The Magazine for ENERGY EFFICIENCY in Blower and Vacuum Systems

BLOWER & VACUUM BEST PRACTICES

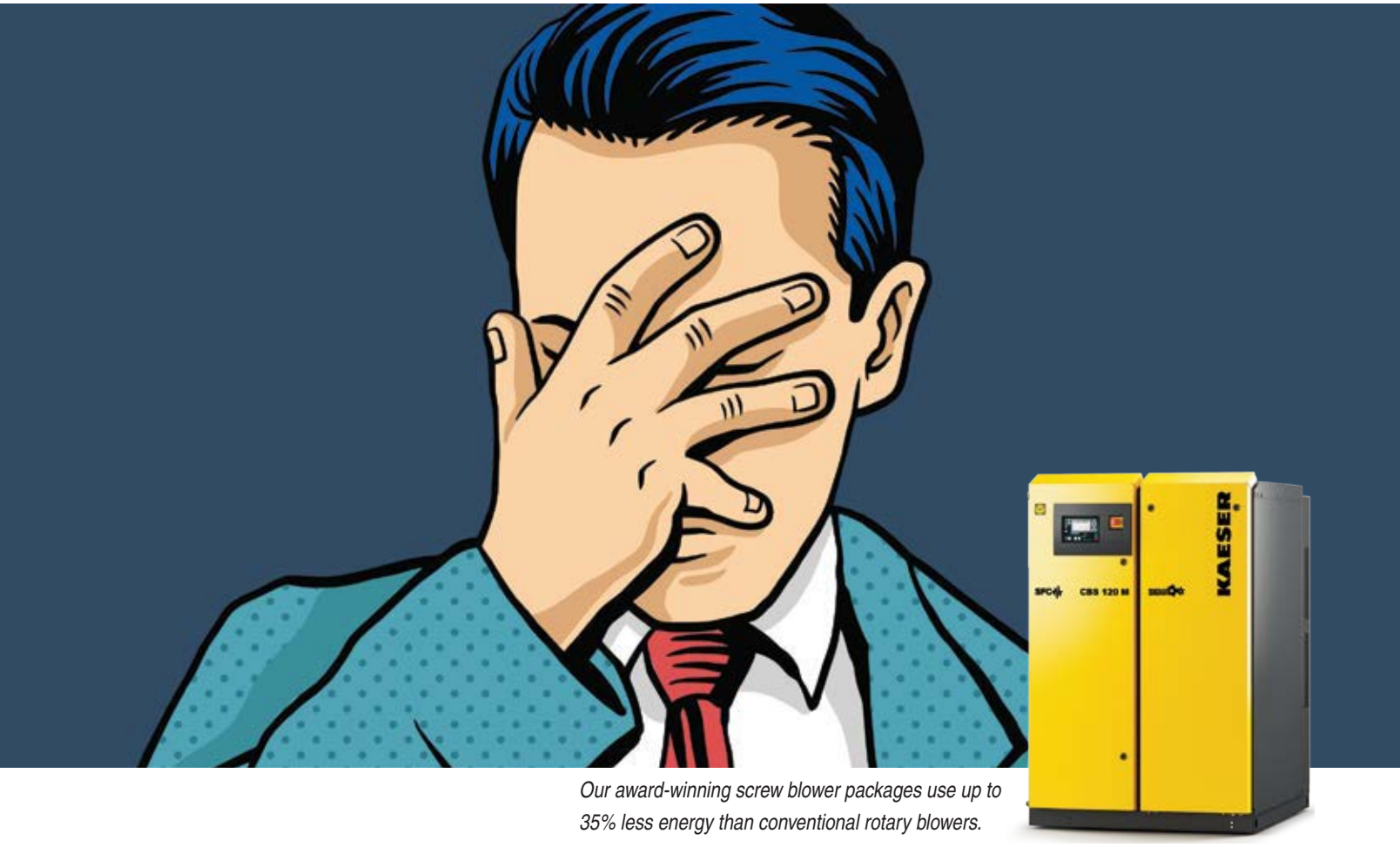
blowervacuumbestpractices.com

September 2018

AERATION BLOWER SYSTEMS

INDUSTRIAL VACUUM & BLOWER SYSTEMS

Our complete blower package costs a lot less D'oh.



Our award-winning screw blower packages use up to 35% less energy than conventional rotary blowers.

Try a complete blower package from Kaeser

Every component in a Kaeser integrated blower package is carefully selected for quality and performance. The package layout is designed with easy accessibility in mind to simplify routine maintenance.

Our packages come with the onboard Sigma Control 2™ to monitor cabinet and oil temperature and pressure as well as provide instant SCADA and IoT connectivity.

You'll also get faster installation and a higher commissioning success rate. And, if anything goes wrong, you've only got one phone call to make.

Visit www.us.kaeser.com/bvbp to learn how a Kaeser complete blower package can make your life easier.

Solving your system challenges.

KAESER COMPRESSORS®

Built for a lifetime.

Kaeser Compressors, Inc. • 866-516-6888 • us.kaeser.com/bvbp

 customer.us@kaeser.com

VISIT US AT WEFTEC 2018 IN BOOTH #1907

AERATION BLOWER SYSTEMS

INDUSTRIAL VACUUM & BLOWER SYSTEMS

COLUMNS

FROM THE EDITOR

I was very fortunate to be invited by Aerzen to visit the Clearfield Municipal Authority in central Pennsylvania. The reason for the invite was they were able to showcase an installation where three different blower technologies were chosen, as the optimal solution, for three different areas of the wastewater treatment plant. The updated plant is designed to handle an average daily flow of 4.5 million gallons per day (MGD), yet allow for a peak flow rate of 25 MGD. I hope you enjoy our article in this issue detailing why specific blower technologies were chosen for each part of the process.

Mar-Bal, Inc. is based in Chagrin Falls, Ohio and manufactures custom molded parts for electrical distribution markets. They had a decentralized vacuum system with thirty (30) oil-lubricated rotary vane pumps supporting their injection molding process. Busch was invited to review their system and has provided us with an excellent article about how they centralized the vacuum system with two (2) rotary vane vacuum pumps.

Does your plant only have fixed speed vacuum pumps? Can you mitigate the impact of power spikes? Greg Marciniak from Atlas Copco has provided us with a very "real-world" article detailing the challenges facing many industrial vacuum systems.

The 2018 Powder & Bulk Solids Conference & Exhibition was held April 24-26 at the Donald E. Stephens Convention Center in Rosemont, Illinois. This event is the leading conference for the powder industry. Vacuum, blower and compressed air technologies play an important role in dilute or dense phase pneumatic conveying systems. These technologies are well represented at this event and we hope you enjoy our Show Report.

Speaking of events, we hope to see you at the inaugural 2018 Best Practices Expo & Conference, September 17-19, 2018 at the Chicago O'Hare Crowne Plaza. Please consider registering for the event!

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

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

PFEIFFER VACUUM

VACUUM SOLUTIONS

A one stop source for the highest standard in vacuums

No two vacuum processes are alike since individual requirements are what matters. Together with our customers, we obtain a vacuum solution based on their specific needs. This process includes all steps in creating a perfect vacuum condition. Besides best-in-class products for vacuum generation, measurement and analysis, we also offer accessories, application training programs and worldwide service.

See for yourself what Pfeiffer Vacuum solutions are about at:

www.pfeiffer-vacuum.com

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

Leybold Oil-free VARODRY Screw Vacuum Pump for Industrial Applications

Short, reliable and clean production processes are more important than ever for the increasingly digital and globally active value chains, in addition to high quality results. Vacuum technology provides a significant contribution to meeting these requirements. The vacuum pioneer Leybold has designed the new VARODRY vacuum pump series for efficient industrial vacuum processes.

The oil-free VARODRY screw pump convinces with first-class performance. It guarantees the required operating pressure, a short cycle time and ultimately high system availability and robustness - especially in moist or dusty processes. The VARODRY is also easy to install and connect. Thanks to its compact design and reduction to the essential, the vacuum pump can be easily integrated into new or existing systems.

Equipped with complete air-cooling, the pump makes water cooling completely superfluous. The developers at Leybold were guided by the idea of using fewer, proven machine parts and components in their design. The VARODRY convinces its users with low maintenance requirements, emission-free ventilation and minimal operating noise in average daily operation. Moreover, this pump is absolutely dry and clean, thus preventing oil and particle emissions or oil leaks as well as oil migrations in the vacuum chamber or into the products and processes.

The new Leybold oil-free VARODRY screw vacuum pump

All in all, the VARODRY from Leybold is designed for highest and reliable performance with low investment and operating costs. Its numerous advantages make the new pump series, which is offered in the two pumping speed classes VD 65 and VD 100, the ideal choice for industrial vacuum requirements. “Handling the vacuum pump is easy for the user, as it requires neither cooling water nor compressed air and is characterized by a robust handling of common process media,” explains Uwe Zoellig, Global Business Development Manager Industrial Vacuum. As a result, VARODRY ensures uninterrupted operation without system downtimes. Its numerous benefits make the pump the ideal choice for all industrial vacuum applications.

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. Learn more at www.leybold.com

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 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. Learn more at www.atlascopcogroup.com

When energy savings and reliability count, rely on Sulzer

Real innovation makes a difference in your energy bill. HST™ turbocompressors from Sulzer are designed for wastewater aeration and optimized for total efficiency, giving you more air output for every kilowatt you put in.

Enclosed in a fully air-cooled package, our HST turbocompressors are liquid-free, which means no worry about oil spills or coolant levels. Their digitally controlled, no-wear magnetic bearings provide optimal clearances and microsecond control of the rotor, which is the only moving part. The result is stable performance and low-noise operation – with efficiency no other compressor can match.

For more innovation in wastewater treatment, visit www.sulzer.com

SULZER

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

Badger Meter Introduces Ultrasonic Clamp-On Flow Meter

Badger Meter, a leading global innovator and manufacturer of flow measurement, control and communications solutions, today announced the introduction of the Dynasonics® TFX-500w Ultrasonic Clamp-on Flow Meter for use in building automation, heating/ventilation/air conditioning (HVAC), water & wastewater treatment and water distribution. Designed for non-invasive, ultrasonic transit time flow measurement, the new meter was unveiled in 2018.

The TFX-500w Ultrasonic Clamp-on Flow Meter is a cost-effective solution for measuring water flow bi-directionally in a variety of applications. Typical examples include water systems, wastewater effluent, agricultural irrigation and industrial discharge.

As a clamp-on flow measurement instrument, the TFX-500w is ideal for users requiring a high level of applicability, functionality, economy and performance, said Cheryl Ades Anspach, marketing manager, Badger Meter. "The meter resides outside the pipe and is compatible with a wide range of pipe sizes. It has no pressure head loss, no contact with internal liquid and no moving parts to maintain. The TFX-500w is quickly and easily installed without cutting or tapping process piping, and can be retrofit in existing installations without shutting down system operations – reducing both installation time and material costs."

The Dynasonics® TFX-500w Ultrasonic Clamp-on Flow Meter from Badger Meter.

With the TFX-500w Ultrasonic Clamp-on Flow Meter, ultrasonic waves transmit upstream and downstream through the pipe wall and liquid flowing in the pipe. By measuring the difference in the travel time and knowing the pipe size, the meter accurately determines the rate, total and velocity of water flow.

The TFX-500w flow meter features a large, easy-to-read display. It provides Modbus RTU and BACnet MS/TP connectivity, and integrates with the Badger Meter BEACON® and AquaCUE® Advanced Metering Analytics (AMA) cloud-based software suites. Programming of the meter is through the front panel or USB cable using SoloCUE® configuration software.

Available in sizes of 1/2...10 in. (15...250 mm), and handling flow ranges of 0.1...9,800 gal/min (44,700 l/min) and temperature ranges of -40...250 °F (-40...121 °C), the TFX-500w is a versatile flow metering device that can be used in almost any industrial environment.

For more information about the Dynasonics TFX-500w Ultrasonic Clamp-on Flow Meter, please visit www.badgermeter.com.

About Badger Meter

Badger Meter is an innovator in flow measurement, control products, and communications solutions, serving water utilities, municipalities, and commercial and industrial customers worldwide. The Company's products measure water, oil, chemicals, and other fluids, and are known for accuracy, long-lasting durability and for providing valuable and timely measurement data. For more information, visit www.badgermeter.com

Edwards Launches New EDS Range of Dry Screw Vacuum Pumps

Edwards announced it has launched its new range of dry screw pumps for industrial and chemical applications. Developed in the UK and designed for a global market, the new range of EDS dry screw vacuum pumps creates a new benchmark in the screw pump market with its innovative design. Featuring tapered variable pitch dry screws, the EDS is an intricate piece of engineering built to the exacting standards and quality that Edwards is recognized for.

Designed for challenging conditions and demanding applications, the EDS features industry-leading dry screw vacuum technology housed in a modern outer enclosure. It is built to be reliable and offer robust performance standards that most production processes demand.

"The EDS is a testimony to the credentials of Edwards and our commitment to stimulate technology innovation in vacuum and accelerate the market adoption of truly revolutionary products," commented Koen Lauwers, President Industrial Vacuum Division, while speaking on Edwards' latest product innovation. "Our aim is to deliver excellence to customers while leveraging our status as a leading provider of vacuum solutions," he continued.

Available in water-cooled and air-blasted variants, the EDS range have second-to-none contaminant handling capabilities

TECHNOLOGY PICKS

in the harshest industrial conditions and dirtiest industrial installations. The pumps high tolerance for particulates make them particularly safe and flexible for the chemical processing industry.

Speaking on the versatility of the EDS vacuum pump, Owain Charles, Global Marketing Manager, Edwards said, "We wanted to ensure a market-leading pump that could handle a diverse range of applications. So we now have a pump that is suitable for any application with specific variants tailored for the chemical and industrial markets. We will have a strong focus on the fine chemical and pharmaceutical markets but the EDS pump will be a game changer in all industrial applications."

Designed for a changing global market, the EDS pumps can be easily configured for hazardous area installations and are certified for global explosion standards. In addition to the wide-ranging benefits offered by the EDS vacuum pumps as stand-alone units and systems, Edwards offers improved serviceability and service options for the global market.

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.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

New 3/8" Super Air Wipe from EXAIR

EXAIR's new 3/8" Super Air Wipe™ produces a 360˚ airstream that can blow off, dry, clean or cool the material passing through it. The split design can be clamped around continuously moving material such as wire, cable, pipe, hose and extruded shapes.

The 3/8" Super Air Wipe ejects a small amount of compressed air through a thin slotted nozzle that pulls in high volumes of surrounding room air. The airflow uniformly ejects from the 360˚ of its inner diameter. Coupling brackets that hold each half of the 3/8" Super Air Wipe together can be latched together or removed quickly. Additional shims can be installed if more blowoff force is required. Air velocity can be varied with a pressure regulator and instant on/off control provides precision blowoff. Air consumption is 11.1 SCFM at 80 PSIG and the sound level is low at only 82 dBA.

Super Air Wipes are CE compliant and available from stock in aluminum and stainless steel in diameters from 3/8" (13mm) up to 4" (102mm). Large diameters up to 11" (279mm) are available from stock in aluminum. Applications include wiping wire; drying inks; cooling hot extruded shapes; and blowoff of water, plating, coatings and dust. Pricing starts at $286. For more information, visit www.exair.com.

EXAIR's new 3/8" Super Air Wipe™ produces a 360˚ airstream that can blow off, dry, clean or cool the material passing through it.

TECHNOLOGY PICKS

Endress+Hauser Introduces the Memosens CCS50D Chlorine Dioxide Sensor

Endress+Hauser is developing a new platform for disinfection sensors. The new Memosens CCS50D chlorine dioxide sensor supports safe and effective disinfection for clean drinking water, pathogen-free cooling water and high-quality process water.

Systematic disinfection is an essential step in water treatment and legally required in many areas to protect people and systems from illness or damage. However, high doses of disinfectants such as chlorine and chlorine dioxide can be toxic, which means compliance with limit values for those disinfectants is also very important. The Memosens CCS50D chlorine dioxide sensor helps to achieve a safe and efficient disinfection by providing stable and fast measured values.

Safety by long-term stability

The chlorine dioxide sensor features a convex membrane made of dense, dirt-repellent material which prevents soiling and makes it extremely resistant to biofouling. Ultrasonic welding of the membrane to the sensor cap ensures its integrity, preventing dilution of the electrolyte. This guarantees long-term stable measurements and gives a plant manager the security that the disinfection process is running smoothly and the required results are achieved. High stability naturally also reduces maintenance.

Minimize water loss

Drinking water is a precious resource. That's why minimum water loss is an important factor in drinking water preparation. Memosens CCS50D is able to deliver reliable disinfection measurements at low flow rates. In combination with the Flowfit CCA151 assembly, for example, the required flow rate is as low as 1.3 gal/h (5 l/h), which means only a minimum amount of water is consumed in the bypass and the required disposal capacities are reduced.

BEST PRACTICES

2018 EXPO SEPTEMBER 17-19 CHICAGO O'HARE, IL

COMPRESSED AIR / VACUUM / COOLING

CABPEXPO.COM

THE INAUGURAL 3-DAY CONFERENCE & FREE EXPO

Where INDUSTRIAL Energy Managers, Utility Incentive Programs and System Assessment/Technology Experts Share Plant Utility "Best Practices."

Limited Hotel Space!
Pre-Register at
cabpexpo.com

4 Conference Tracks

Track 1: Compressed Air Supply Strategies
Track 2: Compressed Air Demand Reduction
Track 3: Blower & Vacuum Optimization
Track 4: Cooling Systems & Energy Management

*All four tracks include system training Fundamentals for Sales Engineers/Utility Reps

FREE EXPO HOURS: Sept. 17, 12-6 PM Sept. 18, 12-7 PM
LOCATION: Crowne Plaza Hotel & Conference Center, Rosemont, IL

See the latest technologies permitting factories to realize "Best Practices."

Compressed Air
- Air Compressors
- Air Compressor Controls
- Air Purification & Piping
- Condensate Management
- Measurement Instruments

Blower & Vacuum
- Aeration Blowers
- Industrial Blowers
- Vacuum Pump Systems
- Inlet Filtration/Oil Separators
- Lubricants

Cooling
- Chillers
- Heat Exchangers
- Cooling Systems

CO-SPONSORS CAGI Compressed Air & Gas Institute ComEd Energy Efficiency Program

NETWORKING EVENTS

WELCOME RECEPTION

Sunday, September 16, 6-8 pm, Balmoral Ballroom, Crowne Plaza Hotel & Conference Center

BUB CITY JOE'S Live

CHICAGO BEARS 2018 HOME OPENER WATCH PARTY!

Giant Big-Screen TV's! Just a 5 minute walk from the EXPO! Join us for Monday Night Football, September 17th at 6:30 pm, after the EXPO, for the Chicago Bears Home Opener against the Seattle Seahawks!

TECHNOLOGY/SYSTEM ASSESSMENT SPONSORS

Diamond
KAESER COMPRESSORS Built for a lifetime. Atlas Copco

Platinum
BEKO Parker ELGi Always Better. hertz COMPRESSORS SULLAIR Gardner Denver PneuTech

Gold
ATLAS CURTIS AIR COMPRESSORS Sullivan Palatek VP INSTRUMENTS JORC Howden applied system technologies

Silver
ODOMETERS BAY COAIRE COMPRESSOR ASK ABOUT ENERGY STAR mattei

Monday, September 17, 10:15 –12:15:

TRACK 3, SESSION #1
Wastewater Aeration Blower Optimization

Understanding Aeration Blower Control Efficiency
Chair: Tom Jenkins, President, JenTech Inc.

Blower System Integration for Wastewater Aeration Applications
Stephen Horne, Blower Product Manager, Kaeser USA

Fundamentals of Different Aeration Blower Technologies
John Conover, National Sales Manager – Blower and Low Pressure Compressors, Atlas Copco

Pressure, Flow and Ammonia Based DO Control
Eric Bennett, Product Manager Controls, Aerzen USA

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

The new Memosens CCS50D chlorine dioxide sensor supports safe and effective disinfection.

Save on disinfection chemicals

Many skids in the food & beverage industry use chlorine dioxide for disinfection. These skids provide only small-volume samples for dosing control. Thanks to its special membrane design, Memosens CCS50D provides a fast response time and supports precise dosing of chlorine dioxide even in these skids, leading to safe disinfection and cost savings for chemicals.

Increase process uptime

The chlorine dioxide sensor is equipped with the proven Memosens technology by Endress+Hauser. Memosens allows for direct commissioning of new sensors without further calibration. During on-going operation, plant operators can pre-calibrate sensors in the lab, swap them into the process with plug & play, and thus continue measuring faster. Finally, contactless data transmission eliminates all measurement errors or even failures caused by humidity or corrosion.

Disinfection based on chlorine dioxide is becoming more relevant

Chlorine dioxide is more and more becoming a disinfectant of choice because its handling has become easier. Today, chlorine dioxide is available as a ready-to-use solution that does not require manual mixing or the application of chemical generators. Memosens CCS50D is the perfect sensor to support this trend. It helps plant managers comply with strict legal requirements on disinfection, whether it is in drinking water treatment, cooling systems, wash water for packed vegetables and salads, beverage production or desalination plants.

For more information visit www.us.endress.com/CCS50D.

About Endress+Hauser in the U.S.

Endress+Hauser is a global leader in measurement instrumentation, services and solutions for industrial process engineering. Endress+Hauser provides sensors, instruments, systems and services for level, flow, pressure and temperature measurement as well as analytics and data acquisition. We work closely with the chemical, petrochemical, food & beverage, oil & gas, water & wastewater, power & energy, life science, primaries & metal, renewable energies, pulp & paper and shipbuilding industries. Endress+Hauser supports its customers in optimizing their processes in terms of reliability, safety, economic efficiency and environmental impact. The Group employs 13,000 personnel worldwide and generated more than 2.2 billion dollars in 2017.

Three Blower Technologies Help Pennsylvania Wastewater Plant MEET WIDE RANGE OF OPERATING CONDITIONS

By Mike Grennier, Contributing Editor,
Blower & Vacuum Best Practices Magazine

Turbo blowers are one of three aeration technologies used at the Clearfield Wastewater Treatment Plant. Shown with the units from left: Randy Rongeux, CMA Treatment Plant Operator; Leo J. Drass, Senior Project Engineer, Gwin Dobson & Foreman, Inc.; and Eric Bennett, Product Manager, Controls, Aerzen USA.

The Clearfield Municipal Authority (CMA) set out to accomplish a number of key goals when upgrading its regional wastewater treatment plant in Clearfield County, Pa., yet few took on more importance than a new aeration blower system capable of efficiently and cost-effectively delivering proper aeration across a wide spectrum of daily and seasonal operating conditions, in addition to meeting the plant's long-term aeration needs.

To achieve its goals for aeration, CMA partnered with engineering firm Gwin, Dobson & Foreman, Inc. (www.gdfengineers.com) and blower manufacturer Aerzen USA (www.aerzen.com/en-us.html) to design and install a system in that leverages three aeration blower technologies, including turbo blowers, hybrid blowers and positive displacement (PD) blowers. Each fulfills aeration and oxygen demands for separate and distinct applications, while helping CMA continue its strong record of compliance at the lowest possible cost.

Mandates and Ongoing Improvement Drive Upgrades

Originally built in 1958, the CMA wastewater treatment plant serves 14,000 residents, as well as businesses, in Clearfield Borough and surrounding portions of Lawrence Township, Clearfield County, Pa. From the start, the plant consistently met water quality and effluent parameters as specified in its National Pollutant Discharge Elimination System (NPDES) permit throughout. However, new mandates in 2010 and the need for ongoing improvements drove the need for plant upgrades.

Mandates required the plant to comply with annual nutrient loading limits of total nitrogen (TN) and total phosphorous (TP) in addition to secondary treatment limits in accordance

> "Realizing the wide range to cover, we decided to use turbo blowers with multiple frame sizes for the application to achieve a wider flow spectrum and better overlap between machines for optimization."
>
> — Eric Bennett, Product Manager, Controls, Aerzen USA

with the Chesapeake Bay Tributary Strategy. CMA also needed to more adequately handle and treat wet weather flow, which historically burdened the facility and its overall treatment capabilities. The new mandates and the need to update the aging infrastructure led to a $35 million plant upgrade.

The plant initiated the upgrade project in 2014. The first phase of the project involved construction of a new treatment facility adjacent to the existing facility. Major components of the new facility included an influent wastewater pumping station, new pretreatment/headworks building, three BNR reactors, clarifiers, channel UV disinfection units, Return Activated Sludge (RAS) pump and chemical feed building, and upgrades to the instrumentation and controls systems.

In the second phase of the project, the plant's digesters and control building were upgraded to a new sludge processing facility. In addition, anaerobic digesters were converted to aerobic digesters with the aid of the blowers. The first phase of the project was completed in fall 2016. The second phase went online in summer 2017.

Operating Conditions Call for Unique Blower Strategy

The updated plant is designed to handle an average daily flow of 4.5 million gallons per day (MGD), yet allow for a peak flow rate of 25 MGD. Additionally, the plant must handle a maximum monthly flow of 16 MGD. A particularly rainy day might result in the need for the plant to handle 12 MGD. In addition to managing flows, the plant must achieve nutrient discharge concentrations of 6.0 mg/l (TN) and 0.80 mg/l (TP).

The need to address wide swings in operating conditions – and hold down costs – dictated a unique approach for maximum aeration efficiency given that aeration energy consumption at wastewater treatment plants typically consume as much as 60% of all electrical usage.

Working with CMA and Aerzen, Gwin Dobson & Foreman (GD&F) developed an aeration blower strategy that includes separate technologies precisely matched to three key areas, each of which with its own unique operating conditions and aeration requirements. These include:

- Three BNR reactors.
- Two digester tanks.
- A sludge holding tank.

Turbo Blowers Ideal for Wide Flow Spectrum

At the plant, a pump station feeds sewage to a headworks building with fine screens and grit separators. Influent is then routed to a reactor feed distribution box with a gravity step feed system for wet weather flows. The distribution box feeds the reactors, each of which is engineered with six zones to achieve various levels of treatment as the wastewater passes through it.

Aeration blowers for the reactors are essential for satisfying the plant's Biological Oxygen Demand (BOD), which allows for aerobic bio-degradation of the pollutant components. When designing the aeration blower system for the reactors, GD&F needed to provide the correct amount of aeration needed, yet no more than necessary to avoid wasted energy.

To achieve the appropriate balance, GD&F specified a system for the reactors that includes two 75 HP turbo blowers, each of which is rated to provide 1500 CFM at 10 psig, and two 150 HP turbo blowers, each of which rated to provide 2,700 CFM at 10 psig. Each blower is equipped with Variable Frequency

One of three NRT Reactors at the CMA Wastewater Treatment Plant.

THREE BLOWER TECHNOLOGIES HELP PENNSYLVANIA WASTEWATER PLANT MEET WIDE RANGE OF OPERATING CONDITIONS

Drive (VFD) controls and has a 2:1 turndown. The turbo blowers are located in a newly constructed building located next to the reactors.

Each turbo blower is designed with air-foil bearings, which rely on compressed air in the two radial bearings of the drive shaft and in the axial bearing for absorbing axial forces. The air-foil technology is based on the principle that in operation an air cushion forms automatically and thus without further energy input. The turbo blowers, as with other blowers, at the plant are also sound attenuated for quiet operation.

GD&F opted for turbo blowers rather than PD or Hybrid blowers for the reactors because units are typically more efficient and cost effective in applications with narrow swings in turndown, which is the case with the reactors at the CMA plant where the operating pressure requirements are consistent and highly predictable.

Actuator valves are used to regulate the airflow for each of the six zones within each NRT reactor at the wastewater plant.

The use of four turbo blowers with different horsepower and CFM ratings also offers a much-needed level of flexibility, said Eric Bennett, Product Manager, Controls, Aerzen USA.

"Realizing the wide range to cover, we decided to use turbo blowers with multiple frame sizes for the application to achieve a wider flow spectrum and better overlap between machines for optimization," Bennett said, adding that an alternative system that uses blowers with the same horsepower ratings for each blower would not be as effective for flexible.

"For example," Bennett said, "the 75 HP unit might operate for the majority of the time but when there is higher demand, it might be best to run with the a 150 HP machine or run the 150 HP blower in conjunction with 75 HP unit depending on the load. It's about truly optimizing the aeration to the process demand on any given day."

MOV Control Method Saves Energy

The turbo blowers are controlled using a dedicated flow-based, Most Open Valve (MOV) method to ensure air distribution at the lowest possible operating pressure, which in turn, reduces energy consumption.

MOV control relies on an error-gain algorithm that automatically calculates the total airflow required for each of the zones within each reactor to maintain the proper Dissolved Oxygen (DO) set point. To do so, probes in each zone measures DO levels and relay the data to a control system located in the building that houses the turbo blowers. The control system automatically monitors the DO levels and opens or closes valve actuators located within each zone to achieve the proper amount of airflow based on the DO set point for a specific zone. Fine bubble membrane diffusers are also used to aid aeration process.

"The strategy allows everything to work together," Bennett said. "The system opens a valve all the way for a zone that has the highest need for air and tapers the other valves that need less air to achieve the optimum flow. It's following the system curve and operating at the pressure needed to efficiently achieve distribution rather than operating at a pressure that is higher than necessary."

Given the need to conserve energy, the MOV control strategy is crucial for the plant, said Bennett. The MOV control strategy also follows best practices touted by the Environmental Protection Agency.*

Hybrid and PD blowers are housed together in a newly constructed blower room.

"A constant-pressure system typically operates at 0.5 to 1.5 psi above static head pressure, but any pressure above static head is wasted energy," he said, noting that a 1.5 psi increase can result in a 20% increase in power consumption. "The MOV system effectively minimizes the waste associated with a constant-pressure system."

Hybrid Blowers Manage Pressure Swings

Waste sludge from the reactor is routed to aerobic digesters tanks where the goal of aeration is to prevent waste sludge from turning septic. Importantly, the aeration scenario in the digesters differs from the reactors in that they experience significant fluctuations in head pressure based on changes in water levels. With a pressure swing ranging from 4 to 12 psig, the tanks called for a specific aeration blower technology. In addition, the application called for on/off blower cycling.

Given the operating conditions of the digester tanks and the need to cost-effectively deliver proper aeration, GD&F specified two 100 HP twisted screw hybrid blowers for the application. Each is equipped with VFD controls and rated to provide 1800 CFM at 12 psig. Each blower also has a 3:1 turndown.

"The hybrid blowers provide the ability to operate at very high pressure and operate efficiently at those high pressures, yet they also offer

THREE BLOWER TECHNOLOGIES HELP PENNSYLVANIA WASTEWATER PLANT MEET WIDE RANGE OF OPERATING CONDITIONS

The PD blowers at the plant compress inlet air to 5.25 psi and route it through the main header (bottom) to SH tanks and the recycling tank.

Up-to-the-minute data for blowers is visible on the treatment plant's Supervisory Control and Data Acquisition (SCADA) system shown here. In addition, the turbo blower building and the building housing the hybrid blowers and PD blowers are each equipped with a master control panel for easy monitoring and independent control of each system.

tremendous turndown," said Bennett. "By comparison, the turbo wouldn't effectively handle the wide pressure swing and a hybrid blower is much more efficient than a traditional PD blower at high pressure."

The hybrid blowers are located in a newly constructed blower room that also houses the PD blowers. The hybrid blowers and PD blowers work off of separate discharge headers to deliver air to each dedicated process.

A programmable logic controller (PLC) controls the hybrid blowers. One unit provides air to both digester tanks. To do so, the system leverages the error-gain algorithm to automatically deliver airflow to the appropriate tank based on DO or Oxygen Reduction Potential (ORP) set points. The second hybrid provides redundancy.

PD Blowers Best Suited for Low-Pressure Application

The primary goal of aeration for sludge holding (SH) tanks and recycling tank, which are downstream from the digesters, is to ensure the wastewater remains mixed to support the aerobic process.

The operating pressure for the SH and recycling tanks is typically at or around approximately 5.0 psi or less. The low operating pressures did not warrant an investment in turbo blowers or hybrid blowers.

Given the low operating pressure and lower capital costs, GD&F specified two 50 HP PD blowers for the SH and recycling tanks. Each is equipped with VFD controls and rated to provide 1200 CFM at 5 psig. Each blower also has a 4:1 turndown, which makes the PD blowers more energy efficient than turbo blowers or hybrid blowers when operating at low pressures and minimum flows.

"Capital cost, power consumption, and turndown all made it a clear decision that best choice for this application is PD blowers. Selecting a blower based on maximum flow efficiency is not always best. You need to look at where the machine will be operating the majority of the time. Since the PD can hit the minimum flows beyond that of a turbo blower or hybrid blower, it becomes the most efficient machine for the application," said Bennett.

The PD blowers use the same control technology used for the hybrid blowers. One blower is dedicated to the SH tanks, while another serves the recycling tank. Given the high turndown ratio of the blowers and the discharge header configuration, the plant has the option of running one unit to easily meet the aeration needs of both SH tanks and the recycling tank. The same maintains control based on established DO and ORP set points.

Blower Strategy Delivers Needed Results

According to CMA Wastewater Treatment Plant Operator Randy Rongeux, the use of three separate aeration blower technologies contributes to the operation's goal of holding down costs for sewage treatment while allowing the plant to comply with stringent regulations.

"I'm a tinkerer and I always try to run the operation as efficiently as possible," Rongeux said. "The aeration blower strategy goes a long way toward helping us achieve our goals." BP

About Aerzen USA

Aerzen USA is a wholly-owned division of the German manufacturer, Aerzener Maschinenfabrik GmbH, and has been a recognized world leader in the production of rotary positive displacement machines since 1868. Established in 1983, Aerzen USA is based in Coatesville, PA. For more information, visit www.aerzen.com.

About Gwin, Dobson & Foreman

Gwin, Dobson & Foreman, Inc. is a full service engineering firm located in Altoona, Pennsylvania. The firm specializes in water and wastewater engineering and has been serving clients throughout Pennsylvania, Maryland, West Virginia and Ohio since 1954. GD&F takes a hands-on, practical approach to their projects to serve the long-term needs of their clients. As with all process technology, GD&F thoroughly evaluates and selects the best blower technology to provide the most cost effective solution to their specific treatment requirements. For more information about Gwin, Dobson & Foreman, Inc. call Senior Project Manager Jim Balliet at 814-943-5214, or visit www.gdfengineers.com.

*Evaluation of energy conservation measures for wastewater treatment facilities. U.S. Environmental Protection Agency, Office of Wastewater Management - 2010

To read more about ***Aeration Blower Technology,*** please visit www.blowervacuumbestpractices.com/technology/aeration-blower

Less Maintenance Thanks to the CENTRALIZATION OF THE VACUUM SUPPLY

By Jasmin Markanic, Coordinator Global Press & Media Relations, Busch Dienste GmbH

Choosing the right vacuum supply can lead to huge cost savings in plastics processing. Mar-Bal, Incorporated has undertaken a critical review of the existing vacuum supply for injection molding when moving to a new plant and has collaborated with Busch, LLC to find a solution that will achieve savings in energy, maintenance and production times.

Mar-Bal, Incorporated was founded in 1970 by Jim Balogh with the idea of serving customized materials to a specialty market. Today, Mar-Bal is run by Balogh's sons, Scott and Steven. The company, an industry leader in composites, sells its own proprietary products, including electric standoff insulators and fire-resistant wastebaskets made from thermoset materials with fiberglass reinforcement.

Due to the reduction of the single vacuum pumps at each injection molding machine to only two, rotary vane vacuum pumps in a centralized system, energy consumption was reduced by 75%

Mar-Bal, Incorporated, headquartered in Chagrin Falls, Ohio, is focused on manufacturing custom molded parts for electrical distribution and control devices (Figure 1), plus a wide range of components for the appliance industry.

More than 130 employees work around the clock, five days a week in Ohio to mold parts for electrical switchgear, controls, motors, drives, circuit breakers, transformers and telecommunication devices. Mar-Bal also produces molded parts with nearly 400 employees at plants in Virginia and Missouri and just recently opened a location in Shanghai, China. Mar-Bal also has a state-of-the-art laboratory where a material engineering team customizes compounding materials to customer specifications.

However, Mar-Bal has grown a lot since its inception in 1970.

In the early years, Mar-Bal facilities had 30 individual oil-lubricated rotary vane vacuum pumps directly installed at the injection molding machines delivering the vacuum for evacuating the mold cavity. Each pump required regular service and Mar-Bal employees had to halt production to tend to the pumps. In 2016, Mar-Bal moved to a new facility and vacuum specialists from Busch developed a new concept to find a more efficient solution for the vacuum supply of the injection molding machines.

The team quickly agreed that a centralized vacuum supply would be the ideal solution to eliminate the previous disadvantages of the decentralized solution. The basis for designing the centralized vacuum system where two brand new R 5 rotary vane vacuum pumps are

Fig 1: Standoff Insulators Made by Mar-Bal, Inc.

LESS MAINTENANCE THANKS TO THE CENTRALIZATION OF THE VACUUM SUPPLY

Fig 2: Centralized Vacuum System from Busch

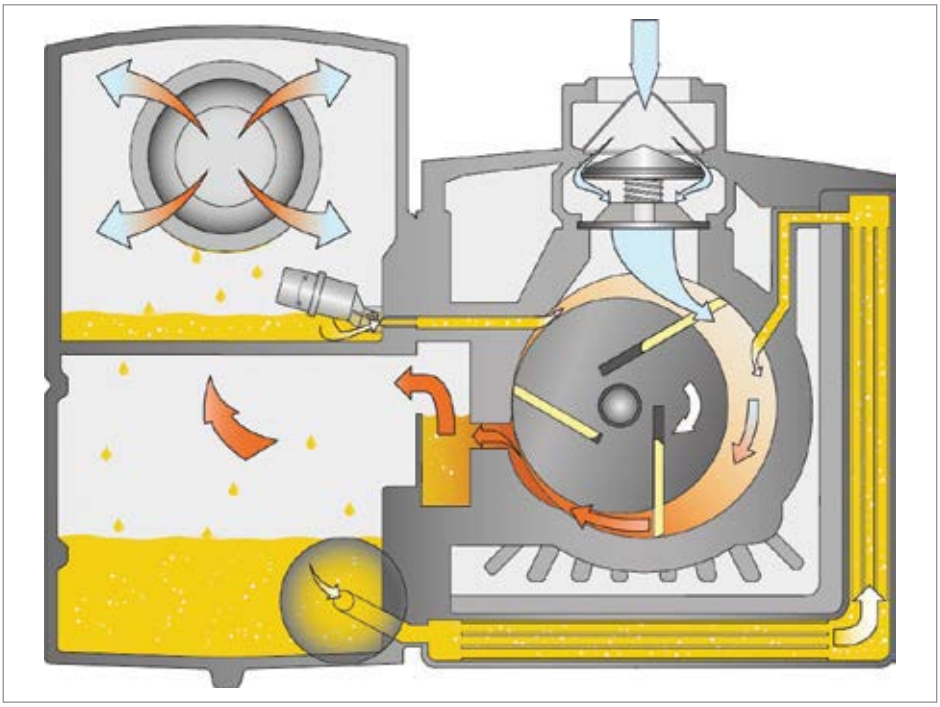


Fig 3: Operating Principle of a R 5 Rotary Vane Vacuum Pump.

located in a separate machine room outside of the production facility.

The new centralized vacuum system has been in operation since March 2017. Its main components are two R 5 rotary vane vacuum pumps (Figure 3), which deliver vacuum to 23 injection molding machines at the moment. But the vacuum system has enough capacity to add up to 10 more injection molding machines. There are buffer tanks between the centralized vacuum system and the molding machines to ensure the required vacuum level is constantly available.

Vince Profeta, Vice President of Product Engineering & Manufacturing Technologies at Mar-Bal, Incorporated is convinced that Mar-Bal installed the most advanced vacuum technology with the new centralized vacuum system from Busch. The new system is far superior to the previous vacuum supply when it comes to the level of maintenance and susceptibility to failures. Mar-Bal has eliminated the maintenance and breakdowns at single vacuum pumps.

Due to the reduction of the single vacuum pumps at each injection molding machine to only two, rotary vane vacuum pumps in a centralized system, energy consumption was reduced by 75%. Vince Profeta and the Mar-Bal team are very happy with the new vacuum solution. In addition to the energy savings and reduced maintenance, Mar-Bal now has a modern, consistent vacuum supply with additional savings by improving molding quality.

For more information, please contact info@buschusa.com or visit www.buschusa.com.

To read more ***Plastics Industry*** articles, please visit www.blowervacuumbestpractices.com/industries/plastics

BEST PRACTICES

2018 EXPO SEPTEMBER 17-19 CHICAGO O'HARE, IL

COMPRESSED AIR / VACUUM / COOLING

CABPEXPO.COM

THE INAUGURAL 3-DAY CONFERENCE

Where INDUSTRIAL Energy Managers, Utility Incentive Programs and System Assessment/Technology Experts Share Plant Utility "Best Practices."

Conference Track 3 Goal: To Train Industry to Implement More Blower & Vacuum Energy Conservation Measures (ECM's)

- Brainstorm on Utility Incentive Program Design
- Training Auditors on how to do System Assessments
- When and When-Not to Centralize a Vacuum System
- Blow-off Air Optimization with Blowers & Air Knives
- Learn to Use Blower Performance Curves
- Treasure Hunt Projects to Reduce Vacuum Demand

4 Conference Tracks

Track 1: Compressed Air Supply Strategies

Track 2: Compressed Air Demand Reduction

Track 3: Blower & Vacuum Optimization

Track 4: Cooling Systems & Energy Management

*All four tracks include system training Fundamentals for Sales Engineers/Utility Reps

Limited Hotel Space!
Pre-Register at cabpexpo.com

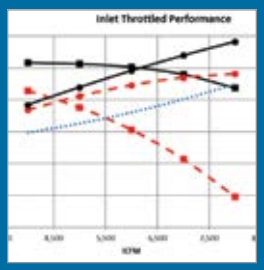
CO-SPONSORS CAGI Compressed Air & Gas Institute | ComEd Energy Efficiency Program

Often Over-looked Energy Conservation Measures for Blower & Vacuum Systems.

Vacuum Centralization

Vacuum Demand Reduction Projects

Blowers & Air Knives for Blow-off Air



Blower Sizing for Aeration & Pneumatic Conveying

TECHNOLOGY/SYSTEM ASSESSMENT SPONSORS

Diamond

KAESER COMPRESSORS, Atlas Copco

Platinum

BEKO, Parker, ELGi, hertz, SULLAIR, Gardner Denver, PneuTech

Gold

ATLAS, CURTIS, Sullivan Palatek, VP INSTRUMENTS, JORC, Howden, applied system technologies

Silver

CDI METERS, BAX, COAIRE COMPRESSOR, mattei

FEATURED SPEAKERS

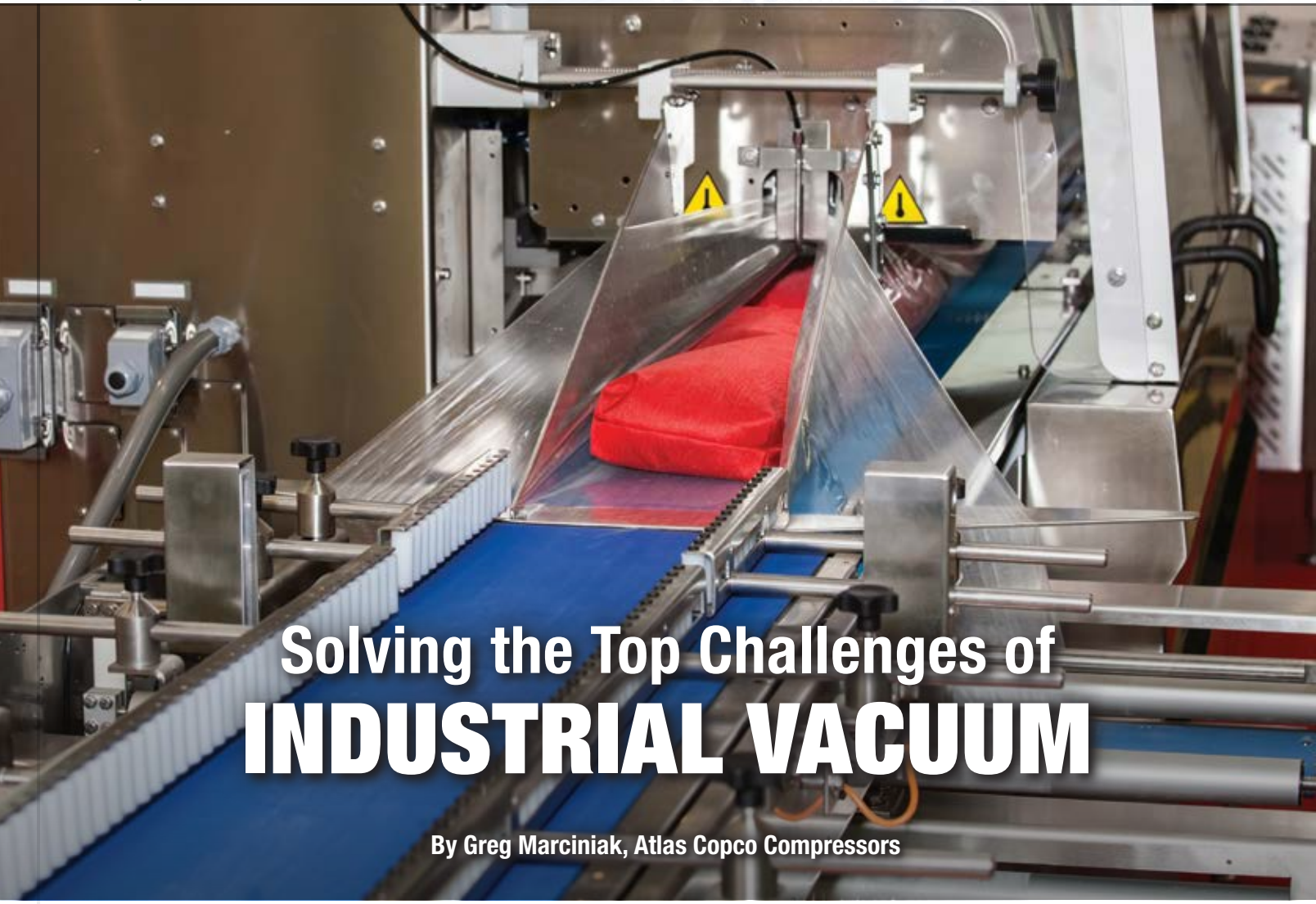
Doug Barndt
Manager Demand Side Energy & Sustainability, Ball Beverage Packaging

Dana Bolton,
VP Customer Solutions, ComEd

Leslie Marshall
Corporate Energy Engineer Lead, General Mills

Walt Tunnessen
National Program Manager, ENERGY STAR for Industry

Kurt Kniss
Innovation Engineer, Shaw Industries



Solving the Top Challenges of INDUSTRIAL VACUUM

By Greg Marciniak, Atlas Copco Compressors

Industrial vacuum can be defined as vacuum used to perform a task in industrial processes, operating anywhere from atmospheric pressure to 1 torr. Traditionally, the most common technologies included liquid ring and rotary vane vacuum pumps. But as with any industry, there was room for improvement…otherwise, we'd still be driving Model A Fords and talking on corded telephones. Luckily in recent years, the industrial vacuum market has started making significant advancements in technology and efficiency.

If we step back into the not-so-distant past, virtually all industrial vacuum pumps were fixed speed machines that ran at one, consistent speed. The constant speed of these machines did not address varied processes with fluctuating demands, which then caused

"Traditionally, the most common technologies included liquid ring and rotary vane vacuum pumps. But as with any industry, there was room for improvement…otherwise, we'd still be driving Model A Fords and talking on corded telephones."

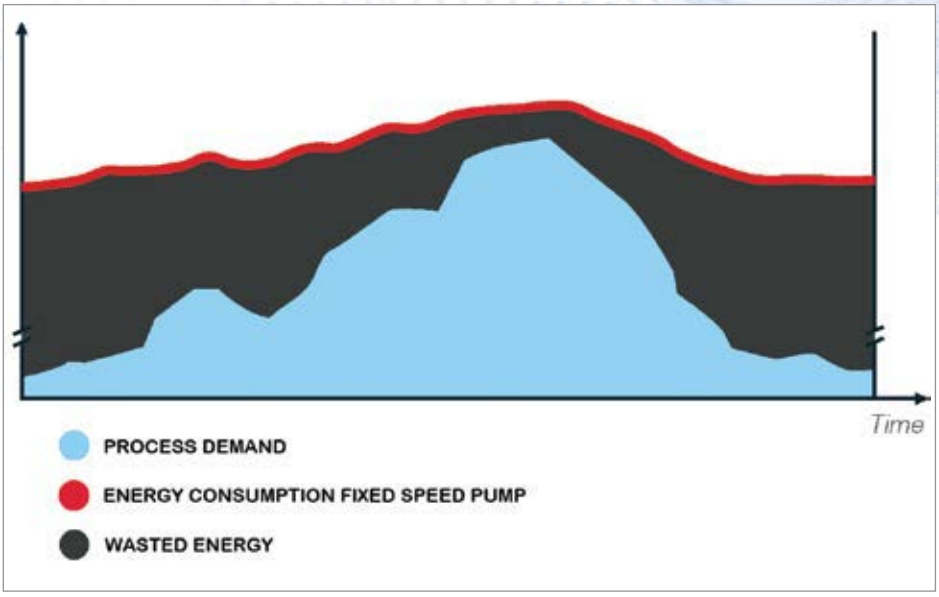
— Greg Marciniak, Atlas Copco Compressors

large inefficiencies between the vacuum pump and the process.

Variable Speed Drive

With the development of Variable Speed Drive (VSD) technology built into industrial vacuum pumps, we can mitigate a lot of energy waste by controlling the motor speed to match the process demand.

While energy savings with VSD industrial vacuum pumps is the primary focal point, there are other benefits to consider when comparing VSD pumps to their traditional fixed speed counterparts. Let's take a look at some of the benefits.



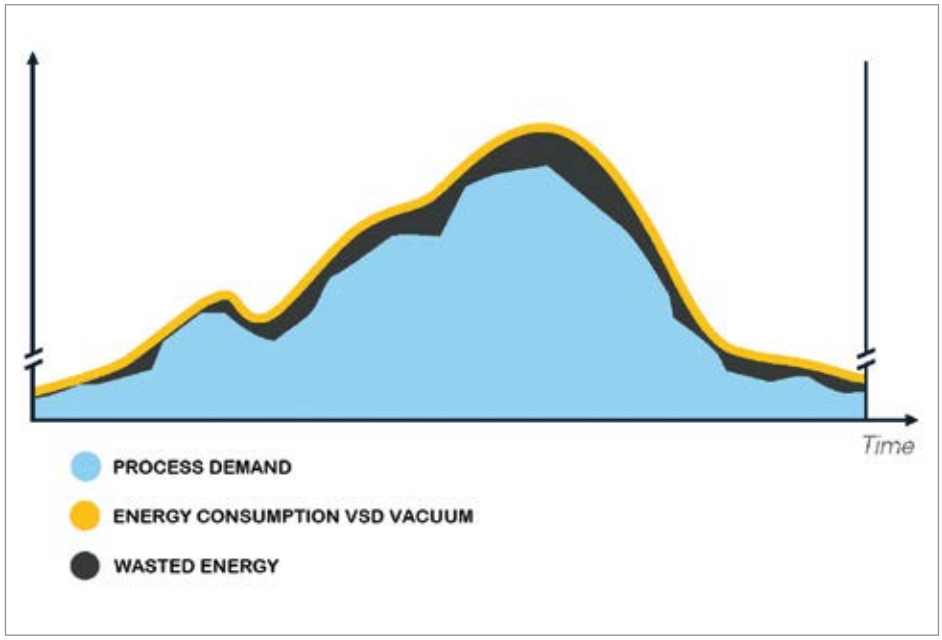
Fixed Speed Vacuum Versus Process Demand

SOLVING THE TOP CHALLENGES OF INDUSTRIAL VACUUM

VSD vs. Fixed Speed

There have been attempts in the past at adding VSD to industrial vacuum technology, but the benefits were negligible due to the nature of some of these technologies. Turn down capability, or the amount of available functional speed reduction, can be limited with certain types of pumps.

Technology such as the oil-sealed rotary screw benefits the most when coupled with VSD technology. This technology will give a wide range of turn down capability, allowing it to operate anywhere from full speed down to around 10-percent speed. In contrast, other compression technologies are at a disadvantage when it comes to varying pump speed. For example, if you look at the operating principle of a liquid ring vacuum pump, the actual compression occurs when a volume of gas is trapped within a ring of liquid, similar to a washing machine's spin cycle. This ring of liquid is created through centrifugal force, and as the pump's motor slows, the centrifugal force is lost and there is no compression. The same goes for rotary vane technology where sliding vanes create compression but also rely on centrifugal force. With the limited ability to slow these technologies, VSD becomes less of a benefit in energy savings.



VSD Vacuum Versus Process Demand

Controlling Pressure in Fixed Speed Pumps

Control has also been a hurdle for fixed speed industrial vacuum pumps. Because fixed speed pumps run at one speed, the pump is always driving toward the deepest vacuum level possible. The best way to think about this is if your car only had two options – fully stopped or full throttle, with no ability to operate in between the two. For industrial vacuum, this only works in situations where the deepest vacuum level is always desired. More often than not, users are looking for a vacuum level somewhere below the ultimate pressure of a pump. For instance, an oil-sealed rotary vane pump will typically have the capability to reach 1 torr ultimate pressure, but most customers do not need this amount of pressure. Users may want to operate at 150 torr but holding this pressure can be challenging for a fixed speed pump; however, there are a couple ways to achieve this.

> "Technology such as the oil-sealed rotary screw benefits the most when coupled with VSD technology. This technology will give a wide range of turn down capability, allowing it to operate anywhere from full speed down to around 10-percent speed."
>
> — Greg Marciniak, Atlas Copco Compressors

BEST PRACTICES

2018 EXPO SEPTEMBER 17-19 CHICAGO O'HARE, IL

COMPRESSED AIR / VACUUM / COOLING

CABPEXPO.COM

THE INAUGURAL 3-DAY CONFERENCE & FREE EXPO

Where INDUSTRIAL Energy Managers, Utility Incentive Programs and System Assessment/Technology Experts Share Plant Utility "Best Practices."

Limited Hotel Space! Pre-Register at cabpexpo.com

4 Conference Tracks

Track 1: Compressed Air Supply Strategies
Track 2: Compressed Air Demand Reduction
Track 3: Blower & Vacuum Optimization
Track 4: Cooling Systems & Energy Management

*All four tracks include system training Fundamentals for Sales Engineers/Utility Reps

FREE EXPO HOURS: Sept. 17, 12-6 PM Sept. 18, 12-7 PM
LOCATION: Crowne Plaza Hotel & Conference Center, Rosemont, IL

See the latest technologies permitting factories to realize "Best Practices."

Compressed Air

- Air Compressors
- Air Compressor Controls
- Air Purification & Piping
- Condensate Management
- Measurement Instruments

Blower & Vacuum

- Aeration Blowers
- Industrial Blowers
- Vacuum Pump Systems
- Inlet Filtration/Oil Separators
- Lubricants

Cooling

- Chillers
- Heat Exchangers
- Cooling Systems

CO-SPONSORS CAGI Compressed Air & Gas Institute ComEd Energy Efficiency Program

NETWORKING EVENTS

WELCOME RECEPTION

Sunday, September 16, 6-8 pm, Balmoral Ballroom, Crowne Plaza Hotel & Conference Center

BUB CITY JOE'S Live

CHICAGO BEARS 2018 HOME OPENER WATCH PARTY!

Giant Big-Screen TV's! Just a 5 minute walk from the EXPO! Join us for Monday Night Football, September 17th at 6:30 pm, after the EXPO, for the Chicago Bears Home Opener against the Seattle Seahawks!

TECHNOLOGY/SYSTEM ASSESSMENT SPONSORS

Diamond

KAESER COMPRESSORS Built for a lifetime. Atlas Copco

Platinum

BEKO Parker ELGi Always Better. hertz COMPRESSORS SULLAIR Gardner Denver PneuTech

Gold

ATLAS CURTIS AIR COMPRESSORS Sullivan Palatek VP INSTRUMENTS JORC Howden applied system technologies

Silver

DOMETERS BAY COAIRE COMPRESSOR ASK ABOUT ENERGY STAR mattei

Monday, September 17, 2:45–4:45:

TRACK 3, SESSION #2
Industrial Vacuum System Centralization

Chair: Walter See, Product Marketing Manager, Atlas Copco

Setpoint Control – VSD vs. Fixed Speed in Varying Demand Applications
Greg Marciniak, Product Marketing Manager, Atlas Copco

Case Study: CNC Routing Tables Switch to Centralized Vacuum System
Tim Dugan, President, Compression Engineering Corporation

Vortex Vacuum Generators: Upgrade or Replace?

Roundtable Discussion: Vacuum Energy Incentive Program Design
Jerry Zolkowski, Senior Engineer, Consumers Business Energy Efficiency Solutions

BLOWER & VACUUM

BEST PRACTICES

blowervacuumbestpractices.com

FREE SUBSCRIPTION

DIGITAL EDITION FREE WORLDWIDE | PRINT EDITION FREE TO U.S. SUBSCRIBERS

2018 FOCUS INDUSTRIES!

Poultry & Meat Packaging • Food Processing & Conveying • Furniture & Woodworking • Wastewater Aeration

Sustainable Energy Savings with Blower & Vacuum Best Practices

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.

"Selecting the correct blower is the most important decision when designing a pneumatic conveying system."

– Roger Blanton, Howden Roots, ("The Heart of Pneumatic Conveying Systems-Positive Displacement Blower Calculations," April 2017 Issue)

"Strong, consistent vacuum pressure enables us to work faster and more precisely."

– Joe Legere, Executive Vice President, Modern Woodcrafts, ("Modern Woodcrafts Automates with Robotic Arms and Intelligent VSD Vacuum Pumps," July 2017 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.

"For most aeration processes, 80% to 90% of the discharge pressure is static pressure resulting from diffuser submergence."

– Tom Jenkins, JenTech Inc., ("Aeration Blower Control Efficiency," September 2017 Issue)

Subscribe Now!

To subscribe visit **blowervacuumbestpractices.com**

SOLVING THE TOP CHALLENGES OF INDUSTRIAL VACUUM

The first option is through the use of a vacuum relief valve in the process. The vacuum relief valve opens at a given pressure setting and bleeds atmospheric air into the process, essentially creating a leak in the system. Because this causes the pump work harder to overcome the leak created by the relief valve, it is a very wasteful way to control pressure.

Another way to control pressure is by using vacuum pressure switches or a pressure transducer, which starts and stops the pump using pressure settings. In this type of control, there is a "cut-in" and "cut-out" pressure. The cut-in pressure is the minimum process pressure at which the pump is turned on, and conversely, the cut-out is when the pump is switched off after it reaches the maximum allowable pressure. Unfortunately, many processes vary greatly so the pressure range between the two set points must be large enough to avoid frequent starts and stops.

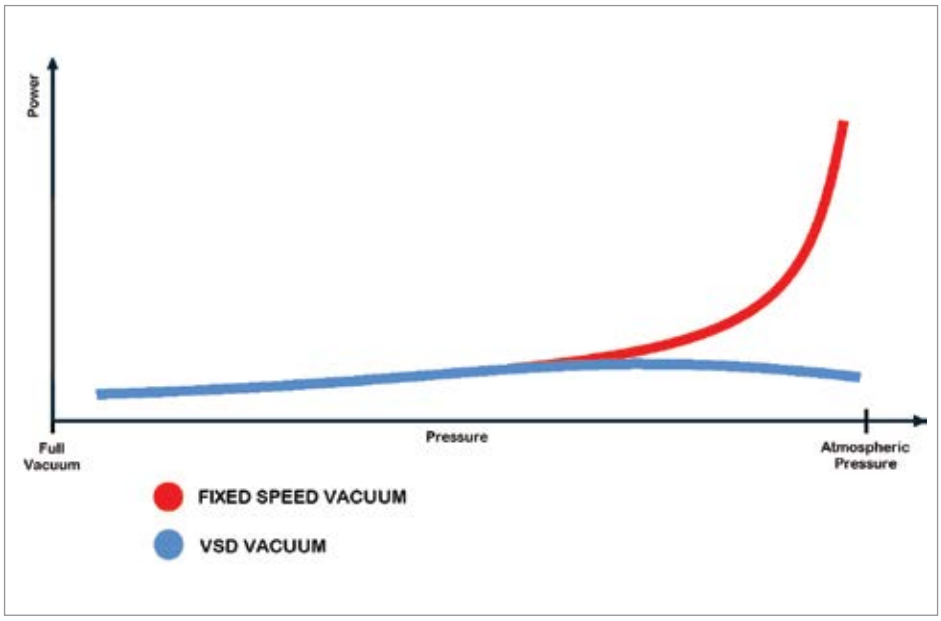
Another issue concerning the pressure switch control is with its fixed speed motors, which are not designed for constant starting and stopping. To combat this, many systems are designed to integrate a minimum run timer in the controls to protect the motors. Typically, this is about 10 minutes of minimum motor run time. In other words, the system controls will force the motors to run the allotted amount of time before shutting them off, regardless of whether or not the cut-out pressure has been reached. This can obviously cause issues if the process is sensitive to deeper vacuum levels than what is desired.

Mitigating Power Spikes

Most fixed speed vacuum pumps have the same power curve profile as shown in the graph. At startup, the fixed speed vacuum pump begins to pull the largest amount of motor power at atmospheric pressure, and as the pump gets deeper in vacuum pressure, or closer to full vacuum, it uses less power. Since VSD vacuum pumps have the ability to control the motor speed, the inrush power can be reduced at startup and allows for a flatter power profile. And because the motor is not sized for the power spike we see with fixed speed pumps, VSD pumps can have smaller horsepower motors than their fixed speed counterparts.

There is no magic solution when it comes to VSD industrial vacuum pumps. They are simply a smarter option when it comes to controlling industrial vacuum. VSD vacuum pumps may not be the best solution in all applications, but many processes can benefit greatly from this technology. Although the largest benefit is reduced energy consumption compared to fixed speed industrial vacuum pumps, other benefits include:

- Ability to maintain a consistent vacuum level, resulting in better product quality and reduced flow requirements
- Lower maintenance intervals compared to vane technology
- Lower installed motor power compared to fixed speed pumps



Industrial Vacuum Power Consumption

Greg Marciniak is the product marketing manager of the Industrial Vacuum Division at Atlas Copco. For more information, please email greg.marciniak@us.atlascopco.com or visit https://www.atlascopco.com/en-us/vacuum-solutions

To read more ***Vacuum Technology*** articles visit www.blowervacuumbestpractices.com/technology

October 17-19, 2018

Charlotte Convention Center | Charlotte, NC

energycongress.com

Hosted By

DUKE ENERGY®

2018

WEEC

World Energy Engineering Congress

Save $200

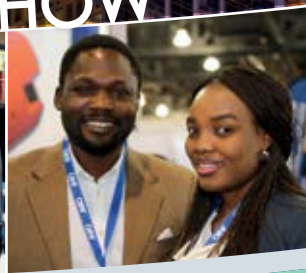
On Your Conference Registration.

Use Code "WEEC18PA" at Checkout

CONFERENCE - SEMINARS - TRADE SHOW





ATTEND THE CONFERENCE
770.447.5083 x226

ATTEND A TRAINING SEMINAR
770.925.9633

EXHIBIT IN THE TRADE SHOW
770.279.4392

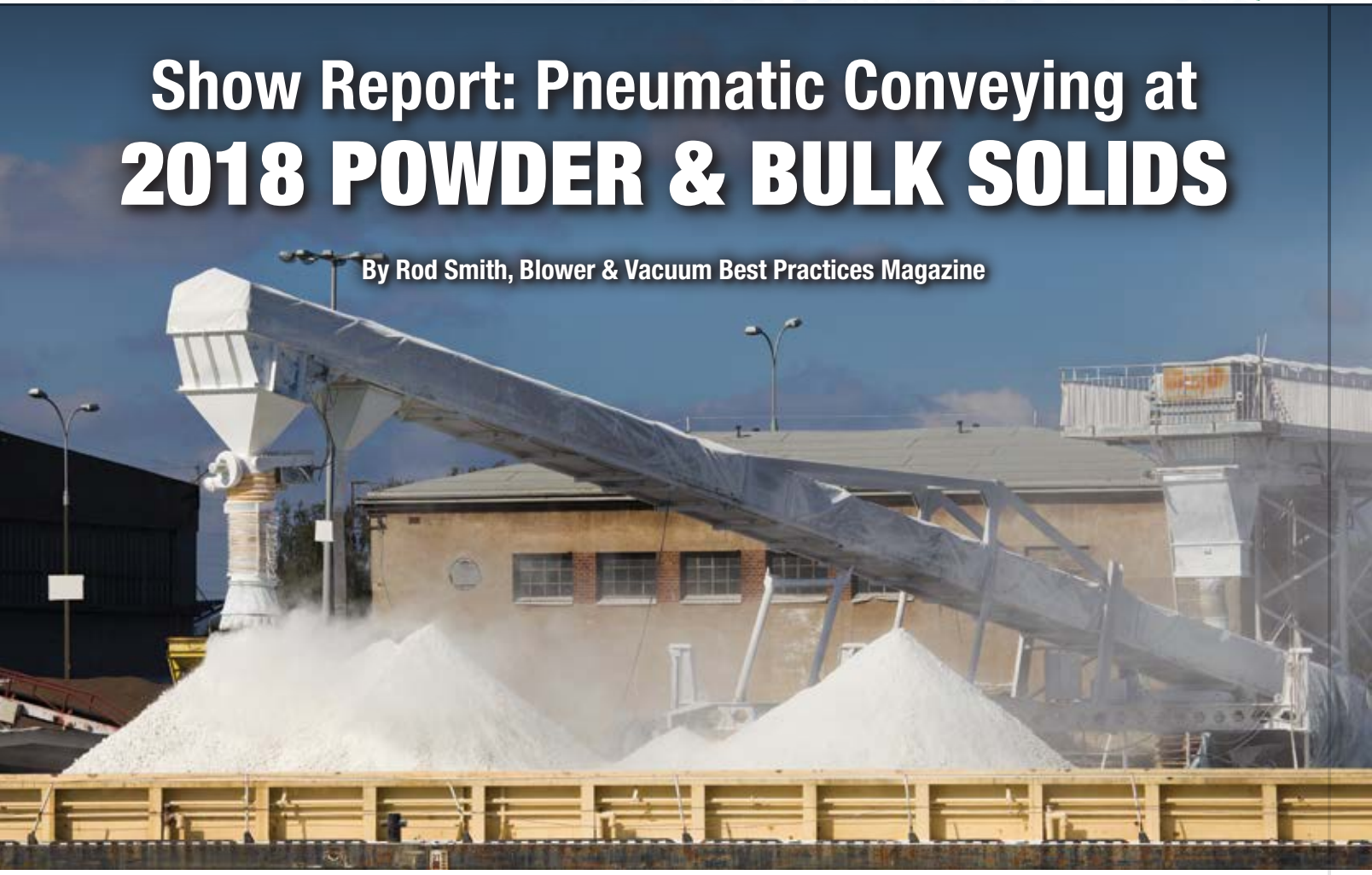
Presented By

aee®

Association of Energy Engineers

Show Report: Pneumatic Conveying at 2018 POWDER & BULK SOLIDS

By Rod Smith, Blower & Vacuum Best Practices Magazine



The 2018 Powder & Bulk Solids Conference & Exhibition was held April 24-26 at the Donald E. Stephens Convention Center in Rosemont, Illinois. Sponsored by the Process Equipment Manufacturers' Association (PEMA®) and produced by UBM Canon, this event is the leading conference for the powder industry. Vacuum, blower and compressed air technologies play an important role in dilute or dense phase pneumatic conveying systems. These technologies are well represented at this event and we hope you enjoy our Show Report.

Matt Vail next to the Roots® 412 HPT Blower at the Howden Roots booth

Charlie Solberg, Chad Solberg and Clint Browning at the Solberg booth (left to right).

SHOW REPORT: PNEUMATIC CONVEYING AT 2018 POWDER & BULK SOLIDS

Steve Dagowitz, Tracy Carter, Shane Smith and Kim Pulford at the Kaeser Compressors booth (left to right).

Mike Gaines describes the Tuthill product range to a "show tour group".

Scott Trail and Doug Cagney at the Aerzen booth (left to right).

Blower and Vacuum Packages

Howden Roots introduced me to the Roots® 412 HPT Blower for dry bulk conveying applications. This pump has a tri-lobe positive displacement impeller designed to optimize flow efficiency and ensure the blower is only delivering the required discharge pressure – and not over-pressurizing the system. The unit is designed for 25 psig/19" Hg vacuum intermittent duty and 22 psig/18" Hg vacuum continuous duty. The unit is designed to go onboard trucks and has a speed-increasing gear set which ensures optimal blower speeds while keeping truck engine idling speeds between 800-1000 rpm.

Solberg turned 50 this year! Over the past five decades Solberg has supplied filtration, separation and silencing products for the Blower, Compressor and Vacuum pump markets from their home base in the greater Chicago area. All employees, including international personnel from Solberg's 19 locations around the world, gathered to celebrate the company's history and discuss plans for an exciting future. It's nice to see a family-run company grow into such an international brand.

Gardner Denver had a massive booth for their blower, vacuum and air compressor technologies. Gardner Denver manufactures many technology styles ranging from side channel regenerative, Sutorbilt bi-lobe with/without dual splash lube, Duroflow solid bi-lobe, RBS Series tri-lobe, Heliflow twisted tri-lobe, CycloBlower® and Cycloblower H.E. rotary screw. The CycloBlower VHX Series is the world's first variable helix technology. The CycloBlower has over 25,000 installations world-wide. The H.E. takes this rotary screw technology to another level offering pressures to 36 psi, vacuum to 22 in. Hg., and flows to 2650 cfm.

Kaeser Compressors exhibited both their air compressor and blower packages able to cover dense and dilute phase conveying applications. On display was their Omega positive displacement rotary lobe blower. Kaeser demonstrated their packages with and without enclosures. They talk about reduced "slip" in the Omega blowers, meaning greater efficiencies. Their booth was quite clever in that they had a tubing system with plastic balls being blown through-an attention grabber for conveying people!

Tuthill Vacuum & Blower Systems had a nice booth and when I walked up, Blower Product Manager Mike Gaines had a "show tour group"

around him. He was reviewing their extensive line of M-D Pneumatics™ and blowers, vacuum boosters and blower packages. These products serve a huge range of air and gas applications with pressures from .0001 Torr to 25 psig. He also reviewed Kinney® brand vacuum pumps and systems covering a range of .0001 to 760 Torr (mmHg). Kinney offers custom engineered systems up to 12,000 cfm seen in vacuum packaging, vacuum furnaces, chemical processing and solvent recovery.

Aerzen continues it's strong growth supported by their platform strategy of four oil-free, energy-efficient technologies available with optional variable frequency drives and sound attenuating enclosures; Delta Blower, Delta Screw, Delta Hybrid and Aerzen Turbos. Their literature says they produce 14,000 blowers per year and 10,000 compressors. These four technologies offer positive pressures ranging from 15 to 51 psig and from 15" to 25" Hg vacuum. The flow ranges go from 18 to 8,100 cfm.

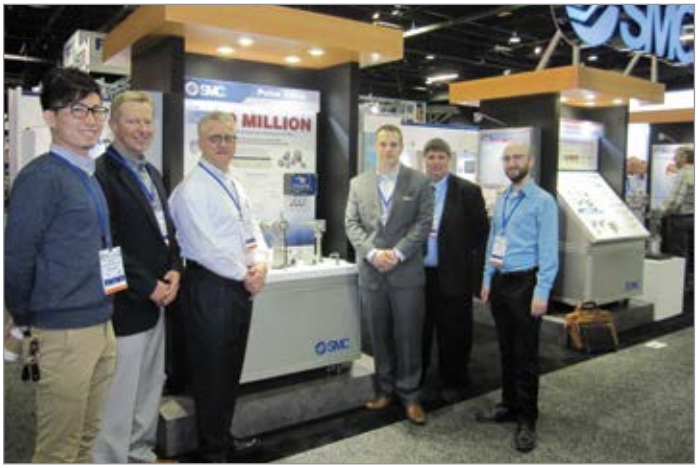
Hardy Pro-Air had a nice booth where they continue to promote their line of Pro-Pack blower packages and high vacuum packages. Based in Antioch, Illinois, they supply standard and custom units for a broad range of aeration/agitation, pneumatic conveying, dust collection, gas pressure boosting and mine ventilation applications.

Process Conveying Components

Kice was introducing a new compact bin vent filter and a new VJX Airlock. The new "easier to maintain" filter is designed for direct-mounting on surge hoppers, silos, bucket elevators and drag conveyors. There are four models for ducts of 3 to 6 inches and flows from 200 to 900 scfm. The VJX Airlock is designed to comply with NFPA 69 criteria as a passive isolation device. Kice Industries focuses on dilute phase conveying (6-15 psig). They provide all the conveying equipment required in the wheat flour milling, oil seed processing and general applications in the wood, plastic and food industries.

Meyer is a leading manufacturer of engineered products in pneumatic conveying. They offer rotary airlocks, slide gates, pneumatic screw pumps, gravity diverters, double-flapgate valves and their own line of Power Pak pressure or vacuum blower packages. They had a 50 year-old rotary airlock in their booth! I found it very interesting to learn that airlocks are the most vulnerable point in most conveying systems. This is where the bulk of service calls are about.

Shawn Boynton, Aaron Placke, Craig Stokes and Jason Costigan at the Gardner Denver booth (left to right).



Harvey Tsuyuki, Scott Martin, Bill Shrewsbury, Chris Dodge, Ken Overby and Kevin Hicks at the SMC USA booth (left to right).

Ben Kice next to their new Compact Filter at the Kice Industries booth.

SHOW REPORT: PNEUMATIC CONVEYING AT 2018 POWDER & BULK SOLIDS

Jeniffer Emetti and Charlie Meyer next to a 50 year-old Airlock at the Meyer booth (left to right).

Ron Inciong and Alberto Garcia at the Festo booth (left to right).

Dean Pederson and Scott Stevenson at the Hardy Pro-Air booth (left to right).

SMC USA was excited to present their new pulse valve technology for bag houses. Bill Shrewsbury is a specialist in pulse valves and told me of very interesting projects he does with major processors – to reduce their use of compressed air and blower air – by having valves which function better! One client he mentioned has 10,000 valves at one plant! They were excited to say their new pulse valve works up to 10 million cycles (vs the norm of 1 million), reduces blower energy consumption by up to 35% (due to reduced open time and 50% faster closing speeds). These double-diaphragm valves come in ¾", 1" and 1 ½" sizes. BP

To read similar articles on ***Pneumatic Conveying*** visit www.blowervacuumbestpractices.com/industries/conveying.

Vacuum, blower and compressed air technologies play an important role in dilute or dense phase pneumatic conveying systems.

weftec® 18

the water quality event™

JOIN THE REGENERATION

SAVE THE DATES

Registration Opens 17 April 2018
Best Rate Deadline 12 July 2018

91st Water Environment Federation Annual Technical Exhibition & Conference

New Orleans Morial Convention Center
New Orleans, Louisiana

Conference 29 September – 3 October 2018
Exhibition 1 – 3 October 2018

www.weftec.org **#WEFTEC18**

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

AERZEN USA Building Expansion Open House Event

Aerzen USA is in a growth and expansion mode. The company celebrated a 21,000 square foot addition to the Coatesville, Pennsylvania headquarters, with an open house event. The event was well attended by the Aerzen Germany management, Commonwealth of PA delegates, members of the national sales teams, employees, customers, vendors and building construction personnel.

Aerzen USA President, Tony Morris addresses the crowd by featuring the aspects of quality and collaboration the new expansion provides to customers.

The new building expansion features include additions to the office and seating areas with new conference rooms and lunch room. Additional manufacturing and warehouse space is part of the addition to accommodate the company's expanding product range.

The celebration event featured keynote speakers, Tony Morris, President of Aerzen USA; Neil Weaver, Pennsylvania Department of Economic & Community Development, and Klaus-Hasso Heller, CEO of Aerzen Germany.

Following the speeches, the guests were invited to lunch then to tour the new facility, complete with demonstrations and Lean initiative explanations for various areas of the production center.

Aerzen USA Fast Facts:

- Number of Employees: 112
- Total Square Feet: 62,388
  - Office: 15,116
  - Manufacturing: 47,272

Environmental Features

- Permeable paving with underground rock beds to retain rainwater
- Solar panels that generate a large portion of the company's energy needs
- Earth tubes that bring in outside air to cool the production space
- Recycled furniture and materials throughout the building
- Wild meadow with native trees & shrubs versus manicured lawns
- Geothermal heat pump heating and cooling
- Straw bale construction of the large conference room: R value of 48
- Walkway areas covered with 40% recycled glass

The new Turbo Blower production cell

About Aerzen USA

Aerzen USA is a wholly-owned division of the German manufacturer, Aerzener Maschinenfabrik GmbH, and has been a recognized world leader in the production of rotary positive displacement machines since 1868. Aerzen USA is based in Coatesville, PA. For more information, visit www.aerzenusa.com

Busch Vacuum Pumps and Systems Acquires NSB Gas Processing

Busch Vacuum Pumps and Systems is pleased to announce that the swiss-based engineering company NSB Gas Processing is now part of the global Busch group. The NSB Gas Processing business has been renamed Busch

NSB AG and brings a highly regarded team of engineers and a portfolio of liquid ring vacuum pumps, compressors and systems to the Busch group.

NSB has a heritage dating back to 1844 and will continue to provide the same very high standard of liquid ring vacuum pumps, compressors, and vacuum and compressor systems for industry. With the acquisition of NSB, the Busch group can now offer reliable vacuum and overpressure solutions for heavy-duty conditions in the oil and gas industries and chemical and pharmaceutical sectors. One of the strengths of the Busch NSB product portfolio is in flare gas recovery, a sub-sector of the oil and gas industry. Flare gas recovery offers the advantages of more-efficient use of scarce resources and a reduced environmental footprint.

NSB products which customers have relied on over the years are now offered under the new brand Busch NSB and will continue to meet the industry requirements for quality based on state-of-the-art technology. Furthermore, NSB customers are now set to enjoy the advantages of the worldwide presence of Busch with the largest and most extensive global service network – in more than 40 countries worldwide.

NSB customers will now also profit from the experience and expertise of Busch in liquid ring technology. The world-class Dolphin series of liquid ring vacuum pumps and compressors are used in a variety of industries worldwide. This series is now complemented by liquid ring vacuum pumps, compressors and systems available under the new brand Busch NSB. This means a greater choice from a wide range of liquid ring technology to meet customers' requirements.

"With NSB, Busch is able to offer more solutions and a more rounded portfolio, while integrating their expert knowledge for our customers," explains Sami Busch. "Flare gas recovery is a technology with a significant environmental impact. Customers of NSB are now set to profit from our service expertise and ability to provide spare parts and service 24/7 – wherever they are. And NSB as part of the Busch Group can look forward to a new impetus for future growth."

About Busch

Busch Vacuum Pumps and Systems is one of the world's largest producers of vacuum pumps, vacuum systems, blowers and compressors. Its extensive product portfolio comprises solutions for vacuum and overpressure applications in all industries, including the chemical, semiconductor, medical technology, plastics, and food sectors. It also covers the design and construction of customized vacuum systems, as well as a global service network.

The Busch group is a family-owned company and is still managed by the Busch family. Busch Vacuum Pumps and Systems has 3,000 employees in more than 60 companies in over 40 countries worldwide. Busch is headquartered in Maulburg, in southwest Germany. This is the location of Busch SE headquarters, as well as the German production facility and German sales company. In addition to Maulburg, Busch also has its own production plants in Switzerland, the UK, Czech Republic, Korea and the USA.

History

Busch Vacuum Pumps and Systems was founded by Dr.-Ing. Karl Busch and his wife Ayhan Busch in 1963. Dr.-Ing. Karl Busch developed the "Huckepack", which was the first vacuum pump that could be used for vacuum packaging of foodstuffs. The follow-up product, the compact "R 5" rotary vane vacuum pump, revolutionized food packaging. A further milestone represented the development of the "COBRA" screw vacuum pump. In 1971 the international expansion of the Busch group started with the founding of a sales company in the UK. The first production plant outside Germany was established in the USA in 1979. Please visit www.buschusa.com

Anguil Environmental Systems Celebrates 40th Anniversary

Starting an environmental company in the late 1970's was not nearly as well received as it would be today, but Gene Anguil, Founder of Anguil Environmental Systems, persevered. Four decades later, Anguil is recognized as a worldwide leader of industrial air pollution control and wastewater treatment technologies. On August 12th, the company hosted a 40th anniversary party drawing attendees from across the United States, Asia, and Europe. Held in downtown Milwaukee, the private celebration was one of the first events in the new wing at Discovery World overlooking Lake Michigan.

Approximately four-hundred people attended consisting of employees, both current and former, as well as partners, key suppliers, sales representatives and close family friends. "It's important that we recognize the people and companies that helped us get where we are today," said Gene. "While my wife was our first, and arguably most-important employee, there were also a lot of other vital contributors to our success."

Throughout the past four decades, the company has celebrated countless successes, but also persevered through some challenges.

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

Major milestones include several moves into increasingly larger facilities, the establishment of international operations, development of an extensive global sales representative network, and a continuous garnering of awards like the employee-driven Top Workplace distinction and the Environmental Business Journal Achievement Award. The tragic passing of Gene's oldest son Jeff in 1993, then company President, was one of those challenging moments that tested the company's resiliency while cementing the family culture that still exists today.

The 40th anniversary celebration comes at a time of widespread enthusiasm for the company's mission and steady growth, including the hiring of several third generation Anguil employees, aggressive global sales targets, and the completion of a remodel of their corporate headquarters in Brown Deer. This investment buoys the optimism of employees and the surrounding community, looking ahead to many more years of success.

About Anguil Environmental Systems, Incorporated: Anguil provides environmental and energy solutions that ensure cleaner air and water for future generations. Company values include a commitment to customer satisfaction, high integrity, family culture, continuous improvement, a passion for excellence and organizational growth. The company is uniquely capable of supplying integrated air and water treatment solutions to the global manufacturing sector and industrial markets for environmental compliance.

On vapor combustion applications, Anguil has over four decades of experience with the design, manufacturing, service and installation of thermal and catalytic oxidizers for the destruction of Volatile Organic Compounds (VOCs), Hazardous Air Pollutants (HAPs), process odors and Nitrous Oxides (NOX). Anguil also specializes in energy recovery systems that reduce a company's operating costs, lower their carbon footprint and decrease energy consumption by utilizing waste heat from manufacturing processes.

On the water side, Anguil Aqua provides turnkey water treatment systems that target solid or liquid pollutants from industrial and remediation applications. As a custom solution company, they can integrate a range of technologies with proven techniques to meet specific site challenges. For more information visit www.anguil.com

Pfeiffer Vacuum Supplies World's Largest Particle Accelerator

Pfeiffer Vacuum has received yet another major order for turbopumps and turbo pumping stations from CERN. CERN is situated in

Gene, Deb and Chris Anguil (left to right)

Pfeiffer Vacuum HiPace Turbopumps

Geneva on the Franco-Swiss border and is the largest center for particle physics research in the world. Its main business is fundamental physics – finding out what the universe is made of and researching the basic constituents of matter. The particle accelerator LHC (Large Hadron Collider) has a circumference of some 27 kilometers and is used for colliding proton and ion beams at nearly the speed of light. The accelerated particles travel in beam lines, which require ultra-high vacuum (UHV) conditions. These beam lines are pre-evacuated with turbo pumping stations. Furthermore, turbopumps with a very high compression ratio for light gases are then responsible for generating the insulation vacuum. The insulation vacuum is necessary for the operation of the superconducting magnets at a temperature of -271 °C.

Andreas Schopphoff, Head of R&D Market Segment: "The cooperation between CERN and Pfeiffer Vacuum is based on many years of working together in a spirit of trust. We are very proud that CERN has chosen Pfeiffer Vacuum products again for its future projects. Since the pumps' application is one that has never been realized before, the technical requirements for this project are especially high. The new order is for HiPace turbopumps and HiCube turbo pumping stations that meet those high demands."

Arthur Pfeiffer GmbH developed the turbopump in 1958 with the objective of generating a hydrocarbon-free vacuum. Today, turbopumps from Pfeiffer Vacuum are considered the epitome of cutting-edge technology, dependability and ultra-high performance. At the time, CERN was one of the first customers to buy this innovative technology and has continued to be a major user of Pfeiffer Vacuum products to this day. Generating the vacuum inside the LHC, measuring it and analyzing the partial pressure requires comprehensive vacuum technology, a major part of which is being supplied by Pfeiffer Vacuum.

CERN was founded in 1954 and now employs around 2,500 staff and hosts more than 10,000 visiting scientists from all over the world.

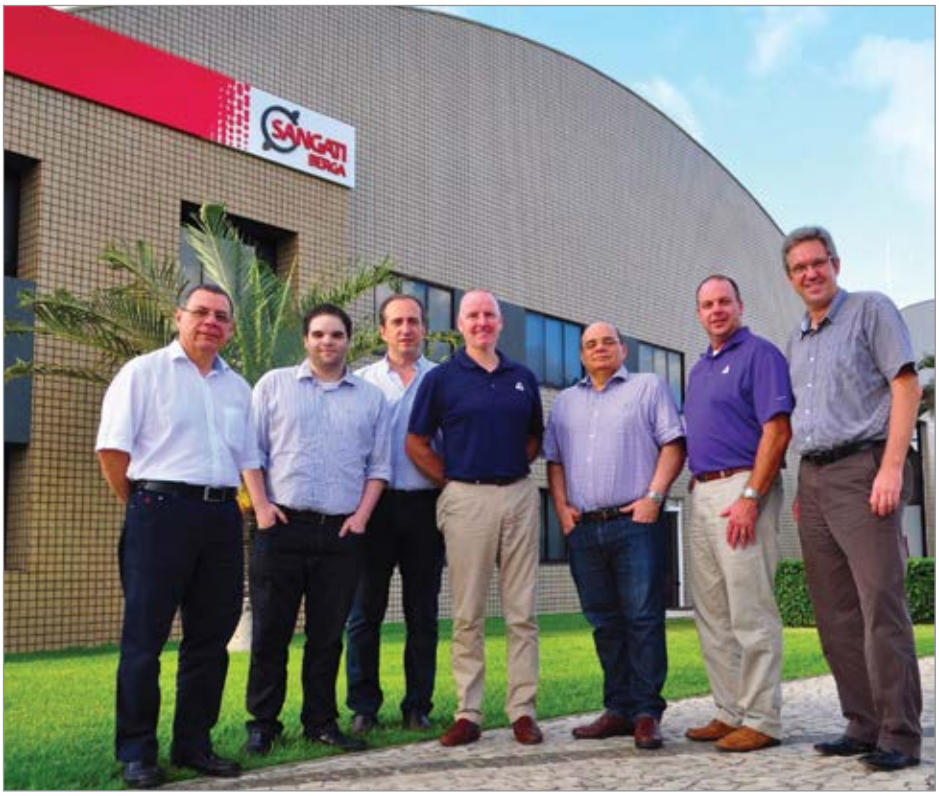
About Pfeiffer Vacuum

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 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 2,900 people and has more than 20 subsidiaries.

For more information, please visit www.pfeiffer-vacuum.com.

Kice Industries and Sangati Berga Announce Strategic Alliance

Kice Industries and Sangati Berga announced the signing of an agreement to form a strategic alliance between the two companies. The agreement includes joint distribution, sales and promotional efforts for new and existing grain milling projects in the United States and Canada.



Kice Industries and Sangati Berga announced the signing of an agreement to form a strategic alliance

WHETHER FEED, MEAT OR POULTRY…
IPPE IS YOUR LINK TO THE ENTIRE FOOD CHAIN

INTERNATIONAL IPPE
PRODUCTION & PROCESSING EXPO

ATLANTA, GA USA | FEB. 12 - 14, 2019

REGISTER NOW AT **WWW.IPPEXPO.ORG**

Join us for the 2019 IPPE. Whether feed, meat or poultry, IPPE is your link to the entire food chain. See it at IPPE first and connect with more than 30,000 industry professionals in feed, meat, poultry and more at one powerhouse of a show in February!

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

"Bringing together over 100 years of combined experience in the milling industry will bring great value to our customers in the U.S. and Canada," said Andy Forrester, Director of Sales for Kice Industries. "We are excited to be partnering with a company that has a strong history of executing outstanding projects in the milling industry and one that continues to develop innovative and highly competitive technology."

The agreement will allow both companies to combine their resources to deliver turn-key solutions and industry-leading customer support.

"We are very excited to enter into this strategic alliance with such a renowned company as Kice Industries, who are known for the high quality of their equipment and excellent customer service", said Ricardo Pereira, President of Sangati Berga. "We are confident that together, we will offer the US and Canadian markets excellent solutions, combining the highest levels of equipment and services.

About Kice Industries

Founded in 1946, Kice Industries is a fourth generation, family-owned business based in Wichita, Kan. with a team of approximately 300 employees. Kice Industries designs complete industrial air systems and builds most of the equipment specified for these systems. Applications include pneumatic conveying, dust control and aspiration systems. Kice's Automation division provides services which include power distribution, controls engineering design, PLC/HMI programming, UL® control panel fabrication, electrical installation, and 24/7 on-call support. Kice Industries has an extensive history in the grain milling industry.

About Sangati Berga

Sangati Berga was founded in July 1992, with a manufacturing facility in the city of Fortaleza (Brazil). At this location Sangati Berga design and build a complete range of technologically advanced equipment for grain milling, mix plants serving the food industry and animal feed plants. Sangati Berga also maintains a technical & commercial office in São Paulo (Brazil), from where they manage equipment sales and the execution of turnkey projects for facilities processing all kinds of cereals and their derivatives on a worldwide basis.

For more information, please visit www.kice.com

THE MARKETPLACE

TECHNOLOGY & JOBS

Job & Product Marketplace Advertising Information

Reach 16,000+ readers of Blower & Vacuum Best Practices Magazine with Marketplace Ads every month! Job Marketplace ads are also placed for one month on www.airbestpractices.com and promoted in our three monthly e-newsletters.

Ad dimensions are 2.36" wide x 3.91" tall. We can help you design the ads. Send us your logo, product photo, and text to rod@airbestpractices.com. We recommend 20-50 total words of text.

Prices are $300.00 per Job Marketplace Ad and $350.00 per Product Marketplace Ad ($300 if 6 or more ads are placed). Contact Rod Smith at rod@airbestpractices.com to schedule your Marketplace Ads.

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

BLOWER & VACUUM BEST PRACTICES
www.blowervacuumbestpractices.com

Advertising & Editorial: Rod Smith
rod@airbestpractices.com
Tel: 412-980-9901

Subscriptions & Administration: Patricia Smith
patricia@airbestpractices.com
Tel: 412-980-9902

A Publication of: Smith Onandia Communications LLC
37 McMurray Rd. Suite 106
Pittsburgh, PA 15241

Blower & Vacuum Best Practices is published quarterly and mailed together with Compressed Air Best Practices®. Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 106, Pittsburgh, PA 15241. Periodicals postage paid at Pittsburgh, PA and additional mailing offices. POSTMASTER: Send address changes to: Compressed Air Best Practices®, 37 McMurray Rd, Suite 106, Pittsburgh, PA 15241.

BEST PRACTICES

2018 EXPO SEPTEMBER 17-19 CHICAGO O'HARE, IL

COMPRESSED AIR / VACUUM / COOLING

CABPEXPO.COM

Limited Hotel Space!
Pre-Register at
cabpexpo.com

Visit the FREE BEST PRACTICES EXPO

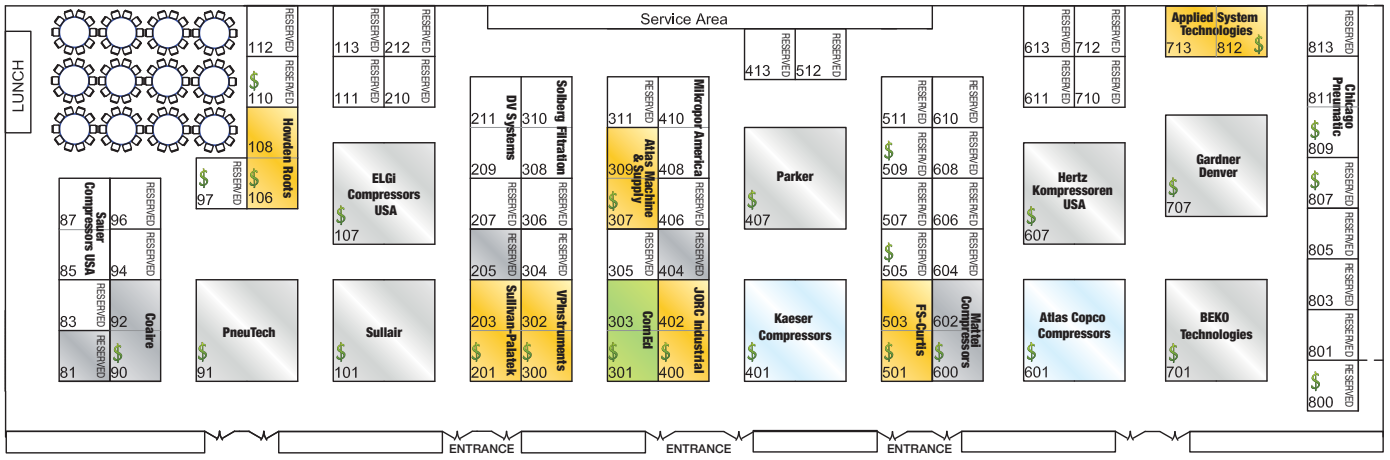
See the latest technologies permitting factories to realize "Best Practices."

FREE EXPO HOURS: Sept. 17, 12-6 PM Sept. 18, 12-7 PM

Blower & Vacuum Technology

- Aeration Blowers
- Industrial Blowers
- Vacuum Pump Systems
- Inlet Filtration/Oil Separators
- Piping & Lubricants

CO-SPONSORS CAGI Compressed Air & Gas Institute — ComEd Energy Efficiency Program



Diamond Sponsor | Platinum Sponsor | Gold Sponsor | Silver Sponsor | Utility Host | Treasure Hunt Bingo Sponsor $

Exhibitors (Green Font Denotes Blower & Vacuum Technology)

81 Bay Controls
83 Ultrachem Lubricants
85 Sauer Compressors USA
90 Coaire
91 PneuTech
94 Fluid-Aire Dynamics
96 Case Controls
97 TRI Air Testing
101 Sullair
106 Howden Roots
107 ELGi Compressors USA
110 ENERGY STAR
111 EnergAir Solutions
112 AABC Commissioning Group
113 Association of Independent Compressor Distributors
201 Sullivan-Palatek
207 Airleader
209 DV Systems
210 Edgetech Instruments
212 Compressed Air Challenge
300 VPInstruments
301 ComEd Energy Efficiency Program
304 ISEL Lubricants
305 Air Services Company
306 Van Air Systems
307 Atlas Machine & Supply
308 Solberg Filtration
311 nano-purification solutions
400 JORC Industrial
401 Kaeser Compressors
404 CDI Meters
406 SPX FLOW
407 Parker
408 Mikropor America
413 MTA USA
501 FS-Curtis
505 Compressed Air & Gas Institute
507 Busch Vacuum Pumps & Systems
509 Edmac
511 Harris Equipment
512 TEMASYS
600 Mattei Compressors
601 Atlas Copco Compressors
604 Trace Analytics
606 SA Performance Lubricants
607 Hertz Kompressoren USA
608 E+E Elektronik
610 ENMET
611 Leybold USA
613 Association of Energy Engineers
701 BEKO Technologies
707 Gardner Denver
710 HydroThrift
712 Edwards Vacuum
713 Applied System Technologies
800 John Henry Foster
801 Sahara Air Products
803 Aircom USA
805 DirectAIR
807 Brabazon Pump, Compressor & Vacuum
809 Chicago Pneumatic
813 Control Devices

INNOVATIVE, INTELLIGENT, INDUSTRY CHANGING

A New Generation of Vacuum Pumps

Superior performance and dependability, energy efficiency beyond compare, noise levels half that of the competition, and reduced environmental impact.

www.atlascopco.com – 866-546-3588

Sustainable Productivity

Atlas Copco