at a safe value.

Surge control can be optimized in several ways. Determining flow rate is more accurate than using motor amps for monitoring. Instead of using a fixed, conservative surge point, the surge line can be corrected for actual inlet conditions and operating speed. Advanced control algorithms can detect the pressure or amperage fluctuations that accompany surge, providing reliable protection without an excessive margin of safety.

Motor heating isn’t usually a problem with dynamic blowers, since the torque and current decrease with reduced blower speed and flow. The minimum speed, valve, or guide vane position is usually dictated by the reduction in discharge pressure capability and the corresponding change in the surge point.

Centrifugal blowers exhibit temperature increases at reduced flow due to reduced efficiency and reduced heat removal. Heat can damage bearings and seals and compromise lubrication. A loss of clearance between impellers and casings may result from differential thermal expansion, causing catastrophic failure.

Improving Turndown with Centrifugal Blowers

Techniques for extending turndown for centrifugal blowers include monitoring air, bearing, and lubrication system temperatures. This allows operation at reduced flow while using high temperature alarms to prevent failure.

Note that increasing maximum flow can also improve turndown and operator flexibility for both types of blowers. Increasing maximum flow rate can reduce the need

to start multiple blowers to meet process demand. Monitoring motor power can identify impending overload before it occurs. System pressure and ambient temperature rarely match worst-case design values. Throttled or guide vane controlled blowers may produce higher flow rates than the design point. Variable speed blowers may be operated slightly faster than 60 hertz provided power draw stays within the drive’s allowable load and vibration is avoided.

Summary

The operating range of aeration blowers is limited by many factors. Having adequate turndown is more important than efficiency in minimizing power consumption.

The factors that limit turndown for PD and centrifugal blowers share similarities and also differ in many ways. Temperature is always a concern. Centrifugal blowers have additional limitations because of the potential for surge.

Regardless of blower type, control systems that accurately monitor key operating parameters can optimize turndown. This provides operator flexibility and minimum energy consumption while protecting the blower system from failure.

For more information contact Tom Jenkins, President, JenTech Inc. at email: info@jentechinc.com or visit www.jentechinc.com.

To read similar articles on **Aeration Blowers**, please visit www.blowervacuumbestpractices.com/technology/aeration-blowers.



BLOWER & VACUUM SYSTEM INDUSTRY NEWS

Pfeiffer Vacuum Opens New North American HQ Facility

Pfeiffer Vacuum, a leading provider of high-tech vacuum solutions for the semiconductor, industrial, coating, analytical and R & D markets, has opened up a new North American headquarters facility in Nashua, New Hampshire.

The 27,000-square-foot building will house the company's Administration, Sales, Product Management, Marketing and Customer Care areas. In parallel, Pfeiffer Vacuum's former 24,000-square-foot administration building has been converted into a Service Center of Excellence, bringing together under one roof all service activities for the major part of the Pfeiffer Vacuum product portfolio. The operation includes state-of-the-art automated cleaning and test equipment, resulting in high-quality, fast repairs of the highest standards.

With its service center in Austin, Texas, and its strong presence in the semiconductor industry, Pfeiffer Vacuum has an ideal organization to serve the North American customers, said Daniel Saelzer, President of Pfeiffer Vacuum Inc.

"With the completion of the two facilities, Pfeiffer Vacuum will be able to better support our valued customers throughout North America, while at the same time providing a modern, best-in-class work environment for our staff," Saelzer said.

About Pfeiffer Vacuum

Pfeiffer Vacuum (Stock Exchange Symbol PFV, ISIN DE0006916604) is one of the world's leading providers of vacuum solutions. In addition to a full range of hybrid and magnetically levitated turbopumps, the product portfolio comprises backing pumps, measurement and analysis devices, components as well as vacuum chambers and systems. Ever since the invention of the turbopump by Pfeiffer Vacuum, the company has stood for innovative solutions and high-tech products that are used in the Analytics, Industry, Research & Development, Coating and Semiconductor markets. Founded in 1890, Pfeiffer Vacuum is active throughout the world today. The company employs a workforce of some 2,250 people and has more than 20 subsidiaries. For more information, visit www.pfeiffer-vacuum.com.

Vacuum Technology Saves Widmer Brothers Brewery Nearly \$40,000 in Water, Sewer and Energy Costs

Atlas Copco, a leading provider of sustainable productivity solutions, recently partnered with Widmer Brothers Brewery, part of the Craft Brew Alliance (CBA), to improve the company's bottling process and eliminate excess water consumption with the first-known waterless vacuum pump in the craft beer industry. By replacing a liquid ring pump with an Atlas Copco GHS VSD+ rotary screw vacuum pump, the Portland, Oregon, brewery saves nearly \$40,000 in water, sewer and energy costs.

Widmer Brothers Brewery originally used a liquid ring vacuum pump to bottle beers, but quickly realized the technology was consuming roughly 5,000 gallons of water per day at an average flow of 3.5 gallons per minute. After consulting Atlas Copco, Widmer Brothers Brewery decided to upgrade to the GHS VSD+ rotary screw vacuum pump.

"Unlike the liquid ring pump, the GHS VSD+ uses a foam dampening water trap to capture water and foam during the bottling process," said Greg Marciniak, Business Development Manager for the Industrial Vacuum Division at Atlas Copco. "Without the risk of liquid and foam entering the system, Widmer Brothers Brewery has peace of mind that their system will stay up and running without excess liquid potentially flooding the production floor. It not only keeps the area safe, it also drives down product waste."

With the GHS VSD+, Widmer Brothers Brewery saves ample time and energy in the bottling process. By replacing the liquid ring pump, it has reduced water consumption by 5,000 gallons per day, which saves an annual



Pfeiffer Vacuum's New North American headquarters facility.

\$5,000 in water costs and \$30,000 in sewer costs, including extra strength charges.

Although the equipment upgrade was originally driven by the desire to save water, Widmer Brothers Brewery has avoided wastewater impact and also saved on energy consumption. In switching to a Variable Speed Drive rotary screw vacuum pump, the system now produces a deeper vacuum with half the horsepower, saving the brewery close to \$4,000 in energy costs.

“Widmer Brothers Brewery has a long history of supporting clean water and investing in innovative ways to protect beer’s number one ingredient,” said Julia Person, Sustainability Manager with Widmer Brothers Brewery. “We’re excited to partner with Atlas Copco to pioneer the first waterless vacuum pump in the craft beer industry, and it’s been great seeing how this innovation will lead to new



Atlas Copco GHS VSD+ rotary screw vacuum pump at Widmer Brothers Brewery.

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energy and water saving technologies to be shared with our peers.”

About Atlas Copco

Atlas Copco is a world-leading provider of sustainable productivity solutions. The Group serves customers with innovative compressors, vacuum solutions and air treatment systems, construction and mining equipment, power tools and assembly systems. Atlas Copco develops products and services focused on productivity, energy efficiency, safety and ergonomics. The company was founded in 1873, is based in Stockholm, Sweden, and has a global reach spanning more than 180 countries. In 2015, Atlas Copco had revenues of BSEK 102 (BEUR 11) and more than 43,000 employees. Learn more at www.atlascopcogroup.com.

About Widmer Brothers Brewing

Widmer Brothers Brewing – Kurt and Rob Widmer – founded Widmer Brothers Brewing in 1984 in a former mattress factory located in what is now the Pearl district in Portland, Oregon. It’s hard to believe that the Oregon craft beer movement started with a cobbled together brewery including two fermenters built from old milk tanks, nuclear power plant parts, and farm equipment gathered in Oregon and Washington, but that’s exactly how the Widmer Brothers began their story. Inspired by their German heritage, the first two beers they brewed were Altbier and Weizenbier. When a loyal local account requested a third beer, and with no way to increase tank space at their brewery, the brothers unfiltered their Weizenbier thinking it was a simple, one-time solution. Not so. The cloudy wheat beer, poured into a distinctive pilsner glass, and garnished with a lemon was about to become the Original American Hefeweizen. Today, Hefe remains Oregon’s top selling craft beer for its distinctive great taste and hazy appearance.

Hefeweizen has remained a NW staple beer and continues to win awards. Widmer Brothers continues to create quality craft beers and push the limits of Beervana. For more information, visit www.widmerbrothers.com.

Hormel Foods Honors Busch with 2017 Spirit of Excellence Award

Hormel Foods Corporation has awarded Busch LLC with a 2017 Spirit of Excellence Award, which is given every year to suppliers that play an important role in the company’s continuous improvement processes. Busch is a contractor of Hormel Foods Corporation, providing vacuum pumps and systems, services and maintenance support. It received the award for the third year in a row.

Suppliers of Hormel Foods that qualified for the Spirit of Excellence Award achieved a minimum supplier-rating index of 92 throughout a period of 12 months. Less than 150 suppliers qualify for this award among the 8,000 plus vendors working with Hormel Foods. Suppliers are rated by a quarterly survey of each Hormel Foods plant, including criteria such as meeting performance requirements, on-time delivery and providing high-level customer support. Ratings ensure each supplier adheres to the same standards. Suppliers are divided into the areas of contractors, pork procurement, provisions, ingredients, packaging and transportation.

An increase in the score from 2016 to 2017 was achieved by improving on-site vacuum pump service support but also by increasing training frequency and the quality of product training and maintenance training conducted by Busch field service technicians on-site at Hormel Foods plants throughout the United States. In addition to regular training seminars, Busch employees visit each Hormel Foods plant at least once a month to check on the performance of the vacuum pumps and make sure everything works as requested.

“We are very proud to be honored with the Spirit of Excellence Award by Hormel Foods again this year,” said Charles Kane, General Manager of Busch LLC. “We are continuously working on improving our performance to support Hormel Foods in producing high-quality food products for consumers around the world.”

About Busch

Today’s food packaging and processing industry uses vacuum in a very wide range of applications. Busch products guarantee the highest level of product quality and process safety. Busch has always focused on optimizing food processes, improving productivity with ongoing investment, and research and development for tomorrow’s innovations. To learn more about Busch products and services, visit www.buschusa.com.

Pfeiffer Vacuum Opens High-tech Production Site in Romania

Pfeiffer Vacuum has opened a new production operation in Cluj, Romania, to meet continued growth of the Pfeiffer Vacuum Group, as well as ongoing demand for vacuum technology.

Pfeiffer Vacuum has produced and serviced vacuum components for vacuum pumps in the city of Cluj since 2010. Cluj, located in northwest Romania, is the second largest city in Romania with a population of approximately 320,000. The company’s new building is located in the Nervia Industrial Park in Apahida. Highly efficient production processes can be run on 4,300 square meters of production area.

“The new building has increased our production and service capacity for turbopump and backing pump components. This is part of our new growth strategy including a global investment program with a volume of 150

million euros,” said Dr. Eric Taberlet, CEO of Pfeiffer Vacuum Technology AG. A total of 74 employees in Cluj support the workforce at Pfeiffer Vacuum's other production locations.

“It is a privilege for our Romanian team to benefit from this new facility. We are proud to contribute to the success of our company,” said Pascal Fesneau, Administrator at Pfeiffer Vacuum Romania. The same production and service standards apply in Romania as at Pfeiffer Vacuum's sites in Germany and France.

The new location in Cluj also plays an important role in energy management. The new building and production facilities comply with the latest findings and technologies for optimum use of resources.

“With modern machinery and plant technology, as well as qualified specialist personnel, we are now even better placed to react flexibly. Quality and flexibility are our top priorities,” Taberlet said.

About Pfeiffer Vacuum

Pfeiffer Vacuum (stock exchange symbol PFV, ISIN DE0006916604) is one of the world's leading providers of vacuum solutions. In addition to a full range of hybrid and magnetically levitated turbopumps, the product portfolio comprises backing pumps, leak detectors, measurement and analysis devices, components as well as vacuum chambers and systems. Ever since the invention of the turbopump by Pfeiffer Vacuum, the company has stood for innovative solutions and high-tech products that are used in the Analytics, Industry, Research & Development, Coating and Semiconductor markets. Founded in 1890, Pfeiffer Vacuum is active throughout the world today. The company employs a workforce of some 3,000 people and has more than 20 subsidiaries. For more information, visit www.pfeiffer-vacuum.com.



Officials celebrate the opening of the Pfeiffer Vacuum facility in Romania.



From left to right, Johan Van der Eeken, Stephan Hohenadl, Eva Heemann and Cemre Altinsoy display the Leybold check for Atlas Copco's Water for All initiative.

Leybold Donates 5,930 Euros to Atlas Copco Water for All Initiative

Leybold has donated 5,930 euros to the Atlas Copco Water for All initiative. The program, which started in 1984, supports projects that provide people in need with access to clean drinking water, sanitation and hygiene.

Water for All is Atlas Copco's most important non-profit initiative and is funded through employee volunteer contributions. In total, more than two million people have now gained access to clean drinking water thanks to the initiative. The Rohingya refugees in Bangladesh were also recently supported with donations

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Blower & Vacuum Best Practices is a technical magazine dedicated to discovering Energy Savings in industrial blower and vacuum systems and in municipal wastewater aeration blower systems. Our editorial focus is on case studies and technical articles where application and system knowledge drives technology selection, creating energy savings in projects delivering excellent ROI's.

"Republic prefers to couple air knives with centrifugal or regenerative blowers. These blowers are energy-efficient and inexpensive, especially when compared to compressed air as an alternative."

— Rich Leong, VP Sales & Marketing, Republic Manufacturing ("Republic Manufacturing Delivers Food Grade Blower & Air Knife Systems," April 2018 Issue)

"Without sacrificing pump performance, recoverable energy levels of up to 75 percent are even possible in some applications."

— Jerry Geenen, Atlas Copco Industrial Vacuum Division ("Rotary Screw Vacuum Pumps Benefit Meat Packaging Plants," January/February 2018 Issue)

From WWTP Aeration Blowers to Centralized Vacuum Systems

Our readers have embraced energy management practices as the next step. Our diverse key subscribers work at multi-factory manufacturing organizations and are targets to consider options such as VSD vacuum pumps in newly centralized systems. On the municipal side, over 1,000+ operators at wastewater treatment plants (WWTP's) and blower sales channels receive the magazine. Lastly, a growing group of industrial blower and vacuum OEM design engineers are looking for technologies able to improve their machines.

"The savings in power obtained by using variable speed instead of throttling centrifugal blowers are significant. Throttling creates a parasitic pressure drop, with the pressure ratio across the blower remaining essentially constant."

— Tom Jenkins, JenTech Inc. ("Proper Blower System Design for Variable Wastewater Depth Processes," July 2018 Issue)

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BLOWER & VACUUM SYSTEM INDUSTRY NEWS

from the Welthungerhilfe. In the long term, the focus is on supporting sustainable water supply and hygiene projects, especially in Africa.

“Our cooperation with Welthungerhilfe makes it possible for institutional donors to double the donation and ultimately raise 17,790 euros for our joint aid projects,” said Eva Heemann and Cemre Altinsoy from the Atlas Copco employee initiative.

“Leybold has been part of the Atlas Copco Group since 2016 and I am very pleased this initiative has been so positively received and supported by our staff,” said Johan Van der Eeken, Leybold Managing Director. “This campaign is a win-win situation for everyone. It supports sustainability to a special degree and serves to make life easier for those in need in a direct way.”

About Leybold

Leybold is a part of the Atlas Copco’s Vacuum Technique Business Area and offers a broad range of advanced vacuum solutions for use in manufacturing and analytical processes, as well as for research purposes. The core capabilities center on the development of application- and customer-specific systems for the creation of vacuums and extraction of processing gases. Fields of application are secondary metallurgy, heat treatment, automotive industry, coating technologies, solar and thin films such as displays, research & development, analytical instruments, as well as classic industrial processes. For more information, visit www.leybold.com/en.

About Atlas Copco

Atlas Copco is a world-leading provider of sustainable productivity solutions. The Group serves customers through its innovative compressors, vacuum solutions, generators, pumps, power tools and

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assembly systems. Atlas Copco develops products and services focused on productivity, energy efficiency, safety and ergonomics. The company was founded in 1873, is based in Stockholm,

Sweden, and has a global reach spanning more than 180 countries. In 2017, Atlas Copco had revenues of BSEK 86 (BEUR 9) and about 34,000 employees. For more information, visit www.atlascopcogroup.com.



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