

BLOWER & VACUUM BEST PRACTICES

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January/February 2018

AERATION BLOWER SYSTEMS

24 Calculating Most-Open-Valve
Aeration Control

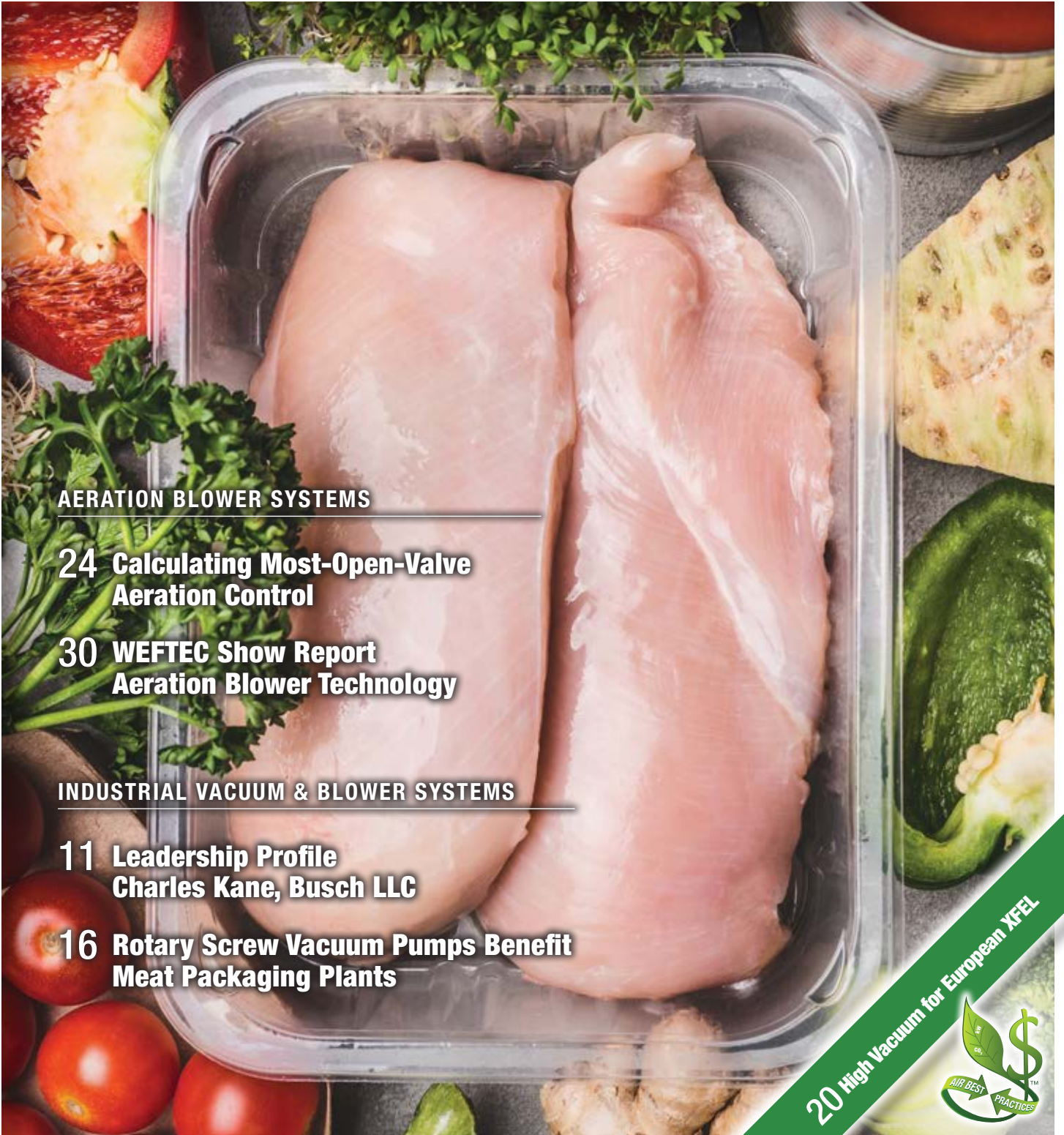
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INDUSTRIAL VACUUM & BLOWER SYSTEMS

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Charles Kane, Busch LLC

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Meat Packaging Plants

20 High Vacuum for European XEEL



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FROM THE EDITOR



Happy New Year 2018! This is a special year for us as we launch the inaugural 2018 Best Practices Expo & Conference, September 17-19, 2018 at the Chicago O'Hare Crowne Plaza. With the simple goal being to help plants improve profitability and sustainability, we are excited to bring experts and users together to learn, share and view the latest "Best Practice" energy conservation measures (ECMs) and technologies in industrial vacuum, industrial blower and aeration blower systems. So far firms like Atlas Copco, Gardner Denver, Howden Roots, Busch Vacuum, Solberg and Harris Equipment (Tuthill Rep) have already committed to participate. Please consider visiting us and registering for the event!

We kick off 2018 with a leadership profile of the CEO of Busch LLC, Charles Kane. I really enjoyed the opportunity to visit him at their U.S. headquarters in Virginia Beach and hope readers will enjoy a personal look at the management philosophies of a leader who has led Busch LLC to triple employment over his tenure.

Many meat packagers use decentralized rotary vane vacuum pumps. In his article titled, "Rotary Screw Vacuum Pumps Benefit Meat Packaging Plants," Atlas Copco's Jerry Geenen details the benefits two prominent meat packaging facilities experienced by moving to a centralized vacuum pump system using rotary screw technology with variable speed drives.

We don't normally write about high vacuum applications, but I couldn't resist when Pfeiffer Vacuum offered to share their experience working with the European X-Ray Free-Electron Laser (XFEL) facility. I feel smart just saying it! Located in northern Germany, this research facility operates the world's most largest and most powerful laser.

Shifting to aeration blowers, Most-Open-Valve aeration control is the topic Tom Jenkins, from JenTech Inc., dives into with a multitude of calculations and formulas with his article this month. He states, "MOV can be a cost-effective way to optimize aeration energy. In my experience MOV is the least understood aspect of aeration control." This article sheds light on the subject!

Last and hopefully not least, my latest roving reporter effort is here with the 2017 Weftec Show Report on Aeration Blower Technology. I hope you enjoy the quick summaries I provide of each booth visit discovering the amazing investments and technology our industry continues to make available to optimize aeration blower systems.

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

ROD SMITH

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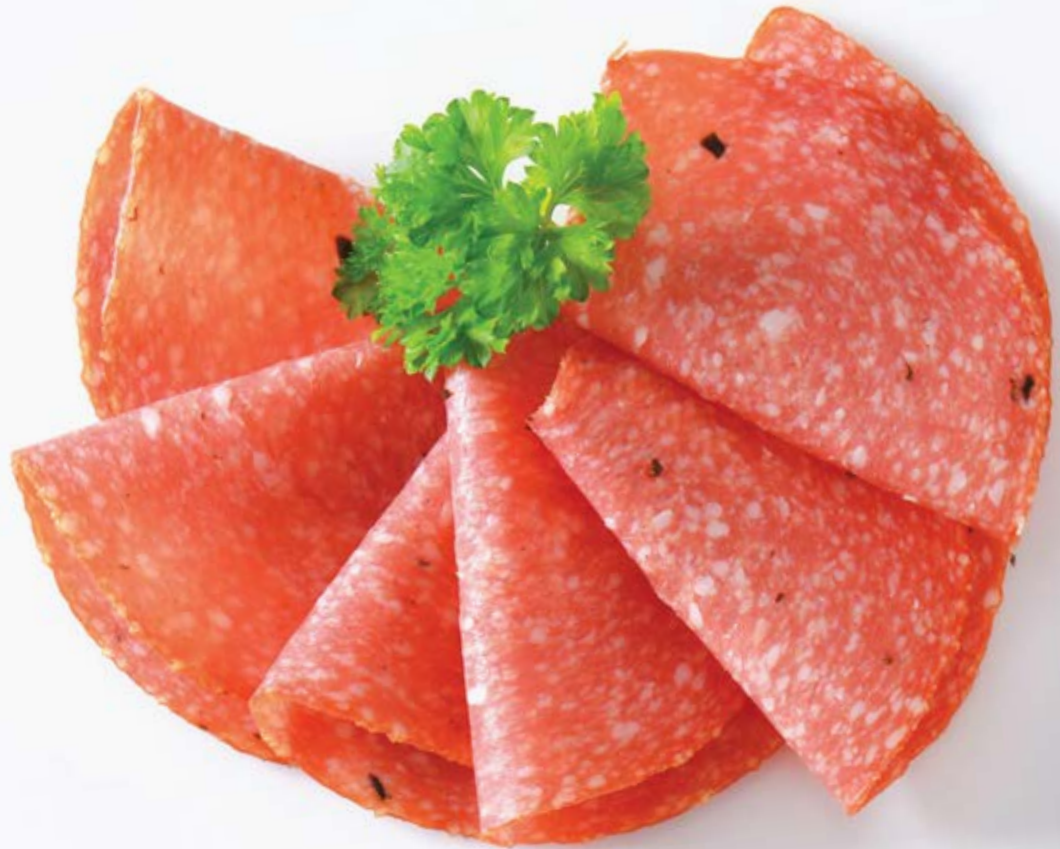
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Busch Presents the New R 5 RD Rotary Vane Vacuum Pump

Busch Vacuum Pumps & Systems presented the newest product line of the R 5 RD rotary vane vacuum pumps series at the Pack Expo 2017. R 5 vacuum pumps are the proven and reliable standard for vacuum packaging with over 2.5 million pumps in operation worldwide. The new R 5 RD offers reduced energy consumption, is easy to maintain and is currently available in two sizes with R 5 RD 0300 A and R 5 RD 0360 A.

The 2017 Pack Expo trade show in Las Vegas was the largest, most comprehensive packaging event in North America. Spanning three days with 2,000 exhibitors, the attendance was record high for the most attendees in its seven-year history. Pack Expo provided a full range of packaging and processing machinery, along with cutting-edge industry trends and innovations.

Busch genuine spare parts, displayed at the show as well, are used in R 5 vacuum pumps to maintain an optimal level of performance and reliability. In addition to the new generation of vacuum pumps for packaging and genuine spare parts, Busch also provided information



The new R 5 RD is available in two sizes, the R 5 RD 0300 A and the R 5 RD 0360 A.

about our Mink MV rotary claw vacuum pumps and Seco rotary vane vacuum pumps. These two vacuum technologies are used in foil handling, forming, labeling, stacking, palletizing and many other applications.

To learn more about Busch Vacuum Pumps & Systems products and services, please visit www.buschusa.com.

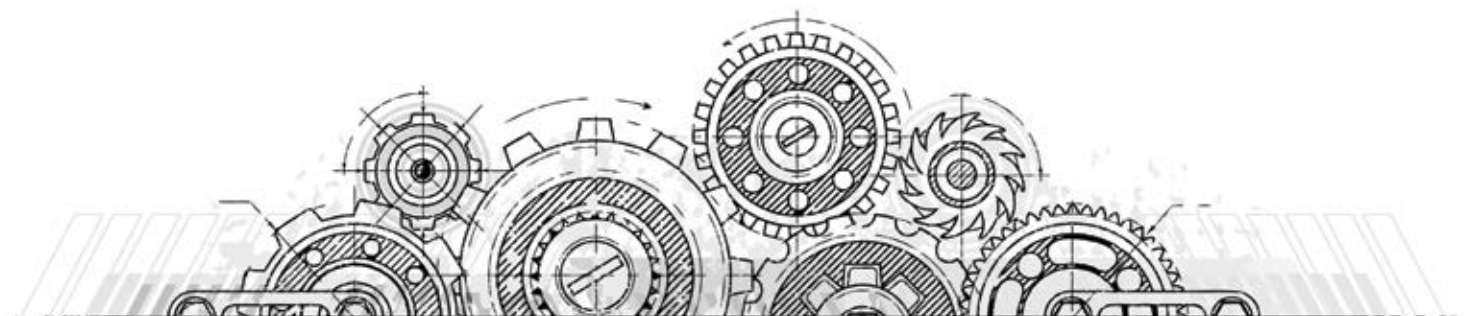
SCROLLVAC plus Vacuum Pumps from Leybold

Users in research and industry increasingly rely on dry and robust vacuum solutions, also providing flexibility of use. With the modernized, air-cooled SCROLLVAC plus, Leybold offers a new, uncomplicated, reliable fore vacuum pump, exactly meeting this requirement profile.

The SCROLLVAC plus, an oil-free, dry running fore vacuum pump, qualifies for a variety of demanding applications. The SCROLLVAC plus can be used whether in the laboratory, in large research facilities, as a backing pump for turbomolecular and cryopump systems, or in vacuum ovens.

SCROLLVAC plus has low power consumption paired with a highly effective suction capacity, making it a real benefit to any application. In addition, with its very light, compact design, it occupies only minimal space in plants and equipment. This makes integration into new and existing vacuum systems an easy and convenient solution. The low level of vibrations and noise [less than 55 dB (A)] further increases the range of potential users, especially as these factors play a central role in ergonomic working environments.

Their functional and constructive features simplify the daily use of this fore vacuum pump. The hermetic sealing of the rotating parts from the pump chamber reduces the risk of contamination. With the absence of



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wear-resistant shaft seals, the developers have achieved a higher leak tightness. This predestines the SCROLLVAC plus for universal use in demanding processes.

The service and the sealing change are correspondingly simple, fast and can be operated by the user on-site. Leybold's SCROLLVAC plus also has longer maintenance intervals than comparable competitive products. "With our new generation of scroll pumps SCROLLVAC plus, we offer the optimized pump variant for all customer requirements and at the same time set new standards with long service intervals and easy maintenance," explains Alexander Kaiser, Leybold's product manager for dry fore vacuum technology.

For all standardized maintenance tasks and procedures, an integrated hours counter documents the operating time. Leybold provides the appropriate maintenance kit for the different stages of servicing.

Various Versions Available

Leybold offers a wide range of pumping options for the different requirements. The product family is available in four versions with the pump speed stages 7, 10, 15 and 18 m³/h. In the single-phase variant, it has a universal voltage drive for a constant performance worldwide, while the three-phase electronic-free variant is intended for areas with radiation. An integrated gas ballast valve also allows the pumping of condensable vapors.



The SCROLLVAC plus has a low level of vibrations and noise, less than 55 dB (A).

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This range of Leybold pumps is complemented by a SCROLLVAC C plus variant for the pumping of aggressive media and chemicals. With this C variant, internal parts are less sensitive to corrosion by aggressive gases. All variants and versions are readily available and can also be ordered via the Leybold online shop at www.leyboldproducts.com.

About Leybold

Leybold is a part of the Atlas Copco's Compressor 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.

About Atlas Copco

Atlas Copco is a world-leading provider of sustainable productivity solutions. The Group serves customers with innovative compressors, vacuum technique 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 2016, Atlas Copco had revenues of 11 Billion Euros and more than 45,000 employees.

Since 1952, Atlas Copco is present in Germany. Under the roof of two holdings located in Essen, more than 20 production and sales companies are gathered (February 2017). By end of 2016, the group employed about 3800 people, including about 100 trainees. www.atlascopco.com.

Silvent Introduces New SILVENT MJ4-QS Air Nozzle Design

Silvent is introducing a new energy-efficient air nozzle designed for quick and easy installation. A growing number of companies are interested in compressed air optimization, and the new SILVENT MJ4-QS now makes it easy to equip small, open pipes.

SILVENT MJ4-QS is a micro nozzle made of 316 L stainless steel. The nozzle is designed with a central hole in combination with surrounding

vents. SILVENT MJ4-QS is equipped with an adapter, easily installable on an existing open pipe. The adapter makes installation easy, smooth and quick, with no impact on the equipment. The small mounting dimensions for the nozzle can fit on most machine designs.

SILVENT MJ4-QS is made for fixed-installations and fits 4 mm OD open pipes.

About Silvent

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

Piab's piFLOW[®]p Vacuum Conveyor Offers WIP Function

Ensuring a safer working environment in food and pharmaceutical processing plants, Wet-In-Place (WIP) functionality has been added to Piab's popular piFLOW[®]p vacuum conveyors. WIP spray nozzles are now available for inclusion/retrofitting in new and existing piFLOW[®]p conveying systems.

The water sprayed by the WIP nozzles will wet any dust from food or pharmaceutical materials left in conveyors, stopping it from escaping into the air where it can be inhaled by processing staff during



The piFLOW[®]p vacuum conveyor allows simple retrofitting of Wet-In-Place units, including extra air filters, in existing conveying systems.

TECHNOLOGY PICKS

maintenance or cleaning procedures. By wetting potentially harmful leftover material before the equipment is opened for cleaning, the spray nozzles ensure dust stays Wet-In-Place until it can be safely removed.

For maximum performance and coverage, and to make sure as much material as possible is captured as quickly as possible, up to three spray nozzles can be fitted to each conveyor. The configurable design of the piFLOW[®]p conveyor also allows simple retrofitting of WIP units, including extra air filters, in existing conveying systems. Piab's sterile Ultra Low Penetration Air (ULPA, class U15-17) filters provide greater filtration than High Efficiency Particulate Air (HEPA) filters, and are offered as standard accessories for piFLOW[®]p.

The piFLOW[®]p conveyor for powder and bulk materials is designed to perfectly match the stringent demands for operational safety and hygiene within the food and pharmaceutical industries. Made from materials complying with the US FDA and EU 1935/2004 regulations, Piab's

conveyors can be used to safely transport large volumes of powder/bulk materials, and their advanced technology will guarantee segregation-free conveying. Maximizing the safety of the processing staff, piFLOW[®]p is available in ATEX dust and gas approved designs, wherein all plastic or rubber parts, including filters and seals, are made of antistatic nitrile butadiene rubber (NBR).

About Piab

Established in 1951, Piab designs innovative vacuum solutions improving the energy-efficiency, productivity, and working environments of vacuum users around the world. As a reliable partner to many of the world's largest manufacturers, Piab develops and manufactures a complete line of vacuum pumps, vacuum accessories, vacuum conveyors and suction cups for a variety of automated material handling and factory automation processes. Piab utilizes COAX[®], a completely new dimension in vacuum technology, in many of its

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original products and solutions. COAX® cartridges are smaller, more energy efficient and more reliable than conventional ejectors, and can be integrated directly into machinery. This allows for the design of a flexible, modular vacuum system. In 2016, Piab completed two strategically important acquisitions, Kenos and Vaculex. Piab is a worldwide organization with subsidiaries and distributors in almost 70 countries. Its headquarters are in Sweden. For more information, please visit www.piab.com.

Maxum Air Devices Optimize Air Impact

Maxum Air Devices for blow-off and drying are designed to optimize air impact on product surfaces. They maximize air efficiency and target the air impact force precisely where it is needed.

The Nozzle Bar®, a powerful new product looking and installing like an air knife, but offering the full blow-off power of individual air nozzles and using less energy to reach further distances. Its internal nozzle system is fully customizable for optimum blow-off of any part, providing



A sampling of Maxum Air Devices delivering high performance in air blow-off and drying applications.

powerful force to reach deep cavities and varying part shapes and distances. The product dries complicated shapes using more air where needed, and less where it is not needed, all from a single nozzle bar.

Maxumizer® Air Knives feature a high efficiency “tear drop” design, stainless steel construction and multiple integrated mounting positions. Their adjusting hardware is in a large separate mechanical chamber, far away from the outlet orifice. This hardware change, along with a unique outlet design, maximizes airflow for blow-off and drying applications. Single, dual and middle air inlet configurations are all available.

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Maxum’s innovative air blow-off and drying equipment remove water, liquids and debris, successfully preparing products for assembly, packaging, labelling, inkjet printing, inspection, powder coating and more using energy efficient blow-off equipment. Whether it is fruit, vegetables, bottles, cans, metal parts, circuit boards, extrusions, or any other air blow-off application, the Maxum mix of creativity and science ensures the success of your application.

For more information, consult Maxum’s newly designed web site, www.maxumair.com.

LEADERSHIP PROFILE

Charles Kane, President, Busch LLC

By Rod Smith, Blower & Vacuum Best Practices Magazine

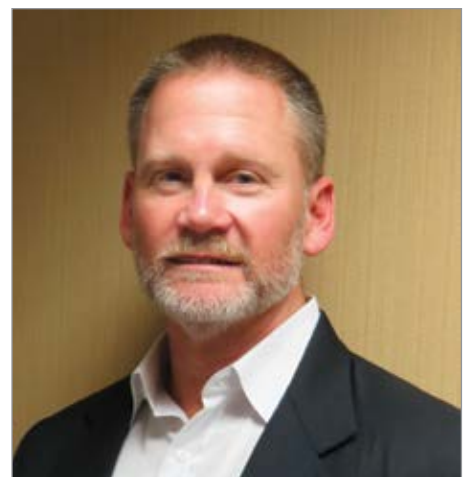
Busch USA in Virginia Beach, Virginia.

► Blower & Vacuum Best Practices (BVBP) Magazine is featuring a series of interview articles profiling leaders in the blower and vacuum industry.

BVBP: Good morning. Thank you for taking the time. To start things off, where did you grow up?

Kane: I was born in Cincinnati, Ohio and lived in a number of areas growing up. Maybe it's a coincidence (chuckle), but wherever we lived,

football excellence existed! Lived in Pittsburgh as a youngster in the late 1970's. We enjoyed watching Tony Dorsett at Pitt and three of the four Pittsburgh Steeler Super Bowl victories. We even met Mean Joe Greene, Franco Harris and Willie Stargell one evening-wish I'd kept the autographs we got! High school in Minnesota included watching the "Purple People Eaters" facing, guess who, the Steelers in the Super Bowl. High school was also spent in Norman, Oklahoma, during the Barry Switzer and Billy Sims championship years and the Sooners are still my favorite team.



Charles Kane, President, Busch LLC

LEADERSHIP PROFILE: CHARLES KANE, PRESIDENT, BUSCH LLC

BVBP: Wow, cities should recruit your family! Why was your family moving so often?

Kane: Dad was an executive with Westinghouse and Mom a traditional homemaker. As you can see, we always found a way to enjoy the place we lived. Dad was a pioneer in the Quality field and a fellow in the American Society for Quality Control, now known as the American Society for Quality (ASQ). He had a long, and successful career at Westinghouse which led to a number of relocations.

BVBP: What is your favorite business management book?

Kane: Three management books have influenced me. One I've taken to heart is "Good to Great" by Jim Collins. He lists a set of leadership characteristics matching my personal beliefs.

One characteristic, for example, of what Collins calls a Level 5 leader, is they are highly capable but very humble. An example is a leader who still drives a twenty-year-old Honda Civic! More seriously, my interpretation of this characteristic is having a management style and philosophy dedicated not to the individual, but rather to the long-term benefit of owners, employees, customers, community and even our vendors.

This characteristic says it's not about managing for the benefit of only the manager(s) themselves - or any one of the stakeholders. How often do you run into CEO/Presidents with huge egos and disproportionate

compensation programs tied to stock values? What happens when labor demands grow too strong? I've worked for and seen in large public and private companies, where there can be too much focus on shareholder value. It can sometimes be hard for leaders to balance competing interests – this is where a long-term focus is so important.

One thing I really appreciate about Busch is that we are a privately held company whose leadership team has always embraced this characteristic.

BVBP: Any examples you can share from one of the other books?

Kane: Sure. The second book is titled, "All I Really Need to Know I Learned in Kindergarten," written by Robert Fulghum. We as humans complicate things unnecessarily. Life and work really is all about doing some of the basic things well.

BVBP: In your own opinion, what are the most important traits of a leader?

Kane: Leaders should possess an element of wanting to do good for others, and not just further their own interests. Good leaders require a unique combination of ego and empathy. Ego is a strong confidence and belief in yourself. The most successful leaders aren't always the



Busch Team Members at the Virginia Beach Headquarters

smartest, but they do have a strong will. There's a difference between arrogance and confidence. The difference is manifested by how much they value others and always respecting other people—even when you disagree. Arrogance is simply thinking you are better than other people.

I really do appreciate other people and the diversity of their backgrounds and skill sets. I'm an engineer by trade, yet I really value people with skills different than my own.

Empathy is the ability to see things through the perspective of others. I'm always asking myself, if I were a customer or employee, how would I see this? Taking different viewpoints into account helps leaders make good decisions.

BVBP: What leaders have inspired you and why?

Kane: I was very fortunate, early in my career, to work for two leaders at General Electric. I benefited from simply watching and learning from them. The first leader was a General Manager for a significant division at GE named Lorrie Norrington. She was the first woman I had ever reported to. I appreciated and respected her as a person and manager. She was tough, very tough, and was able to lead people towards strong results. Yet she balanced it with compassion. This was an important leadership lesson for me on how to treat people with balance.

The second leader was Lloyd Trotter, who was CEO of the GE Consumer and Industrial business at that time. He led 12,000 employees and was responsible for \$14 billion in revenue. At the time, he was one of the most powerful African American executives in the U.S.. Trotter grew up in inner city Cleveland and was raised by a single parent. What impressed me was he never played the victim. Conversely, he only spoke of the opportunities he'd been given. He taught me to play your hand and play it well. He started an affinity network at GE, still active today, called the African American Forum (AAF). The AAF follows his belief in investing in "hand-ups" and not "hand-outs." The AAF's Lloyd Trotter Scholarship program today helps make college a reality for many deserving minority students.

BVBP: What traits do you look for in Busch team members as leaders?

Kane: There are quite a few! We begin with three main ones: competency (skill sets and training), intellectual aptitude, and work ethic (internal drive). These elements play a big role in determining whether they can meet their commitments to customers and colleagues. We also take a particular look at whether or not they have a customer

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Pros & Cons of Centralized Vacuum Systems

Join **Keynote Speaker**, Tim Dugan, P.E., President and Principal Engineer of Compression Engineering Corporation to learn the pros and cons of centralizing vacuum systems. Many plants purchase production equipment with vacuum pumps included, while some are beginning to centralize their vacuum supply. Mr. Dugan will explore the potential energy efficiency and system reliability benefits in a centralization strategy. He will also discuss scenarios where centralization is not recommended.



Tim Dugan, P.E. is the President and Principal Engineer of Compression Engineering Corporation.

Our first **Sponsor Speaker** is VJ Gupta, Systems Engineering Manager for Busch USA, whose presentation is titled, "How to Assess Central Vacuum Systems." The presentation will focus on various aspects to consider when properly assessing a central vacuum system. The presenter will also demonstrate the importance of establishing relationships between potential benefits to application requirements.



VJ Gupta is the Systems Engineering Manager for Busch USA.

Our second **Sponsor Speaker** is Greg Marciniak, Product Marketing Manager for the Industrial Vacuum Division of Atlas Copco, whose presentation is titled, "Installation Guidelines for a Centralized Vacuum System." He will discuss the system changes required for a centralized vacuum system. This will include the piping system, control strategy, equipment location and incorporating redundancy.



Greg Marciniak is the Product Marketing Manager for the Industrial Vacuum Division of Atlas Copco.

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LEADERSHIP PROFILE: CHARLES KANE, PRESIDENT, BUSCH LLC

focus-do they have the empathy required to put themselves in the customer's shoes?

Maturity is another trait we look for. It's highlighted in Stephen Covey's popular book, "7 Habits of Highly Effective People." Maturity determines things like, can you manage yourself and others? Can you constantly improve yourself? Can you figure out when it's time to focus on the garden and not on the plant? Leaders have to balance this. Too much focus on an individual plant can neglect the health of the garden.

BVBP: What role does the business you lead play in the community of Virginia Beach?

Kane: Busch has a very active community service group. Volunteer employees evaluate and select areas and charities they are passionate about. The Company then supports that effort. These efforts provide the benefit of raising money for deserving causes while supporting the passions of the employees. My personal passion and what I feel is the biggest thing I can do, is increase employment levels here. Since I've been here, and this is what I'm most proud of, our employment has increased three-fold!

As you know, the Busch USA headquarters has been in Virginia Beach for a long time. Virginia Beach is a military hub hosting most notably the Norfolk Naval Shipyards, Naval Amphibious Base Little Creek and Langley Air Force Base. Busch is an active member of the Virginia Values Veterans (V3) program. V3 program members are committed to trying to help veterans transition to civilian life. As V3 program members, we have committed to making veterans a certain percentage of our new hires. We've been successful in meeting these goals and are very proud to count veterans as part of our work force. We have veterans on staff who help us understand how to coach veterans and help them transition to the private business world.

BVBP: How is the U.S. industrial vacuum market doing? What trends are impacting it?

Kane: The market health is moderate. 2017 was a better year than 2016, which saw a slight decline. With that said, 2017 will be a good year for us. One major trend impacting the industrial vacuum market is industry consolidation. Busch employees and clients benefit against this dynamic market environment, from the strength and stability of our

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family-owned business- a business with over 3,000 employees in over 60 subsidiaries worldwide. The average tenure, for a subsidiary General Manager, is twelve years. This allows us to stay focused on managing for the long term benefit of customers and employees.

Another dynamic is the trend of customers getting more sophisticated in their use and knowledge of the vacuum systems they operate. They are now, more than ever, looking at Total Cost of Ownership including metrics such as reliability, first costs and energy consumption over a 10 year period. We now receive requests for Busch vacuum auditing services where we look at uptime, performance, piping and technology selection.

BVBP: What are the biggest opportunities for Energy Conservation Measures (ECM's) with industrial vacuum systems?

Kane: Centralization of vacuum systems is one of the biggest opportunities. The installed horsepower of individual vacuum pumps is relatively small compared to other equipment in the plant. When you add them all up, however, the aggregate horsepower can now be worth looking into. It's application specific. In plants using vacuum in the same way and at the same vacuum level, centralization makes sense. In plants with different vacuum uses and different vacuum specifications, centralization gets much more complex and isn't always the right solution.

The most important thing is vacuum system design. Designs need to include piping buffers and strategies to manage varying flows and pressures in the system. How one manages leaks is also critical. The magnitude is amplified. A leak-tight system allows you to get into the right technology. This can be much more important than a VFD. Don't put drag racing tires on a Model T car.

Energy savings is increasing in importance, but with many of our applications, the energy savings are dwarfed by production uptime and output. We always need to be mindful not to jeopardize output for modest energy savings.

BVBP: Which markets have the greatest opportunities for system improvement?

Kane: Market segments like food and pharmaceutical packaging, furniture routing and semiconductor manufacturing are leading the way. Applications where the pumped gas is relatively clean and a common pressure is used across many applications. We see, for example, many packaging machines with vacuum venturi type devices



Busch Mink Dry Claw Vacuum Pump

using significant volumes of compressed air to generate vacuum. Here a centralized vacuum system can generate huge savings over the compressed air system.

BVBP: What new technologies are impacting the vacuum market?

Kane: The primary trend is the use of dry vacuum pump technologies over wet. Vacuum pumps which are oil-flooded, oil-filled or liquid-ring require energy to overcome the liquid. Advancements in dry technologies are making this possible-without sacrificing reliability.

Energy saving technologies like variable frequency drives (VFDs) are also presenting great opportunities. Our dry screw and claw vacuum pumps often use VFD technology. Like everything in vacuum, each system requires a unique assessment to take care of each unique situation. You need skills and knowledge to know how to do it and have the tools to solve it. It's key to not ever compromise quality and reliability. At Busch, we have one of the broadest product lines and deepest experience levels to help clients come up with the right solutions.

BVBP: Thank you very much for your insights and time. BP

For more information on Busch Vacuum Pumps and Systems please visit www.buschusa.com or contact: 1-800-USA-PUMP.

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Rotary Screw Vacuum Pumps Benefit MEAT PACKAGING PLANTS

By Jerry Geenen, Atlas Copco Industrial Vacuum Division



Atlas Copco's GHS VSD+ rotary screw vacuum pumps.

► Meat packaging plants have long used vacuum pumps as a way to remove air and reduce the amount of oxygen in their products' plastic packaging. Vacuum packaging extends the meat's shelf life while protecting its flavor and exposure to outside elements, such as freezer burn and bacteria.

Traditionally, meat packaging plants have used rotary vane vacuum pumps in their facilities without giving much thought to the technology's energy consumption and maintenance costs. The rotary vane pumps are turned on at the start of the shift and left running at full capacity until end of day.

Rotary vane pumps are a positive displacement pump. The pump's rotor contains sliding vanes that use centrifugal force to slide the vanes in and out of the rotating rotor while sealing and maintaining contact with the pump housing. As the vanes rotate, they expand the opening and create chambers where fluid enters. The chambers get smaller as the vanes continue to rotate and retract, which forces the fluid to exit through the discharge port. The resulting contact between

the rotating vanes and the pump's rotor and housing create wear in the pump.

In 2016, two prominent meat packaging facilities decided to run trials that compared their rotary vane vacuum pumps to Atlas Copco's GHS VSD+ rotary screw vacuum pumps, as recommended by Pierre Matschke, a business line manager of the Oil-Free Air Division at Atlas Copco. The results were a pleasant surprise. They found a 17 percent increase in energy savings, fewer equipment overhauls and better uptime. And the bottom line? Overall lifecycle costs were much lower when using rotary screw technology.

Rotary screw vacuum pumps contain two intermeshing screws that rotate in opposite directions within a stationary housing to pressurize and move fluid along the screws' axis. Often times, the pump is equipped with oil-lubricated gears located outside the pumping chamber, which keep the screws rotating properly. With the rotary screw vacuum pump design, the screws never come in contact with the housing, resulting in less equipment wear and fewer overhauls.

Since 2016, more meat packaging facilities across the U.S. and around the world have switched to rotary screw vacuum technology for reliability, energy efficiency, increased uptime and lower maintenance costs. Instead of overhauling their rotary vane pumps, packaging plants in Kansas, California, New Jersey, North Carolina, Illinois and across Europe have chosen to replace them with Atlas Copco rotary screw vacuum technology to decrease life cycle costs.

Reliability

Rotary screw vacuum pumps are designed and assembled to have no metal-to-metal contact within the pump housing, which means there's minimal wear on the pumps and the equipment's capacity remains unchanged over the years.

The pump's canopy includes hot and cool zones. These zones are responsible for isolating the heat produced from high temperature

components to avoid condensation while assuring perfect cooling and long life to the electronic components.

The design, open structure and slow rotation speed of rotary screw pumps make it a heavy-duty option that operates reliably for many years without trouble. Packaging plants no longer have to worry about pumps breaking down during production hours and causing a system shutdown that results in costly labor hours.

Energy Efficiency

It's fairly common to find 25 hp rotary vane vacuum pumps in meat processing plants. In switching to a 15 hp GHS 730 VSD+ Atlas Copco vacuum pump, customers receive more flow rate and reduce install power by 40 percent. While users of rotary vane pumps normally see a low vacuum of 2 to 3 mbar, rotary screw pumps can achieve vacuum at 1 mbar or less. The deeper vacuum helps remove more air and



The header is recognizable, located above the vacuum pumps, more commonly seen in compressed air configurations.

ROTARY SCREW VACUUM PUMPS BENEFIT MEAT PACKAGING PLANTS

oxygen from the meat's packaging to deliver a better product for customers.

Operating power is also slowed with use of the Atlas Copco's Variable Speed Drive (VSD) technology. The VSD pump automatically adjusts its motor and element speed to the lowest level possible. Therefore, flow is delivered to match the application's required vacuum level, saving an average of 50 percent in energy consumption. The VSD vacuum pump eliminates the need for frequent starts and stops when there's variable demand. In turn, users experience fewer motor problems, such as overheating, fan breakage, oil degradation and vane delamination.

Optional energy recovery components can be integrated into the rotary screw system, allowing users to recover heat generated by compression. Without sacrificing pump performance, recoverable energy levels of up to 75 percent are even possible in some applications. Meat packaging plants also benefit from the unit's ability to keep the heat release within vicinity of the units so it does not affect nearby workstations.

Lower maintenance costs

Rotary screw pumps need less maintenance. While rotary vane pumps are overhauled on an average of every 3 to 4 years, or every 16,000

running hours, rotary screw pumps can run 48,000 hours until it needs an overhaul, which averages every 11 to 12 years. Over a 10-year period, this can result in a reduction of close to 89 percent in overhaul costs. And when maintenance is required, it's easy for your trained maintenance staff to fix the issue. Given the savings on power and maintenance costs alone, users see a return on investment in less than two years.

Increased uptime

Rotary screw vacuum pumps like the GHS VSD+ feature plug-and-play installation. Install time is minimized so meat processing plants



In switching to a 15 hp GHS 730 VSD+ Atlas Copco vacuum pump, customers receive more flow rate and reduce install power by 40 percent.

can quickly resume operations when replacing their vacuum systems. The GHS VSD+ also comes with a SMARTLINK connectivity option for maximum uptime. The SMARTLINK remote monitoring system keeps users informed of pump performance and maintenance requirements throughout the day.

The inherent design of rotary vane vacuum pumps makes them prone to expensive overhauls that require time and money. Recent trials show that using the GHS VSD+ increases production rates by close to 20 percent because less time is spent on maintenance issues and the additional flow at deeper vacuum levels allow increased speed on the packaging equipment.

Screw vacuum pump technology is beginning to transform the way meat processing plants are thinking about the vacuum pumps they use in their facilities. Independent tests and trials repeatedly point to the advantages of using rotary screw vacuum pumps in place of vane pumps. Plants are getting higher flow with minimum absorbed power for lower energy consumption and the screw pump's VSD technology can adjust flow based on application demands. With longer periods between overhauls, facilities are decreasing their maintenance costs and increasing uptime for better reliability and operating efficiency.

To see if rotary screw vacuum technology is right for your processing facility, contact a vacuum solutions expert. **BP**

For more information, please contact Jerry Geenen, Vice President and Business Line Manager, North America Utility Vacuum, Atlas Copco Compressors, tel: 803-817-5736, email: jerry.geenen@us.atlascopco.com, www.atlascopco.us

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High Vacuum Solutions for European X-Ray Free-Electron Laser

By Fabian Frey,
 Pfeiffer Vacuum

*View from inside the XFEL accelerator tunnel
 (© European XFEL / Heiner Müller-Elsner)*

► The beginning of September 2017 marked a milestone in the history of nanotechnology research: With the inauguration of the European XFEL (X-Ray Free-Electron Laser), the world's largest and most powerful X-ray laser was officially put into operation. It will completely open new areas of research and insights into the nanocosmos that were never achieved before.

The European XFEL is a new international research facility, where 12 European countries participate. The non-profit society European XFEL GmbH is responsible for the construction and operation of the X-ray laser. DESY (Deutsches Elektronen-Synchrotron), one of the leading centers for the investigation of the structure of matter worldwide and a long-term partner of Pfeiffer Vacuum, is the main shareholder. The facility starts at the DESY site in Hamburg and stretches to the town of Schenefeld in the German federal state of Schleswig-Holstein.

The interdisciplinary research at the European XFEL will deliver valuable insights into many areas of science. Experience from this type of basic research shows important applications develop. Many areas of science will profit from the new facility such as medicine, pharmacology, chemistry, physics, materials science, nanotechnology, energy technology, and electronics.

Using the unparalleled X-ray flashes of the European XFEL, scientists can decipher the atomic details of viruses and cells, take three dimensional images of the nanoworld, film chemical reactions and study processes such as those occurring deep inside planets.

To generate the X-ray flashes, bunches of electrons are first accelerated to high energies, and then directed through special arrangements of magnets called undulators. Undulators are arrays of permanent magnets placed in an alternating pattern. They force

Interview with Ian Thorpe, Engineer for the High Energy Density (HED) Instrument at European XFEL

Ian Thorpe, European XFEL's instrument engineer for the High Energy Density (HED) instrument, explains where the vacuum solutions are used, the requirements they have to fulfill and why Pfeiffer Vacuum was chosen as a supplier.

Pfeiffer Vacuum: Mr. Thorpe, could you please explain to us the most important characteristics of the X-ray laser?

Thorpe: The European XFEL will open up areas of research that were previously inaccessible. Using the X-ray flashes of the European XFEL, scientists will be able to decipher the molecular composition of cells, record chemical reactions, study processes like those inside planets or map the atomic details of viruses.

Pfeiffer Vacuum: For which processes do you apply vacuum technology during your work at European XFEL?

Thorpe: I am an instrument engineer for the HED instrument at European XFEL. The HED instrument will focus on scientific applications of matter occurring inside exoplanets, of new extreme-pressure phases and solid-density plasmas as well as of structural phase transitions of complex solids in high magnetic fields. This is, for example, useful for research into planetary science, magnetism and plasma physics.

We need a good level of vacuum to enable the XFEL beam and high power lasers to propagate and interact with matter without being affected by air molecules or generating spurious background signals, which will be picked up by the detectors.

Pfeiffer Vacuum: Where do you use Pfeiffer Vacuum solutions?

Thorpe: At the HED instrument, we have UHV X-ray optics and diagnostics in the optics hutch. These systems are pumped using ion getter pumps to maintain the UHV conditions. As the beam line passes into the experiment hutch, which is where the users of the instrument will conduct their experiments, the requirements for vacuum are reduced to high vacuum (HV). This is where the Pfeiffer Vacuum products come into use.

Pfeiffer Vacuum: Are there further areas of application for the products from Pfeiffer Vacuum?

Thorpe: Ultra-high and high vacuum applications at European XFEL predominantly use Pfeiffer Vacuum turbopumps, controllers and gauges. Moreover, also our portable pump carts are equipped with Pfeiffer Vacuum solutions.

Pfeiffer Vacuum: Which of the characteristics of our solutions are especially important for European XFEL?

Thorpe: First and foremost, it was crucial that they could be integrated into the specific XFEL control system. Moreover, their easy installation was a plus. Also, their low maintenance effort qualified them for our application.



HiPace turbopumps installed at European XFEL

HIGH VACUUM SOLUTIONS FOR EUROPEAN X-RAY FREE-ELECTRON LASER

accelerated electrons onto a zigzag slalom course. With every turn, the electrons emit X-ray light. Due to the behavior of the X-rays in relation to the electrons, and the pattern of the magnets in the undulator, the light emerging is laserlike, with all of its waves in phase with each other. This means the European XFEL generates X-ray radiation with properties similar to those of laser light.

All of these processes require ultra-high (UHV) or high vacuum (HV) conditions. Within several years of cooperation, Pfeiffer Vacuum developed matching vacuum solutions for the high vacuum applications inside European XFEL. All solutions were exclusively tailored to the specific needs and demands of these applications.

Pfeiffer Vacuum supplied European XFEL with comprehensive vacuum solutions.

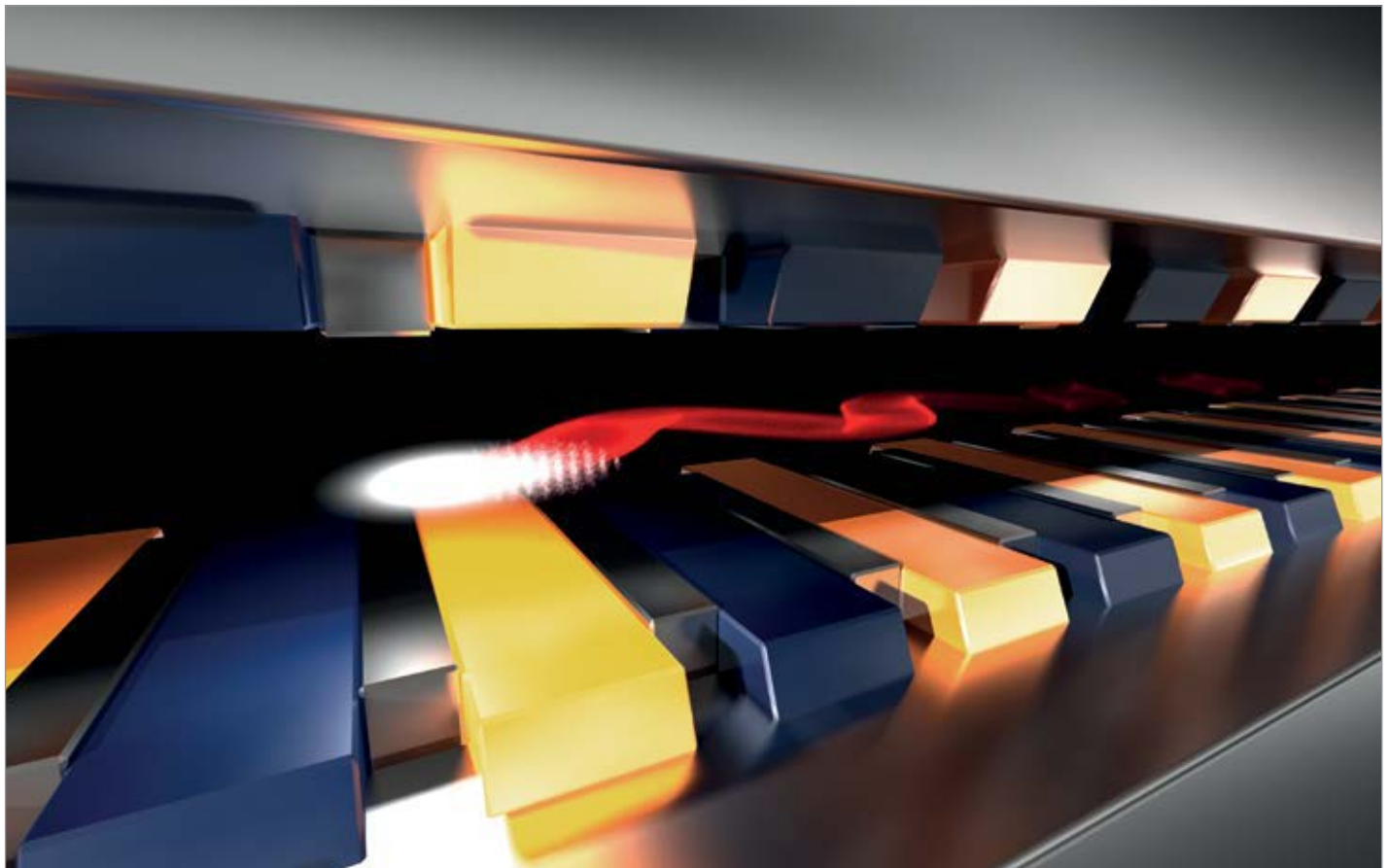
At the HED instrument of European XFEL, multiple turbopumps from Pfeiffer Vacuum are used to increase the pressure from UHV to HV. This is where ion getter pumps cannot be used. The whole beam line is windowless, so the differential pumping stage not only has to cope with

the different vacuum levels, it also has to be able to handle a sudden or unexpected influx of gas. Furthermore, the turbopumps have to maintain the UHV as a link on the side to the ion getter pumps, so as not to trigger the machine protection valves and shut off the beam.

Pfeiffer Vacuum also developed and supplied the customized flange for the large interaction chamber. The volume is approximately seven cubic meters. The solution from Pfeiffer Vacuum is specifically tailored to the needs of the application.

By using 800-liter pumps on two specially designed manifold flanges, the customer's demands were exceeded thanks to the higher compression. The pumping speed can now be tuned to the user requirements with more or less pumping speed, depending on the type of experiment. Moreover, user safety was guaranteed and the down time was minimized.

The vacuum experts from Pfeiffer Vacuum also recommended using more small pumps. If a large pump is to fail, this could not only be potentially dangerous, but also put the beam line out of operation



Generation of X-ray laser flashes in an undulator (© European XFEL)



Interaction chamber at European XFEL equipped with Pfeiffer Vacuum solutions (© European XFEL)

until a replacement pump is fitted. Now, the pump can simply be replaced, or a blank flange can be mounted and the normal operation can continue until a convenient time to replace the pump is found.

In further high vacuum applications at the European XFEL, HiPace 80, 300 and 800 turbopumps and associated controllers are used. Moreover, gauges as well as flanges, viewports and standard parts are in operation. Additionally, Pfeiffer Vacuum designed and manufactured customized parts and instruments for the HED instrument. The HiPace turbopumps allow an easy integration into the XFEL control system. Pfeiffer Vacuum modified the pumps according to the XFEL standards by enabling the option to use deionized water for cooling. Pfeiffer Vacuum supplied customized cables matching the specific length of the XFEL standard connectors.

Vacuum Solutions from a Single Source

Special vacuum components, such as flanges and pipe components, were developed for the use in European XFEL's electron beam lines. The used turbopumps and mass spectrometers were designed in close cooperation with the customer to match the requirements. Special editions of leak detectors were also delivered according to the customer's demands. Pfeiffer Vacuum successfully provided tailored vacuum solutions from a single source for the UHV and European XFEL. **BP**

Mr. Fabian Frey is the Market Manager R&D for Pfeiffer Vacuum. For more information contact Pfeiffer Vacuum. Tel: 800-248-8254, www.pfeiffer-vacuum.com

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Calculating Most-Open-Valve AERATION CONTROL

By Tom Jenkins, JenTech Inc.

► Most-Open-Valve (MOV) can be a cost-effective way to optimize aeration energy.

It can also be a confusing and troublesome addition to a process automation project. In my experience MOV is the least understood aspect of aeration control. This article will shed light on MOV, the process and energy impacts and why it's worth the trouble.

MOV Benefits

Many engineers and operators think MOV is part of the blower control system or part of the DO control logic. MOV integrates with blower and DO control, and they affect each other.

However, MOV is a separate aspect of the control logic.

MOV is a method of minimizing the pressure of the air distribution system, thereby minimizing the discharge pressure of the blowers.

Reducing pressure reduces aeration blower power. Reduced power results in lower energy cost to meet the process air demand.

Many parameters influence blower power:

$$P_{wa} = \frac{Q_s \cdot T_i}{\eta_{wa} \cdot 3131.6} \cdot \left[\left(\frac{p_d}{p_i} \right)^{\frac{k-1}{k}} - 1 \right]$$

$$\frac{k-1}{k} \approx 0.283$$

Where:

P_{wa} = wire-to-air power, kW

Q_s = flow rate, SCFM

T_i = inlet air temperature, °R

η_{wa} = wire to air efficiency, decimal (includes blower, motor, and VFD)

p_d and p_i = discharge and inlet pressure, psia

k = ratio of heat capacity = C_p/C_v , dimensionless, ≈ 1.4 for air

Most factors determining wire-to-air power are beyond the control of the operator or the design engineer. Flow rate is determined by process demand, and DO control automatically

alters flow rates as process load changes. Inlet air temperature and pressure are dictated by ambient conditions. Wire-to-air efficiency varies across the blower operating range and is established by equipment selection.

Discharge pressure is a function of air flow rate and the air distribution system's resistance to flow. The control system can manipulate discharge pressure – within limits.

System pressure includes two independent components. Their sum creates the system curve, i.e. the total pressure the blower must produce as a function of air flow rate.

$$p_{total} = d \cdot 0.433 + k_f \cdot Q_s^2$$

Where:

p_{total} = total discharge pressure, psig

d = depth of water at top of diffuser, feet

k_f = constant of proportionality for friction, psi/SCFM²

Q_s = flow rate, SCFM

The value of $d \cdot 0.433$ represents static pressure, typically 80% of total pressure in aeration systems. For conventional activated sludge, the static pressure is constant. For Sequencing Batch Reactors (SBRs), aerobic digesters and equalization basins the water depth and static pressure fluctuate.

The value of $k_f \cdot Q_s^2$ is the friction loss from air moving through pipes, diffusers and valves. For a given system, the pipe and diffuser losses are set by the design.

The remaining component of friction loss, pressure drop through valves, constantly varies as valve position and air flow change.

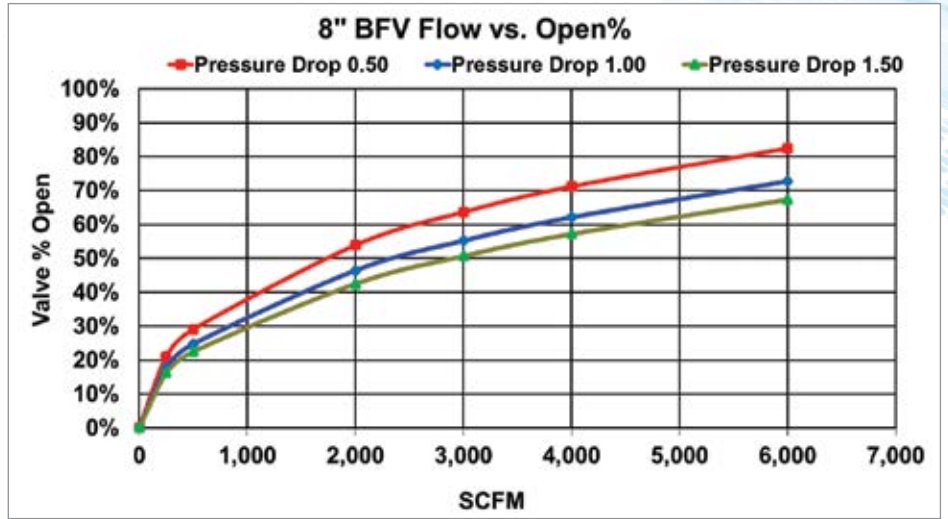


Figure 1: Typical Flow Response for Butterfly Valves

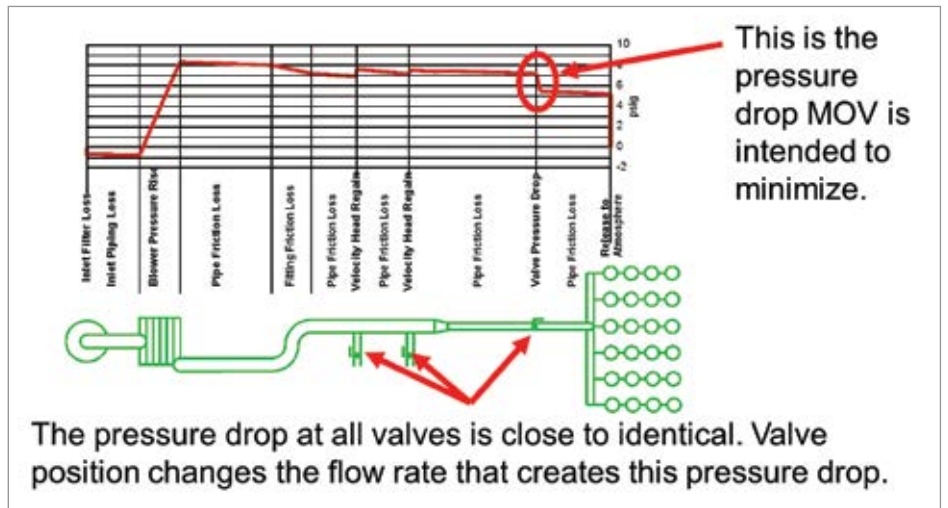


Figure 2: Pressure Changes in an Air Distribution System

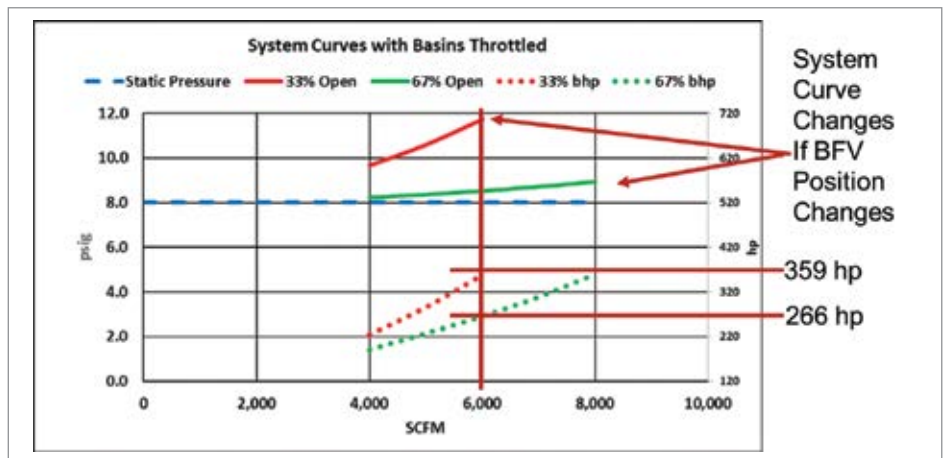


Figure 3: Changes in BFV Position and System Curves

CALCULATING MOST-OPEN-VALVE AERATION CONTROL

$$\Delta p_v = \left(\frac{Q_s}{22.66 \cdot C_v} \right)^2 \cdot \frac{SG \cdot T_u}{p_u}$$

Where:

Δp_v = pressure drop across the valve, psi

Q_s = air flow rate, SCFM

C_v = valve flow coefficient from the manufacturer, dimensionless

SG = specific gravity, dimensionless, = 1.0 for air

T_u = upstream absolute air temperature, °R

p_u = upstream absolute air pressure, psia

As valve opening increases at constant flow, C_v increases and Δp_v decreases. The objective of MOV is to minimize power by minimizing blower discharge pressure. This is accomplished by keeping the basin valves as close to maximum position as possible. The valve at maximum position is referred to as the “Most-Open-Valve,” giving rise to the name of the technique.

Air Flow Control Basics

The C_v for a valve is defined as the gpm of water the valve will pass at 1.0 psi pressure differential. It is determined by valve geometry,

size and opening. [See Figure 1.] The most common valve type for aeration air flow control is the butterfly valve (BFV). This is largely dictated by economics. Butterfly valves are generally lower cost than other types of valves, like specialized knife gate valves, that have better flow control characteristics.

Air flow control with a BFV is non-linear. As the valve disk closes and approaches the seat, small changes in position create large changes in flow at constant Δp . Conversely, when the valve is nearly open, large changes in position result in minimal changes in flow. To maintain effective control, the travel range for a BFV is commonly kept between 20% to 70% open.

It is apparent in any given position a valve may pass a wide range of air flows, depending on pressure differential. At 50% open, for example, the flow rate changes from 1,700 scfm to 3,000 scfm with a 1.0 psi change in Δp . This magnitude of pressure variation is common in aeration. Similarly, with a changing Δp the BFV can maintain 3,000 scfm by moving from 50% to 64% open.

Air pressure constantly changes along the length of aeration piping. [See Figure 2.] The pressure rises through the blower, and gradually dissipates from friction through the system. At the point of release from the diffuser into the wastewater, pressure exactly equals static pressure. As the bubbles rise, the pressure returns to atmospheric.

Two important aspects of the air distribution system are illustrated by Figure 2. First, MOV logic only controls one of many pressure drops in a system. Second, the Δp across all basin flow control valves is essentially identical. For a given set of operating conditions, changing BFV position merely changes the air flow rate required to create that Δp . This effectively changes the system curve and power demand.

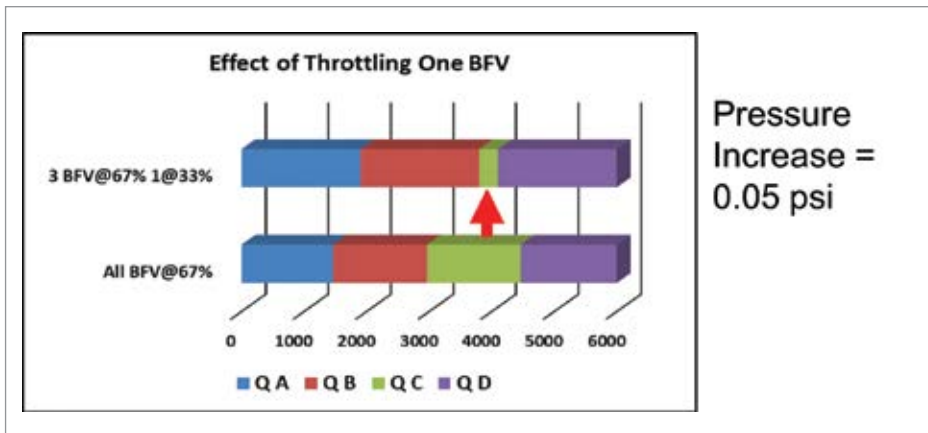


Figure 4: Changing Flow Proportions

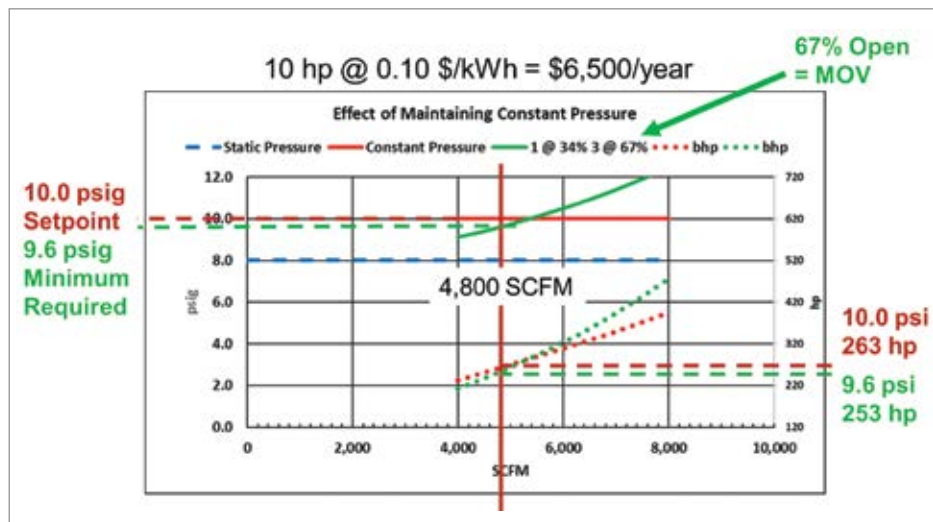


Figure 5: Blower Power with Pressure Control

[See Figure 3.] If the total air flow rate remains constant, then changing one valve's position will shift the air flow from that basin to the others. This changes the proportion of total flow going to each basin. [See Figure 4]

These relationships are integral to understanding MOV control logic. At any time, there will be one BFV representing the "worst case." That is, one control location will have a combination of flow rate and valve restriction (C_v), dictating the minimum pressure required to provide the air flow needed to meet process demand. The objective of MOV is to have this valve be at the maximum open position and minimize Δp . This in turn minimizes the blower power demand. The valve at maximum position is the system's "most-open-valve."

Pressure Based Systems

Blower control can operate in one of two ways. It can maintain a set flow rate and let the pressure vary as required by the system restriction. Conversely, it can maintain constant pressure and vary the flow to generate that pressure.

Due to technological limitations, early aeration and blower control systems used independent, single loop, feedback controllers. When a basin control valve was modulated to a more open position, the system's total restriction would decrease and the system curve would become flatter. A larger proportion of the total flow would go to the modulated basin, and a smaller proportion to the other basins. If the system had a manually controlled centrifugal blower, the pressure decrease would increase the total system air flow as well.

The designers' response to these interactions was to maintain constant pressure. If the system restriction decreased, the pressure controller would increase the blower flow. If

the other basin valves held position, the Δp would stay the same and so would the air flow through those valves. Theoretically, the increase in total air flow would match the desired increase in the modulated basin, and all other basins would be unaffected.

The problem with this system was if the pressure was set too high it wasted energy.

This was particularly true during periods of low process air demand. [See Figure 5.]

MOV logic was developed to minimize wasted power. In pressure based systems, MOV functions by changing the pressure setpoint. In the above example if the most-open-valve position was below a certain threshold, say 50%, the pressure setpoint would decrease

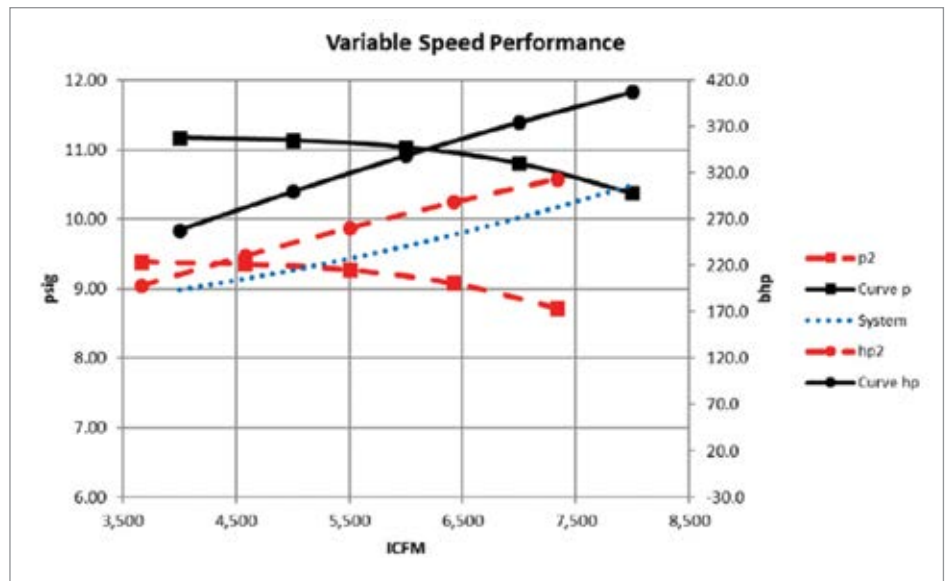


Figure 6: Centrifugal Blower with Variable Speed Control

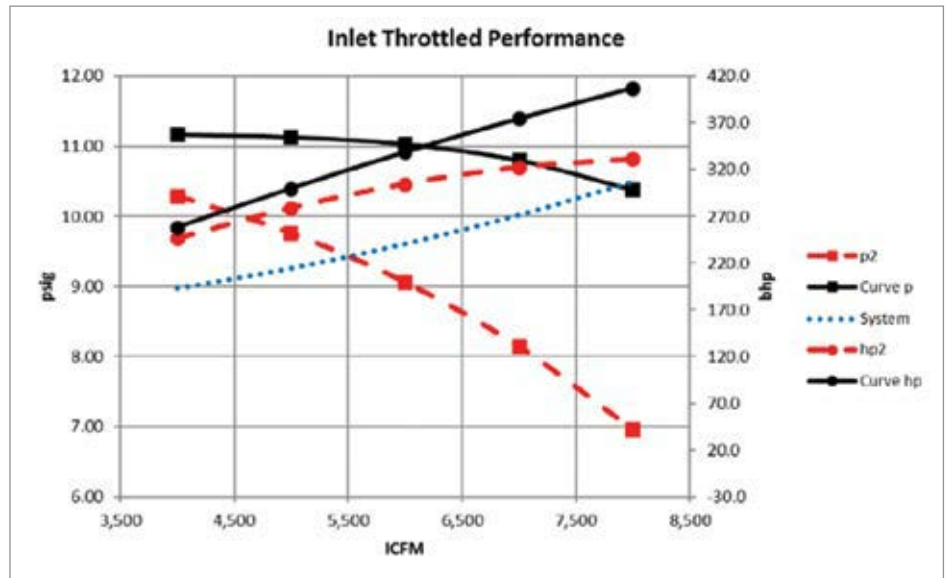


Figure 7: Centrifugal Blower with Inlet Throttling

CALCULATING MOST-OPEN-VALVE AERATION CONTROL

by a fixed increment. This would force a decrease in blower and total system air flow to drop the pressure. This in turn would cause all basin valves to open to increase their air flow rate. The restriction decrease would drop system pressure, forcing the pressure control loop to increase blower air flow again. After a few iterations the system would in theory, stabilize with the desired air flow to all basins, reduce system pressure and have a greater opening at the most-open-valve.

Flow Based Systems

Pressure based systems, with or without MOV, were likely to experience problems. Tuning the controllers was intimidating for many operators. If tuning and response times were not compatible, both blower and aeration basin controls began hunting. Adding the complex interactions of MOV increased the tendency to hunt. The deadband between maximum and minimum valve position meant the discharge pressure was not always optimized.

Early controllers limited the interface between devices to a single electrical or pneumatic signal. Modern control technology includes communications links, networked controllers and consolidation of multiple control functions into one controller. Coordination of related process control functions is possible. The

programming task may be more complicated, but stability and performance are improved.

Newer direct flow based DO controls take advantage of the data exchange capability to blend the various functions of blower and aeration basin control. Multiple process air flow demands are combined. The total demand is matched with the air flow supplied by multiple blowers. This eliminates the need for pressure control. The iterations of the control logic needed to achieve equilibrium are reduced.

A flow based master controller can access the position of every valve in a system. If none of the BFVs are in the maximum position, it can make required adjustments. Most importantly, it provides control based on actual process equipment functions. It uses the blower controls to match total air flow to process demand. It uses basin flow control valves to divide the total air flow to the basins in proportion to their individual demands.

Flow based systems inhibit movement of the most-open-valve, until another valve reaches maximum position. Air is divided in proportion to process demand. If the zone with the most-open-valve has excess flow, then another zone will have insufficient flow. The BFV in the zone with insufficient flow will open, and at some point, it will reach maximum position. The original valve is then

allowed to close. One valve will always be at maximum position.

Effects of Blower and Blower Control Type

The improvement in energy consumption from MOV depends on the type of blower and the type of blower control. MOV can minimize pressure, but not all blower systems benefit equally from the reduction.

Positive displacement (PD) blowers maximize the power reduction. The air flow rate delivered by PD blowers is controlled by seed variation. Discharge pressure inherently rises and falls to match the system requirement, and blower power is linear with discharge pressure. If discharge pressure drops, the power draw drops.

Centrifugal (dynamic) blowers exhibit a performance curve identifying the pressure capability and power draw at specific flow rates and inlet conditions. The intersection of system curve and blower curve establishes the operating flow rate. This, in turn, defines the blower's power demand. Centrifugal blowers are controlled by devices modifying the performance curve.

Reducing the speed of a centrifugal blower shifts the performance curve down and to the left. [See Figure 6.] At reduced



“Despite the confusion and potential complexity, MOV control can decrease power by minimizing the pressure drop through basin air flow control valves.”

— Tom Jenkins, JenTech Inc.

speed the pressure ratio is reduced, and therefore the pressure increase from inlet to discharge is also reduced. The intersection of the performance curve with the system curve shifts to a lower flow. This is the most efficient way to control centrifugal blowers, since both flow and pressure ratio are reduced. The benefit of MOV logic is maximized with this control method.

Throttling a constant speed blower does not change the pressure ratio. Instead it moves some of the total pressure increase through the blower from discharge to inlet. [See figure 7.] This decreases the discharge pressure. The intersection of blower and system curves move left, reducing flow and power. However, the benefit of MOV is minimal, since the blower pressure ratio is unchanged.

Large centrifugal blowers are often controlled by inlet and/or discharge guide vanes. Guide vanes function by shifting the blower curve. Guide vanes also obstruct and throttle the air flow into the blower. As a result, the reduction of blower power from MOV control is good, but not maximized.

Conclusion

MOV is a concept causing confusion for designers, programmers and operators. Despite the confusion and potential complexity, MOV control can decrease power by minimizing the pressure drop through basin air flow control valves. A variety of MOV techniques have been developed. They can be adapted to aeration control maintaining blower discharge pressure or air flow rate.

Coordination between multiple components and control loops is necessary for successful MOV implementation. MOV control, DO control and blower control affect each other and should be considered as parts of a system. It is particularly important to select a blower control strategy maximizing the benefits from MOV control. **BP**

*For more information contact Tom Jenkins, President, JenTech Inc. at email: info@jentechinc.com or visit www.jentechinc.com. Mr. Jenkins has texts now available in hardcopy and electronic versions titled *Aeration Control and Facility Design* at www.riley.com and www.e-wef.org/store.*

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Show Report: 2017 WEFTEC

Aeration Blower Technology

By Rod Smith, Blower & Vacuum
Best Practices Magazine

► The 2017 WEFTEC Technical Exhibition and Conference was held October 2-4 at McCormick Place in Chicago. The 2017 event made the list of the top five largest and best-attended events in the conference's 90-year history. A total of 22,860 registrants and 1,011 exhibitors using a net of 305,600 ft² of space attended WEFTEC. The event featured

technical sessions, workshops, facility tours, and numerous other educational and networking events. My apologies go out in advance to the many booths I visited (and also those I did not) who are not covered in this article due to running out of editorial space. WEFTEC is an enormous show. Both Blower & Vacuum Best Practices and Compressed



Alex Lequo and Tim Dobyms presented the KA44 single-stage turbo compressor at the Howden Roots booth (left to right).



Jason Costigan and Carl Kruthoff next to the new and improved Gardner Denver CycloBlower H.E. Series rotary screw blower (left to right).

Air Best Practices® Magazines were pleased to be in the literature bins at the 2017 WEFTEC!

Howden Roots Closes Siemens Turblex® Acquisition at the Show

In a deal signed in March, Howden Roots and Siemens Energy announced, at the show, the closing of Howden's acquisition of the Siemens Turblex® business based in Springfield, Missouri. Springfield-based General Manager Tim Dobyms said, "Roots and Turblex have long been two important brands in our industry. It's exciting to see us join forces." Sales Manager Alex Lequio showed me the KA44 single-stage turbo compressor in their booth commenting, "This unit has a 60% turndown making it uniquely efficient at such a wide range of operation." The KA turbo compressor is also available in a Baseline version, designed specifically for water resource recovery facilities.

The combined sales forces will now have access to an extremely broad product offering, ranging from turbo compressors to multiple positive displacement technologies - including the original Roots blower built in Connersville, Indiana. The Connersville-based Howden Roots team was talking about their new EasyAir™ Rotary factory standard package, featuring the latest Tri-RAM rotary blower. North America Sales Manager Paul Kearney said, "The sound attenuating enclosure is designed to optimize process airflow and ensure easy service access to belts, filter and oil fill points through the front doors." The units also offer an

optional integrated electronic controller. The small footprint package allows for side-by-side installation for ore efficient use of floor space and has an automatic belt-tensioning system, counterbalanced to optimize v-belt life.

Aeration Blower Technology Roundup

Gardner Denver continues to power forward with its incredibly broad product offerings in blower technology. GD Director of Blower and Vacuum Technology, Kenny Reekie, suggested I review the new CycloBlower® H.E. Series 160, 200 and 250 models. This product range, marketed as "the original rotary screw blower", has been reinvented with a patented design and claims best-in-class energy efficiency. The new models deliver pressures to 36 psi and 22 inHg, and flows to 6,200 cfm. The patented design features a 3 x 5 helical screw rotor profile. The rotors are coated with food-grade PTFE to minimize air loss while maximizing efficiency. An exclusive split-cylinder design combined with three discharge port options (low, medium, high pressure) helps optimize efficiencies based upon specific performance needs of different applications. The CycloBlower has over 25,000 installations around the world and it's great to see engineering resources applied to it to maintain it's "world class" stature. A tremendous solution for OEM's, the GD team said it's the only rotary screw bare blower on the market. This allows OEM's to retrofit existing packages, upgrade product lines and design future machines with the new efficiencies and features of the CycloBlower.



Ralph Wilton next to the Aerzen Multicore single stage high speed turbo blower.

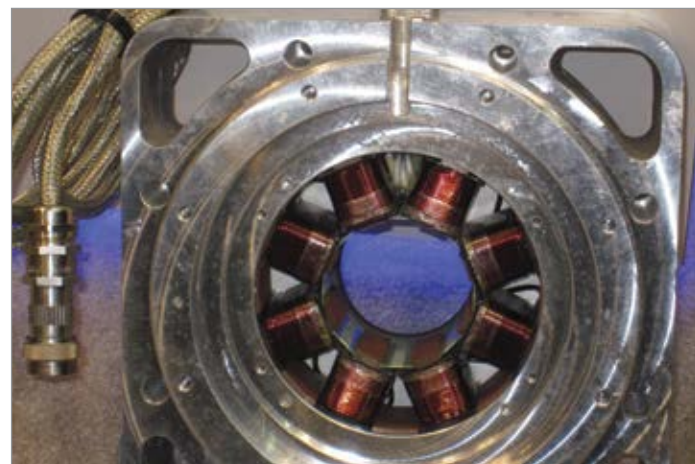


Standing next to their ZS Series oil-free, rotary screw, variable speed drive, blower are Trey Poer, Lee Ann Hellums, John Conover, and Edgar Arreaza (left to right) at the Atlas Copco booth.

SHOW REPORT: 2017 WEFTEC



Visitors at the Kaeser booth learn about rotary lobe technology from Stephan Dagovitz (pictured) and experienced the new IoT capabilities of the controller on the DBS direct drive rotary screw blower.



Landy Lu, Chris Chong and Dave Parsons (left to right) at the Sulzer booth next to their Turbocompressor Type ABS HST 20. Also pictured is a close-up of the magnetic bearing technology.

The Aerzen booth highlighted the MultiCore series of single stage high speed turbo blowers. Multiple Cores allow for a wide range of operation with airflow deliveries up to 20,000 cfm. Using multiple cores, the design offers over 6 to 1 turndown for WRRF's with significant variances in demand. The units utilize one user interface and come standard with one discharge connection allowing for easy installation and simple operation. Marketing Manager Ralph Wilton also explained how Aerzen is focusing significant resources to educate engineering firms and integrators on how to use their AERprocess dissolved oxygen (DO) control system. This system provides DO to the activated sludge process by calculating the total airflow required as well as the exact airflow required in each aeration zone to maintain the DO at the set point. AERprocess then sequences the blowers and accurately adjusts the valves to distribute the airflow as required. The control strategy is a Most Open Valve (MOV) method for air distribution at the lowest possible operating pressure for reduced energy consumption.

The Atlas Copco team was bubbling (pun intended-sorry) with enthusiasm over new product introductions and positive results in 2017. Blower and Low Pressure Compressor Sales Manager, John Conover, commented on their ZB VSD (variable speed drive) centrifugal air blower range, featuring magnetic bearings. "The ZB "all-in" package has been well received. Clients appreciate the magnetic bearings' ability to withstand surge conditions and appreciate all the full-feature components integrated into the package." Conover said 2018 will bring expanded options and models to the ZB Series range. We also reviewed the ZS Series Oil-Free Rotary Screw Blower line with Blower and Low Pressure Product Manager, Travis McGarrah, "The ZS range has models from 24 to 422 hp and the ZS VSD range covers 24-475 hp." McGarrah continued, "Atlas Copco has pioneered the development of oil free air technology. We are very excited to bring Class 0 oil-free air, leveraging the energy-efficiency benefits of rotary screw technology, to the blower market." The team also said the application engineering and support staff, at the Houston Blower Competency Center, is also growing.

If you wanted to learn something about magnetic bearings, the Sulzer booth was the right place to be. Dave Parsons managed

to have a cutaway of the actual magnetic bearings inside a Sulzer high-speed ABS HST turbo compressor! Parsons, who also is also the Chairman of the CAGI Blower Section, commented, “The U.S. market continues to adopt premium magnetic bearing technology, we are up to close to 300 installations now in this market.” I still find the technology and engineering behind the use of magnetic bearings amazing. The magnetic bearings used, eliminate physical contact and thereby all mechanical wear – even during starts and stops. Parsons continued, “We run the turbo at 42,000 rpm, taking measurements on 5 axis points and monitoring it 50,000 times per second.”

Kaeser Compressors continues to gain market share in the blower market with their time-tested Omega line of rotary lobe PD blowers and in recent years, with the introduction of their rotary screw blowers featuring their famous Sigma Profile™ rotor technology. Kaeser Blower Product Manager, Stephen Horne, said the market reception for the truly integrated full feature direct drive DBS Series blowers has been excellent, with more and more interest in using the IoT capabilities of the Sigma Air Manager 4.0. “Models come standard with Sigma Control 2™. In addition to monitoring all onboard sensors, Sigma Control 2 features expanded communication capabilities and can be seamlessly integrated into plant control/monitoring systems like the Kaeser Sigma Air Manager 4.0.” The packed Kaeser booth had working models where engineers could see how the blower controller could interface with the overall system controller. Very high-tech!

APG-Neuros continues to grow their air bearing turbo blower business. The firm, over the past ten years, has carved out a significant market share providing customers with energy savings, smaller package foot prints, low noise and vibration and maintenance cost savings. Allen Bradley is their standard 6” touchscreen PLC controller on smaller 50 hp units and clients can choose between Allen Bradley, CIMON, Siemens, GE and Modicon PLC’s on larger units. I spoke to company representatives about actions they take to help their technology perform under adverse working conditions. They said this is very important and they take particular care to understand each unique installation. For example, if there’s reason to suspect it, they send out hydrogen



Jim Billings (G3 Engineering), Chet Adamczyk and Tom Hodanovac at the EurusbLOWER booth (left to right).



Scott Stevenson at the Hardy Pro-Air booth.



Ranjan Manivelu next to a 50 hp air bearing turbo blower at the APG-Neuros booth.

SHOW REPORT: 2017 WEFTEC



Scott Matthews introduced NexTurbo technology to the market.



James Jin next to the GL Series geared single stage turbo blower at the Lone Star Blower booth.



Mick Wentzel and Darin Ladd presented the new SV Series of regenerative blowers at the Becker booth (left to right).


sulfide (H₂S) monitors to analyze ambient conditions. Based upon these readings, they will put special protective coatings on key components.

Hardy Pro-Air is an interesting packager of PD blowers serving a multitude of applications including wastewater and pneumatic conveying markets. Sales Manager Scott Stevenson said, “Our Pro-Pack standard blower packages are “Made in Illinois” and we specialize in custom engineering projects.” The firm also builds customized vacuum packages. We reviewed a package for 3,000 cfm at 24" Hg.

Eurus Blower, with U.S. General Manager Tom Hodanovac, was at the show with their Bi-lobe (ZZ Series) and workhorse MB Series standard blower and vacuum packages. The firm is carving out a solid presence as primarily an OEM supplier. Units feature heavy duty everything – from oversized bearings, to one piece integrated ductile iron rotors and shafts with large shaft diameters.

Lone Star Blower has also shaken up the market in the last few years. General Manager Andrew Balberg’s firm offers geared (GL Series) and gearless (DT Series) single stage turbo blowers, multistage centrifugal (LS Series) turbo blowers and PS Series custom engineered blower packages for pressure, vacuum, air or gas applications. Based in Houston, the firm focuses on applications in water and wastewater, power, petrochemical, oil and gas, food and beverage and mining industries. The capacities of their products reflect this - like the GL Series turbo blower: 100 to 6,000 horsepower, 2-35 psi, 500 to 70,000+ scfm!

Conclusion

The 2018 WEFTEC Technical Exhibition and Conference will be held September 29th to October 3rd at the Morial Convention Center in New Orleans. For more information on the 2018 WEFTEC, visit www.weftec.org 

To read similar **Aeration Blower Technology** articles, visit <http://www.blowervacuumbestpractices.com/technology/aeration-blowers>

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BLOWER & VACUUM SYSTEM INDUSTRY NEWS

Busch Honored with Hormel Spirit of Excellence Award

Hormel Foods Corporation awarded Busch LLC, for the second consecutive year, the Spirit of Excellence Award. Busch is a contractor of Hormel Foods Corporation, providing vacuum pumps and systems products, services and maintenance support. Award criteria include meeting performance requirements, delivering on-time and providing high-level customer support.

"The suppliers that have earned our Spirit of Excellence Award truly go above and beyond in helping us produce high-quality products for consumers around the world," said Curtis Southard, Hormel Foods' director of purchasing. "We are proud to partner with these outstanding suppliers, and congratulate them on this achievement."



Busch has been awarded with the Spirit of Excellence Award from Hormel Foods Corporation for the second consecutive year.

Today's food packaging and processing industry uses vacuum in a very large number of applications. Busch vacuum pumps guarantee the highest level of product quality and process safety. Major advantages of Busch vacuum pumps include low maintenance, low energy consumption and top-quality performance. Busch has always focused on optimizing food processes, improving productivity with continual investment and research and development for tomorrow's innovations.

Busch is honored and proud to be recognized, once again, by one of their partners in the processing and packaging industry, Hormel Foods.

To learn more about Busch products and services, please visit www.buschusa.com.

Howden Acquires Siemens Energy North America Turblex

Howden acquired Siemens Turbomachinery Equipment businesses in Europe and China along with a Siemens Energy business in America to create the most comprehensive and broadest range of compressors, blowers, fans and now steam turbines to their turbomachinery solutions. Newly acquired established brands include Turblex® in the U.S., as well as HV-TURBO® and Kuhnle, Kopp & Kausch® in Europe. These brands have been added to Howden's Turbo Technologies, including brands like Roots®, Donkin® and Exvel®.

In total, all of the Howden Turbo Technologies brands represent a combined 500+ years of experience to bring to the wastewater treatment, power generation, oil and gas, petrochemical, iron and steel industries among others.

New manufacturing, engineering and service sites have been added as a result of this acquisition. This will provide customers with more personal support locally, as well as the breadth of global service for international locations. As Howden Teams combine forces with new business sites in Springfield, Missouri, Frankenthal, Germany, Helsingoer, Denmark, Mornago, Italy and Beijing, China, the Howden Turbo Technologies platform is uniquely poised to give customers more.

For more information, visit <http://www.howden.com/turbo>

About Howden

Howden is a world-class engineering company with a proud heritage and a desire to be the world's leading application engineering company providing solutions for you in air and gas handling. With 6,000 employees in 27 countries we are undergoing a period of significant business growth. Based at our global headquarters near Glasgow, UK, Howden provides high quality air and gas handling products and services to the power, oil & gas, mining and petrochemical industries - just to name a few. Innovative and agile, we are Howden. Howden - Revolving Around You. www.howden.com

Pfeiffer Vacuum and ATC Present CCIT Technologies

Since February 2017, ATC is a 100% subsidiary of Pfeiffer Vacuum, a global leader in vacuum and detection solutions. With this merger, Pfeiffer Vacuum can offer its customers a complete range of leak testing and leak detection solutions. At the Pack Expo trade show, Pfeiffer Vacuum and ATC presented a wide range of CCIT (Container Closure Integrity Testing) technologies for pharmaceutical packaging.

ATC's patented Micro-Flow technology, and Mass Extraction technology, ensure product sterility and compliance with regulatory expectations and USP standard for container closure integrity testing. The non-destructive, deterministic leak testing uses Mass Extraction technology to detect defect sizes as small as 1-2 micron (microbial challenge).

With short cycle times, high sensitivity and repeatability these systems are very cost-effective. Pfeiffer Vacuum presented its helium tracer gas leak detection solutions, as well as the AMI non-destructive integrity test system. This conducts qualitative and quantitative leak measurements in real time without using any specific tracer gas. This self-calibrating method offers the widest test range in the market, and has higher sensitivity than conventional methods. For all leak testing solutions, Pfeiffer Vacuum offers FDA 21CFR Part 11 compliant software as well as IQ/OQ qualification support.

Leak Testing with Mass Extraction Technology (Air)

At Pack Expo Pfeiffer Vacuum displayed products from its new subsidiary Advanced Test Concepts (ATC) from Indianapolis, IN. The leak testers

being exhibited will work on the basis of leading leak testing technology using air, and therefore do not require any special tracer gases.

The devices operate according to patented Micro-Flow and Mass Extraction technology. The USP 1207 recognized Mass Extraction thereby works on the principle of rarefied gas flow. Testing takes place in vacuum conditions to attain higher sensitivity. This type of testing is particularly suitable for packaging or enclosed objects, such as pharmaceutical packaging, as for IV-bags or glass vials. Defect sizes smaller than 2 μm , respectively, leak rates of down to $5 \cdot 10^{-6}$ mbar l/s can be detected with this method. The method is thereby suitable for



Pfeiffer Vacuum AMI 121 Integrity Test System.

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

laboratory applications, as well as for the use in production environment allowing stability control as well as automated 100% testing.

Leak Detection with Tracer Gas

The ASM 340 leak detector delivers very good performance for tracer gas leak detection using helium (or hydrogen) as a tracer gas. The device combines high performance, reliability and repeatability with the fastest time to test. This leak detector is easy to use thanks to its user-friendly and intuitive color touch control panel. The ASM 340 is the leak detector for MALL (Maximum Allowable Leakage Limit) testing within the packaging development process, e.g. for syringes. Pfeiffer Vacuum also supplies corresponding adaptations for specific test parts, as well as process support.

Optical Emission Spectroscopy

The Pfeiffer Vacuum AMI integrity test systems measures leak tightness using a patented process not requiring a tracer gas. Instead, this method uses the existing gas mixture in the cavities inside the packaging to perform high-sensitivity testing over an extended measuring range. The procedure offers great flexibility. A variety of different packaging types such as blister packs, pouches, vials, plastic bottles, and sealed parts such as battery casings, can be tested in this way.

A big advantage of the AMI is its wide measuring range, also offering higher sensitivity than conventional tests, down to 1 µm, respectively, leak rates of down to $1 \cdot 10^{-7}$ mbar l/s. As a result, the AMI device provides gross and fine leak test in just one device. The procedure delivers deterministic test results with high repeatability, irrespective of the user, and with reliability and accuracy complying with USP 1207.1. It can be used in laboratory testing as well as IPC (In Process Control) during production testing. Depending on the packaging, the simultaneous testing of multiple parts at the same time is also possible.

About Pfeiffer Vacuum

Pfeiffer Vacuum 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 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 please visit www.pfeiffer-vacuum.com.

Leybold Increases Energy Efficiency of DIP and DIJ Diffusion Pumps

The subject of energy efficiency of vacuum solutions plays an important role in all areas of application. Not least for this reason, the vacuum supplier Leybold, from Cologne, has continuously reduced the energy consumption of its product range in recent years.

Diffusion pumps do not have any moving parts, their principle of operation is based on steamed propellants, thus enabling extremely reliable and low-maintenance operation. In addition, they are robust and offer an excellent cost/performance ratio for high vacuum generation. For decades, these properties have made them the "workhorse" in industrial applications. Many suppliers considered this technology to be mature, and accordingly, the technical development came to a standstill.

Leybold has recognized the potential to raise this established technology to a contemporary level, and has significantly reduced the energy consumption of the established DIP and newly developed DIJ diffusion pump series. This was accomplished with the aid of intelligent technologies and innovations. Leybold now provides a number of flexible optimized models and accessories able to be implemented worldwide into the relevant diffusion pump applications. The new DIJ family comes with an optimized housing design, offering connections for both ANSI and ISO flange components, as well as



“Leybold has recognized the potential to raise this established technology to a contemporary level, and has significantly reduced the energy consumption of the established DIP and newly developed DIJ diffusion pump series.”



The DIP and DIJ diffusion pump series consume less energy by an average of more than 30%.

various electrical connection variants. The new five-stage nozzle system of the DIJ series has been improved especially for the pressure range from 10⁻² to 10⁻³ mbar

Through design changes and modern control elements, the vacuum specialist was able to reduce the energy consumption of the diffusion pumps by an average of more than 30%, without sacrificing performance. In addition, there are further improvements in terms of serviceability and integration into the customers' systems.

The lowering of the energy requirement has a positive effect in all areas of application. Even relatively low increases in efficiency of individual vacuum components can lead to improved energy balances. Customers and users will experience noticeable reductions in operation costs over the entire service life of their plants and equipment.

The greatest savings potential was achieved by selecting an improved heating system and adjusting it to produce the propellant steam. In addition, energy is saved by an optimized arrangement of the heating elements in the boiler room, the loss-free energy transmission and the thermal insulation.

In addition to these structural elements, the option of an integrated energy regulator reduces the power consumption of the diffusion pump. The integrated energy regulator is particularly useful because a high heating power does not lead automatically to a higher suction capacity. During a typical production cycle, the full heater power must only be used during the initial heating up of the pumps boiler room. In the following process phases, the necessary energy supply can be controlled exactly with the settings of the controllers.

For this, sensors in the boiler room measure the oil and heater temperature. As soon as the optimum temperature is reached, the heating output is lowered. The power consumption is adapted to the requirements at the respective operating point by means of the energy regulator, operating manually or via a PLC. The measured pump data is stored inside the regulator. It can be easily integrated into the customer's own process controller and can be exported and evaluated via an USB port.

Depending on the propellant fluid, mineral oil or silicone oil, the optimum target temperature where the liquid develops its respective maximum performance is adjusted at the digital energy regulator. Compared to the energy consumption of unregulated standard pumps, energy savings of up to 50% are possible, depending on the process cycle.

A large number of users from a wide range of industrial and research areas are benefiting from the economic and ecological improvements of this established high vacuum pump. For example: vacuum coating, research and development, metallurgy, vacuum furnace construction, mechanical engineering or electron beam welding.

In this way, these innovative diffusion pumps from Leybold, developed by the vacuum engineer Wolfgang Gaede about 100 years ago, will continue to generate and maintain efficient and stable high-vacuum processes in the future.

About Leybold

Leybold is a part of the Atlas Copco's Compressor 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.

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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)

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BLOWER & VACUUM SYSTEM INDUSTRY NEWS

About Atlas Copco

Atlas Copco is a world-leading provider of sustainable productivity solutions. The Group serves customers with innovative compressors, vacuum technique 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 2016, Atlas Copco had revenues of 11 Billion Euros and more than 45,000 employees.

Since 1952, Atlas Copco is present in Germany. Under the roof of two holdings located in Essen, more than 20 production and sales companies are gathered (February 2017). By end of 2016, the group employed about 3800 people, including about 100 trainees. www.atlascopco.com/en-us.

Nash Exchange Pump Program Keeps Systems Running

Nash keeps over 60 pumps in 26 different models and configurations available for immediate exchange. You can use this to keep your critical systems running while they return your equipment to working order. Their emergency-swap out pumps are shipped within 24 hours. For less common models not immediately available, they offer a Swap Out program. Contact Nash Sales or your regional service center for an estimated lead time on a swap-out pump for your specific model.

Any repair. Any Service Center. Ship your pump to your closest NASH Certified Service Center for evaluation and repair. You can trust your unit will be returned to working order, original design and specifications using the latest upgrades in NASH Certified parts. Every repair comes with a NASH Certified performance guarantee and two-year warranty. If you would like to learn more about Nash Certified Service Center capabilities please visit, www.gdnash.com/aftermarket/service_centers/.

If your pump is not repairable, does not contain some of the newer energy-saving features, is not available as a swap-out or exchange pump and/or the repair price approaches the price of a new pump, Nash can outline your options for a new product. They will take into consideration your entire process and what pump would best fit your needs. Their most popular pumps are available for shipment within two days.

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If your current pump is losing performance, needs repairs, or you simply want to replace it, you can exchange it and receive an identical unit for a fraction of the price through their Unit Exchange Program.

About Nash

Nash, a division of Gardner Denver, is a leading manufacturer of liquid ring vacuum pumps, compressors and engineered systems serving the chemical, oil & gas, power, paper, mining, environmental and food industries. Nash also provides global service and technical support for its products through its locations around the world.

For more information, visit www.GDNash.com, email: nash@gardnerdenver.com or call 1-800-553-NASH.



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