The Magazine for ENERGY EFFICIENCY in Blower and Vacuum Systems

BLOWER & VACUUM BEST PRACTICES

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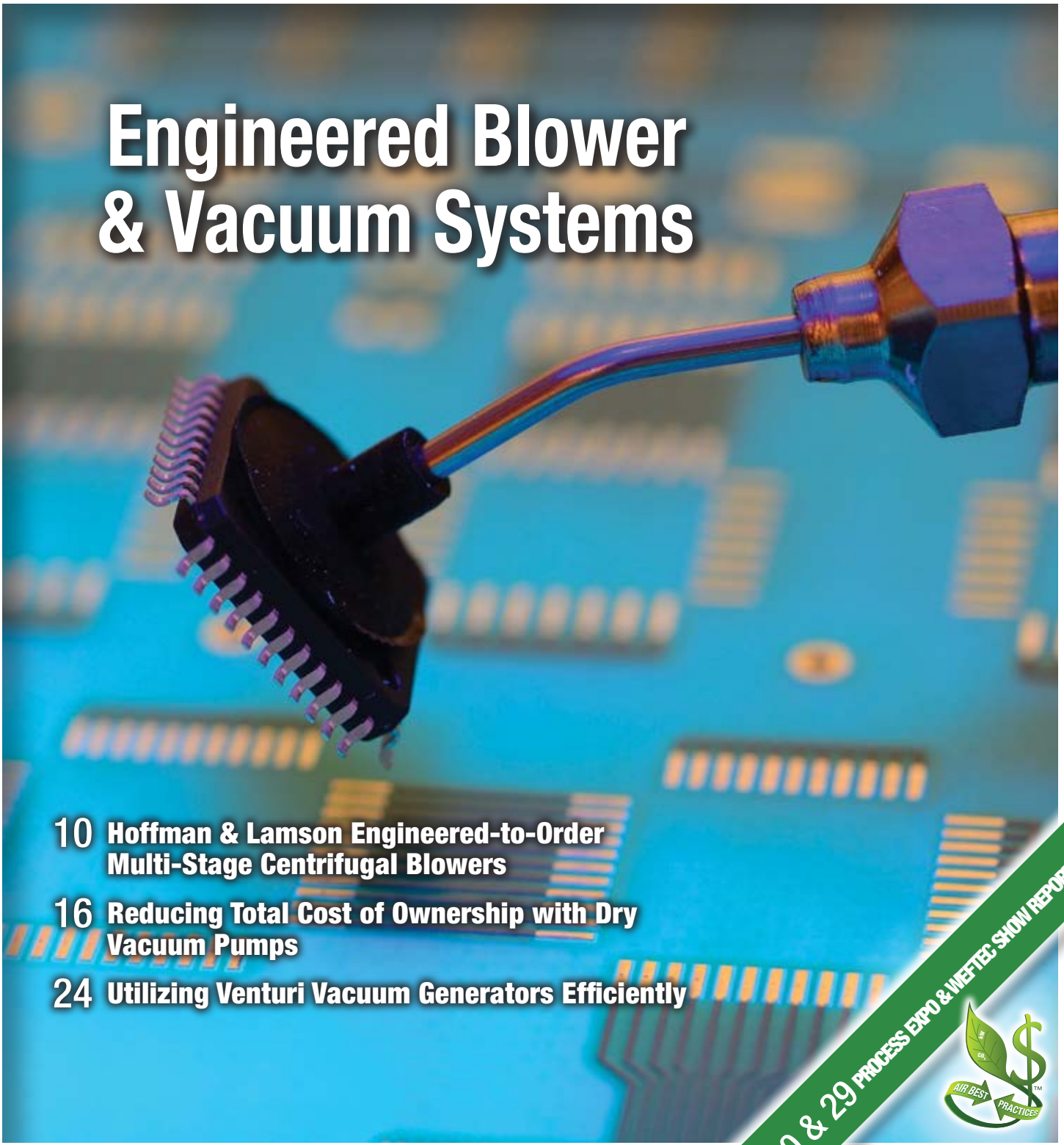
Engineered Blower & Vacuum Systems



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Using vacuum blowers for better hold down in CNC router table applications

PROBLEM:

For many years, the compressed air system for an industry leader in furniture manufacturing relied on vacuum instead of flow to provide hold down for their CNC router tables.

Despite having multiple rotary screw vacuum units providing up to 27" Hg vacuum, there was still significant scrap materials and downtime since the sheets would move after portions were cut away. The 40 hp vacuum screw units were upgraded to 100 hp units and special roller bars were added to keep the sheets in place, but the problems continued.

Additionally, the leather fibers and dust that go hand-in-hand with this type of installation were harsh on the vacuum screw units. Filters collapsed and airends had to be replaced due to contamination.

SOLUTION:

Kaeser provided a unique solution – it's not the vacuum that provides the hold down, it's the flow that keeps the sheets of wood in place. Kaeser recommended an Omega DB 236 with optional external STC controls and additional DB 236C units with integrated controls to replace the multiple vacuum screw units.

RESULT:

In addition to providing outstanding hold down, the blower packages have a significantly smaller footprint – almost a quarter of the size of the 100 hp screw compressors. These blower packages require less routine maintenance and are less sensitive to the ambient conditions. They also use less oil and require few consumables, making them a greener solution. Finally, the energy savings have been significant – only 120 hp is needed to provide exceptional hold down instead of the 320 hp previously used for the vacuum screw units. To save on space, energy, and maintenance costs, sometimes you just have to go with the flow!

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FROM THE EDITOR | Engineered Blower & Vacuum Systems

The Gardner Denver Nash Division's new manufacturing plant, located south of Pittsburgh, supports the Hoffman & Lamson centrifugal blower and Nash vacuum pump and compressor businesses. Our article this month discovers a million-dollar ASME-certified test lab testing blowers to ASME PTC 10 & 13 and engineering and fabrication resources embracing Engineered-to-Order projects. In addition to providing customers the opportunity to witness ASME wire-to-air testing in-person or virtually, the company embraces designing and building the whole system. Marketing Director Peter Klipfel says, "We bring an expertise in designing the entire system, including controls, VFDs, instrumentation and all other components required."

Dry compression vacuum pumps are going mainstream and used, in conjunction with mechanical boosters, for applications requiring a vacuum level to 1 x 10^{-2} torr or potentially even lower, according to Oerlikon Leybold's Michael Delahunt in his article, "Reducing Total Cost of Ownership with Dry Vacuum Pumps." This useful article compares oil-sealed with dry compression vacuum pumps (Oerlikon Leybold is a significant manufacturer of both technologies) in terms of purchase price, maintenance cost, energy efficiency and production performance.

Venturi vacuum generators are present in most manufacturing facilities. OEM machine builders design them into production equipment to provide a convenient, flexible, fast and reliable solution. The often-correct perception, however, is they are not energy efficient with their use of compressed air. As usual, different truths exist in case-by-case situations. Veteran auditor, Hank van Ormer, provides us with an article outlining engineered applications and installation techniques where venturi vacuum generators may be not only convenient and responsive, but often the most energy-efficient selection.

One of our objectives is to keep readers up-to-date on blower and vacuum technologies and companies. To this end we hope you enjoy our Show Reports, on both the Process Expo and WEFTEC trade shows, which took place in the final quarter of 2015.

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

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BLOWER & VACUUM SYSTEM INDUSTRY NEWS

Oerlikon Agrees to Sell Vacuum Segment to Atlas Copco

Oerlikon announced that it has signed an agreement to sell its Leybold Vacuum business to Atlas Copco. The transaction is based on an enterprise value of CHF 525 million and is expected to close by middle of the year 2016.

Oerlikon advances its strategic agenda and continues to focus on streamlining its portfolio with the objective of further developing the company's Best-in-Class businesses. The divestment of its Vacuum Segment to Atlas Copco marks the thirteenth strategic transaction for the Group since 2010. It will allow the Group to further allocate resources and management attention to its strategic growth areas.

Oerlikon CEO Dr. Brice Koch said: "This is another important milestone in our strategic effort toward focusing our businesses on attractive core growth markets in the fields of energy, mobility and urbanization. We intend to use the proceeds to invest in sustainable profitable growth within our core competencies."

Atlas Copco is the ideal owner to unfold the full potential of Oerlikon Leybold Vacuum, as it has a strong position and wide expertise in the vacuum and compressor sector. The enterprise value for Oerlikon Leybold Vacuum is CHF 525 million. In 2014, the Segment generated sales of CHF 390 million, and, as of June 30, 2015, has 1646 employees worldwide. The transaction provides Oerlikon with a stronger position to invest in its leading businesses funding innovation, operational excellence as well as organic and inorganic growth opportunities.

Process and Guidance

The transaction is expected to close by middle of the year 2016, subject to regulatory merger approvals in a number of countries and the standard closing conditions.

Oerlikon will report the Vacuum Segment under "Discontinued Operations" in the 2015 full-year financial statements and will restate the 2014 accounts accordingly. Based on preliminary restated 2014 full-

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

year Group figures for order intake (CHF 2 647 million), sales (CHF 2 825 million) and EBITDA margin (16.8 %).

Oerlikon confirms for its continuing operations for the financial year 2015 at constant exchange rates the guidance provided on October 27, 2015:

- Order intake to increase by low single digits
- Sales to be at prior-year level
- EBITDA margin to be sustained at prior-year level

For more information about Oerlikon Leybold Vacuum, visit www.oerlikon.com/leyboldvacuum/en/

Kinetic Traction Systems Introduces Turbo Aerator KTF 5000ä

The Kinetic Turbo Aerator is the latest product designed and developed by KTSi and offers efficient, compact, cost effective aeration solutions for industries that require high quality air processing, such as wastewater treatment, food and beverage, pharmaceutical, and chemical processing. Unlike conventional compressors with lubricated gearboxes, the Kinetic Turbo Aerator uses a single shaft coupling the impeller and direct drive high-speed permanent magnet motor, eliminating oil carryover contaminants in the air compression process to comply with ISO 8573 and ISO 12500 quality standards.

"We are excited about our new products, which are based on KTSi's proprietary know-how and expertise in high-speed permanent magnet motors, magnetic bearings, power electronics and controls," said Richard Newark, Chief Executive Officer. KTSi products are designed to improve performance and efficiency, reduce energy consumption and lower carbon emissions, while providing innovative solutions to a variety of applications and industries in global markets.

The Kinetic Turbo Aerator complies with ISO 8573 and ISO 12500 quality standards.

With only one moving part, the Turbo Aerator is the combination of proprietary know-how and proven technologies, such as direct drive air cooled permanent magnet motor, self-diagnostic active magnetic bearings and controls, high efficiency impeller and variable frequency inverter with optimized algorithms for high speed rotation and compatibility with plant SCADA and interface connections.

Digitally controlled active magnetic bearings and rotordynamics adopted from proprietary GTR flywheel technology are unequaled within the air compression industry. This bearing system allows the turbo aerator to operate in a safe, controlled manner with small impeller clearances. Magnetic bearings handle high loads and multiple start and stop cycles that air-foil bearings cannot. Kinetic Turbo Aerators are equipped with magnetic bearing and controls battery backup power and touchdown bearings providing high reliability and shutdown control in the case of a utility power interruption.

The Kinetic Turbo Aerator offers 60 percent flow turndown resulting from an efficiently designed impeller and labyrinth seal using computation fluid dynamics and 5-axis machining of flow path components. Exceptional energy savings from "wire to air" provides customers with maximum air output for every kilowatt input.

For more information, visit www.kinetictraction.com

Metallurgical High Vacuum Announces ISO 9000:2008 Certification

Metallurgical High Vacuum Corporation (MHV) is proud to announce another milestone in their commitment to excellence: they were awarded certification attesting to establishment of their quality management system in conformance with the International Quality System Standard ISO 9000:2008, with a scope for Design and Manufacture of High Vacuum Mechanical Pumps and Rebuild of Mechanical Pumps. This was granted by American Systems Registrar, LLC., which is accredited by ANSI-ASQ National Accreditation Board.

Geoff Humberstone, MHV President, noted: "With independent registration of MHV by an outside auditor, you can be assured that we have committed to the highest standards in our operations, production, and management."

"ISO 9000 is the internationally recognized series of quality management system standards issued to date in 180 countries. Certification is especially important to our strategic business plans since MHV has been a vital partner in the heat treating industry for over for over 33 years. This provides our customers with

MHV Rebuilt Stokes 412 Vacuum Pump with filters

the confidence that our vacuum pump manufacturing and pump rebuilding services are at the highest level of quality."

MHV has pioneered the use of filters in new and rebuilt pumps to mitigate the effects of acids on pump life. They currently have over 37 Stokes 412 units with MHV filtration now exceeding 1 million hours on them, adding more profits to the bottom line with their extended life.

For more information, visit www.methivac.com

Vactor Joins AEM Vacuum Excavator Leadership Board

Vactor Manufacturing, a leading provider of vacuum excavators for utility, oil and gas, telecommunication and industrial water system applications, has announced its participation in the Association of Equipment Manufacturers' (AEM) Vacuum Excavator Leadership Group. The group was formed to develop essential marketing, technical and safety resources that will help the vacuum excavator industry segment continue to grow.

Promoting safe vacuum excavator operating practices is the top priority of the Vacuum Excavator Leadership Group. Additional areas of importance include statistics program development and equipment standards development. The group will also identify any means by which AEM may better support vacuum excavator products through existing or potential new programs, products or services.

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

"Vactor is honored to play such an integral role in this important industry group," said Ben Schmitt, product manager, Vactor Manufacturing. "With more than 19 million miles of buried utilities in the United States, it's essential that vacuum excavation equipment operators are proficient in the safe and proper use of the equipment to efficiently locate underground utilities while protecting vulnerable and expensive infrastructure. We look forward to sharing Vactor's insight and deep understanding of vacuum excavation technology and collaborating with our fellow industry leaders in this group to improve operator safety, performance and productivity."

Vactor Manufacturing produces the full-sized Vactor HXX Hydro-Excavator® and the compact Vactor HXX Prodigy® vacuum excavator. Vacuum excavation uses high-pressure air or water (hydro-excavation) to loosen soil, providing a non-destructive means to safely locate and uncover underground utilities and precisely excavate an area. The loosened soil is removed through a vacuum hose and deposited into a debris tank for disposal or backfilling. This increasingly popular method of excavation is widely used by utility contractors, municipalities, pipeline companies and other end-users.

The Vacuum Excavator Leadership Group is currently developing a vacuum excavator statistics program covering both truck-mounted and trailer units. Vactor is one of eight vacuum excavator manufacturers participating in the program. To date, the group has accomplished several key initiatives, including:

- Completion of vacuum excavator terminology and definitions
- Illustrations of the vacuum excavators for the standard
- Submission of vacuum excavation pictorials

For more information, visit www.vactor.com

Piab Introduces Single Bellows DURAFLEX® Suction Cups

Piab recently introduced a new addition to its range of dual durometer DURAFLEX® suction cups that promises to speed up robots and improve productivity. Designed with a single bellows, the new DURAFLEX® cup (10 to 110 mm) stays more stable when in motion, offering users the opportunity to run their robots or production lines at higher speeds, while maintaining a very high level of accuracy and precision.

DURAFLEX® suction cups combine firm bellows with soft, flexible lips made from a specially developed material that features the elasticity of rubber and wear resistance of polyurethane, making them particularly suitable for uneven and porous surfaces. The material's durability and elastic memory increase the longevity of cups, hence providing a higher return on investment (ROI). The material is mark-free and contains no Paint Wetting Impairment Substances (PWIS).

Dual durometer DURAFLEX® suction cups are designed with a single bellows for more stability in motion.

The single bellows version has a lower building height than the multi-bellows cups, making it easier to fit into space-restricted areas, such as robot arms picking from molds. Additionally, the single bellows provides a better lifting force, so each cup is able to lift heavier loads. This means that fewer cups can be deployed for a specific task, reducing the initial investment.

Their stable, yet flexible function enables the single bellows cups to meet the specific demands of a variety of industries, where they will improve productivity and reduce downtime. Not only do they reduce the risk of objects being dropped, but they also help reduce investment and energy costs, as their excellent sealing properties result in less leakage, allowing the use of smaller vacuum pumps.

Ideally suited for the high-speed unloading of parts with textured surfaces, such as molded plastic parts for car interiors, the single bellows cups can help plastics manufacturers to shorten the cycle time for injection molding. The improved stability also offers more precise placement of parts when the cups are used in holding fixtures. This improves the quality of the finished products, and will also result in fewer parts being scrapped, which in turn will improve productivity and reduce costs.

For more information, visit www.piab.com

For more ***Blower & Vacuum System Industry*** news, please visit www.blowervacuumbestpractices.com

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Hoffman & Lamson ENGINEERED-TO-ORDER MULTI-STAGE CENTRIFUGAL BLOWERS

By Clinton Shaffer, Associate Editor, Blower & Vacuum Best Practices Magazine

Hoffman & Lamson has been manufacturing multi-stage centrifugal blowers for a *long* time. Lamson was founded in 1880, and Hoffman was established in 1905. Now a single entity under the Gardner Denver Nash Division, the company has some serious resources to complement its 100-plus years of blower expertise.

"The real benefit for Hoffman & Lamson came when we became part of Gardner Denver Nash," said Nick Dorsch, Director of Global Product & Business Strategy at the Gardner Denver Nash Division, and Global Director for Hoffman & Lamson products. "As part of the Gardner Denver Nash Division, we've expanded the engineering, sourcing and procurement team for Hoffman & Lamson products. We bring materials savings to the table, and we've expanded the operations team from the standpoint of skill sets around engineering and building complete packages. We're also able to drive towards lean manufacturing and better operating principles."

So, what do those expanded capabilities mean for end users? As Nick Dorsch told Blower & Vacuum Best Practices, the direct result is an advance beyond blower manufacturing.

"Besides being a blower manufacturer — which is what a lot of our competitors are, and what we've been in the past — we are now able to be a solutions provider," Nick Dorsch explained. "Gardner Denver Nash's core competency is on the engineering side. Couple that with Hoffman & Lamson, and you are now able to build blowers and design the systems they go into, providing more value to the customer."

The company touted its custom engineering abilities at WEFTEC 2015. Their message was simple: "There is virtually no limit to the system specs or size that we can design, engineer and build." To substantiate the claim, the company developed an Augmented Reality app to demonstrate examples of custom-engineered blower systems. The app offers a 3D look at several systems — from a bird's eye view, all the way down to a close-up of every component — bringing massive, complex systems to a user's fingertips.

Blower & Vacuum Best Practices had an opportunity to visit Hoffman & Lamson's facility in Bentleyville, Pennsylvania. There, we saw what attendees witnessed at WEFTEC 2015 via virtual reality — large blower systems custom engineered to meet exacting specifications. During our tour, we got to see their ASME-certified testing lab, and discussed the Engineered-To-Order mentality that the company brings to each application. We also talked about some of the new innovations from Hoffman & Lamson geared for the wastewater treatment industry, including Rigel Controls for energy savings and blower protection.

ASME Test Booth for Multi-Stage Centrifugal Blowers

For years, engineers have been asking, "How do the blower manufacturers prove their energy efficiency claims?" And, with new blower standards on the horizon, it is becoming increasingly important to verify the performance of a blower before installation. Hoffman & Lamson has made a major investment in its testing laboratory to do exactly that — show customers precisely what they are getting, and how the entire package will perform.

"We have invested in our own ASME-certified test lab," Nick Dorsch explained. "And it's essential, because we have a lot of customers that want the ASME-certified test performed. They can come in and witness. We are completing the capability where they can remote witness. They could be sitting on the other side of the world, and visually see actual testing and results online."

The ASME-certified test booth is highly valuable for customers. Many other blower manufacturers have to outsource the testing, or simply take exception to it. Hoffman & Lamson can provide the testing as part of its design engineering process. However, as we learned from Terry Hole, C.E.M. (Certified Energy Manager) and Manager of Aftermarket – Centrifugal Products at Hoffman & Lamson, those value-adding capabilities did not come cheap.

"Gardner Denver Nash invested over one million dollars to construct a test lab with advanced testing capabilities and data collection," Terry

HOFFMAN & LAMSON: ENGINEERED-TO-ORDER MULTI-STAGE CENTRIFUGAL BLOWERS

Hoffman & Lamson's ASME-certified test lab.

told Blower & Vacuum Best Practices. "The addition of the lab brings added power capabilities, operating capabilities, instrumentation, flow measurement devices, and all types of safety devices. We also invested in the collection and presentation of testing data, making this a customer-focused test booth."

Terry Hole helped design and set up the test booth. Part of Lamson's blower business since it was based in Syracuse, he has been in the blower industry for 25 years. As he informed us, the lab in Bentleyville can test a wide range of voltages and motor hp requirements. In order to accommodate the lab, they actually had to bring in a special power feed from Allegheny Power, the local utility company, to provide the voltages necessary.

"We've designed our test booth for real-life simulation where you can bring the whole package in and test it as a complete unit," Terry Hole explained "Our booth has a lot of flexibility built into it. Plus, we can do vibration analysis and sound testing as well."

Testing Wire-To-Air Efficiency

Currently, Hoffman & Lamson tests its multi-stage centrifugal blowers to ASME PTC 10, which helps prove thermodynamic performance. However, PTC 10 has been deemed inadequate for measuring the energy spend of high speed turbo (HST) blowers, because it only requires the measurement of input power to the shaft — not the entire blower package.

Given that the impellers of HST blowers are attached to an extended motor drive shaft, and they need auxiliary devices — such as cooling pumps and air filtration units — PTC 10 does not accurately convey their energy footprint. As Terry Hole explained, PTC 10 "was more about what that compressor would deliver at the shaft level, and less about what the motor was doing." For these reasons, the company goes beyond PTC 10 when testing HST units by ascertaining the wire-to-air efficiency. And, since PTC

"We've designed our test booth for real-life simulation where you can bring the whole package in and test it as a complete unit. Our booth has a lot of flexibility built into it. Plus, we can do vibration analysis and sound testing as well."

— Terry Hole, C.E.M. and Manager of Aftermarket – Centrifugal Products at Hoffman & Lamson

13 is geared to address those issues, Hoffman & Lamson has allocated resources in its budget to upgrade the facility to meet those requirements.

When asked if the industry will get to the point where wire-to-air numbers will be a required part of an order, Terry Hole asserted that the industry "will demand it." He continued, "Whether it is PTC 13, or BL 5389, or ISO 1217, they're all similar aspects of wire-to-air, and something the customer will require."

Embracing an Engineered-To-Order Culture

When visiting their facility, one singular mantra was repeated quite often: "Engineered-To-Order." Given its own acronym (ETO), the phrase conveys a challenging concept — taking a customer's unique specifications and turning them into complete systems. In this regard, Hoffman & Lamson is mirroring the new blower standards by seeking to address more than just the blower and motor of the system.

"The blower and the motor are small parts of the package," Nick Dorsch explained. "There's a lot more to the package that the customer needs to get done — in one way or another. What we're able to do is incorporate our blower into an entire system, so they end up with an optimal design."

The company started to advocate their ETO capabilities right before WEFTEC 2015. Since then, that part of their business has picked up, according to Nick Dorsch. The company emphasizes bringing the most value possible to each customer. In the wastewater treatment industry, this type of partnership can be quite beneficial.

"We design blower systems all the time, whereas an individual treatment plant may do it once or twice in twenty years," explained Peter Klipfel, Marketing Director at Gardner Denver Nash. "We bring an expertise in being able to optimize that entire system, and that includes controls, VFDs, instrumentation and other components that are required in the installation. So rather than the customer trying to shop from ten

Hoffman & Lamson's custom-engineered blower package was designed for a demanding thermal hydrolysis application.

HOFFMAN & LAMSON: ENGINEERED-TO-ORDER MULTI-STAGE CENTRIFUGAL BLOWERS

different sources, we're bringing an overall optimized system together to be installed directly at the job site."

Engineered-To-Order System for Wastewater Treatment Plant

A great example of the ETO capabilities is a highly customized gas booster system the company designed for a wastewater treatment plant's thermal hydrolysis application. Thermal hydrolysis is a relatively new technique that treats the leftover solids at the end of the wastewater treatment process with high heat and pressure — effectively "pressure-cooking" them. The process weakens the cell walls of the solids, facilitating anaerobic digestion. Methane is produced during anaerobic digestion, and it is then captured and converted to steam for the facility's combined heat and power (CHP) plant.

For this particular project, the engineers needed to design a blower system to pressurize the methane to approximately 12 psig as a preparatory last step before converting it to steam. The system uses a coalescing filter to remove moisture, along with a bypass line and heat exchanger for controlling gas flow. As with many biogas applications, the process needed an explosion-proof motor starter and stainless steel componentry, including specialized valves, gauges and pressure transmitters.

Rigel Controls Present Blower Retrofit Opportunities

It isn't just Hoffman & Lamson's consultative engineering approach that can help wastewater treatment facilities optimize blower systems. Product innovation, including the introduction of Rigel Controls, has improved the processes at wastewater treatment plants as well. Designed for multi-stage centrifugal blowers, Rigel Controls can yield energy savings of 20 percent when compared to inlet throttling. The control system also helps unregulated blower installations prevent surge conditions, and comes with a number of benefits not available with traditional variable frequency drives (VFDs).

"We have about 25 Rigel installations out in the field now. They are all working very well, and we have a lot of open quotes for them," Nick Dorsch told us. "The Rigel can go as part of a new package, and it can also go into any multi-stage centrifugal blower installation. So whether it's our system, or one of our competitors, we can take a system that is already in place and upgrade it. This is where the bigger impact is:

Retrofitting blower installations with Rigel Controls can yield substantial energy savings.

It's an upgrade opportunity for existing wastewater and water treatment facilities to upgrade their existing systems with improved controls for energy savings, system monitoring and protection."

Essentially, Rigel is a speed control system for multi-stage centrifugal blowers designed to modulate the blower's operating speed based

on a number of parameters. Rigel can monitor and respond to most industrial process signals. Most importantly, it monitors and responds to the dissolved oxygen (DO) levels of aeration basins, ensuring the blower maintains proper airflow to achieve the DO set point. Since many wastewater treatment facilities monitor other engineering units, Rigel is also capable of controlling multi-stage centrifugal blowers based on metrics like pressure, flow and other generic parameters.

Another significant factor in blower performance is seasonal temperature change, which can have a huge impact. According to Terry Hole, as air gets colder, it becomes denser, causing the blower to produce more pressure and airflow. However, typical wastewater aeration applications don't require more pressure, so the end user needs to throttle it out to decrease pressure. Rigel can help control the blower to remove the need for throttling and save energy.

"As you're reducing the pressure, you're impacting horsepower tremendously. That's where the largest benefit can be found." Terry Hole explained. "When you get a large temperature swing — maybe the machine was sized for 100˚F inlet, and in the winter it is running at 40˚F inlet — you're getting so much more pressure, but you don't need that pressure."

Additionally, the ecology in an aeration system doesn't need as much air during the winter months, given that it is located in an area with seasonal temperature swings. Coupled with the fact that the blower is generating more air, the energy savings of 20 percent "is really a conservative amount." As Terry Hole said: "You're probably going to save around the neighborhood of 30 to 40 percent."

Also significant to note, each Rigel panel is programmed to a specific blower's performance curve to keep it running efficiently and to prevent surge — an unstable airflow condition in which a machine can no longer overcome the pressure that is developing internally. The potential for energy savings, combined with the surge protection and other features, helps to differentiate Rigel Controls from standard VFDs.

"The Rigel offers much more than a standard VFD. The Rigel optimizes efficiency, but it is the advanced features that really set it apart," Terry Hole told us. "We've added features into Rigel that protect the blower. Rigel can automatically adjust to prevent blower surge, while providing real-time monitoring for predictive maintenance. A standard VFD just doesn't have that."

Pictured is the home screen from a Rigel Controls interface.

Engineered-To-Order Blowers for Virtually Any Wastewater Application

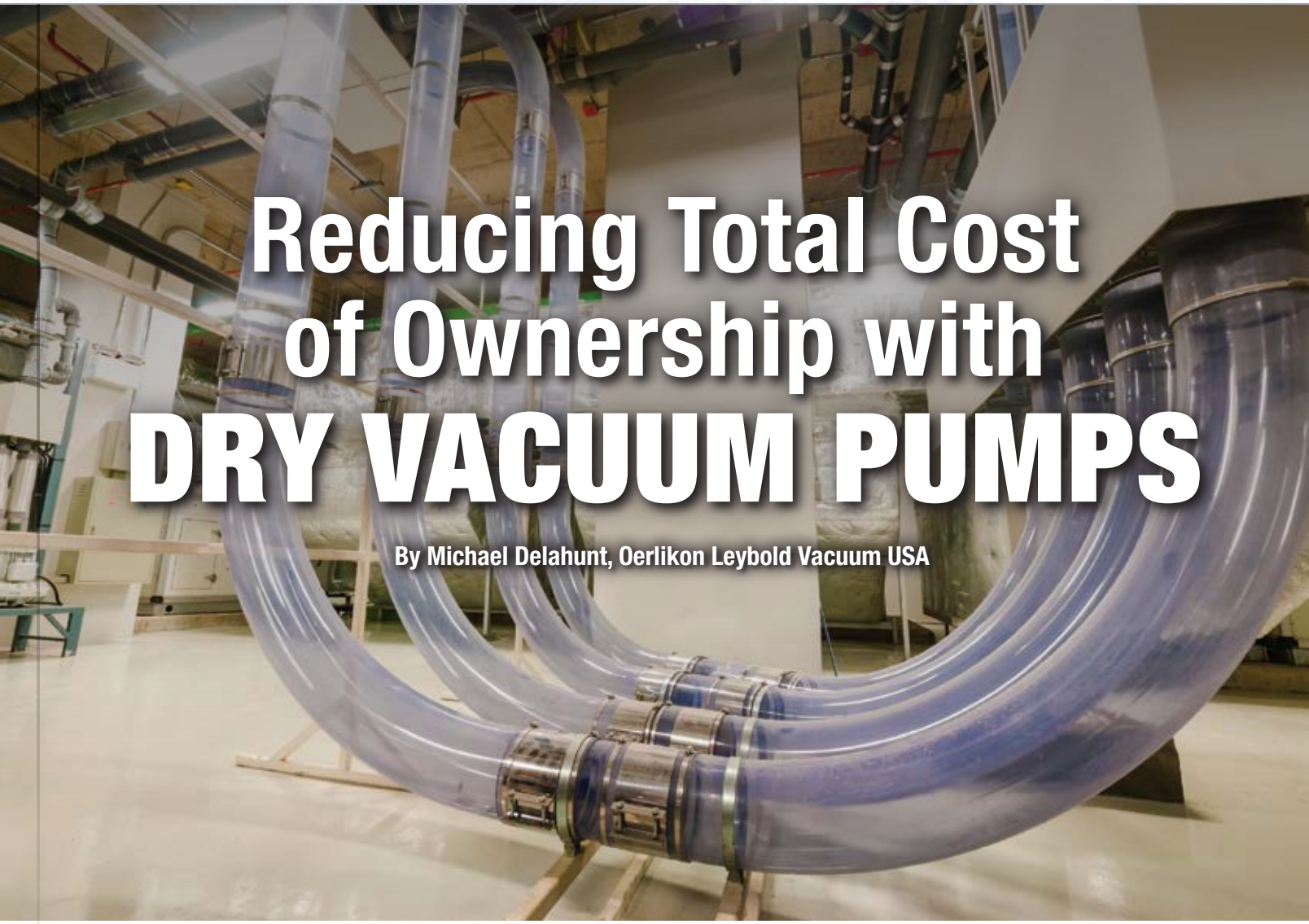
Blowers are the biggest energy-consuming piece of equipment in any wastewater treatment facility, which is a big reason why the technology is under such scrutiny. Engineers want to find the ideal blower solution for their application, but it is a tough task — especially without adequate standards. Add budgetary constraints to the mix, and the process becomes extremely challenging.

"A lot of people are continuing to try and do more with less," Nick Dorsch said. "What happens then is they have to prioritize what is worth doing in house and what needs to be outsourced. The system design and engineering that we deliver through Nash is part of the value we bring, because it is not necessarily their core competency."

In addition to the consultative engineering at Hoffman & Lamson, Rigel Controls can provide value by alleviating strain on a municipality's budget. The potential energy savings and improved reliability that come with blower controls make for an intriguing project with a great ROI. BP

For more information, contact Nick Dorsch, tel: (724) 239-1603, email: nick.dorsch@gardnerdenver.com, or visit www.HoffmanAndLamson.com.

To read more about ***Aeration Blowers,*** visit www.blowervacuumbestpractices.com/technology/aeration-blowers



Reducing Total Cost of Ownership with DRY VACUUM PUMPS

By Michael Delahunt, Oerlikon Leybold Vacuum USA

When it comes to industrial vacuum pumping applications, whatever material is involved in the process generally gets ingested into the vacuum pump. It's an inherent issue with any industrial vacuum application, whether it's simply moisture from inlet air, or something more tangible (i.e. dust, debris, etc.). Harsh vacuum applications — such as those that involve corrosive acids, excessive moisture, or dust particles — can wreak havoc on a vacuum pump's reliability. This holds especially true for oil-sealed vacuum pumps, rotary vane pumps and piston vacuum pumps.

Any material that enters an oil-sealed vacuum pump has the potential to seriously damage it. Dust mixes with oil to effectively form grinding paste that wears the pump down. Acid eats away at the pump. Water vapor changes state to liquid, and forms an emulsion that can rust out internal components. For these reasons, it is imperative to change the oil and filters frequently in oil-sealed vacuum pumps. However, frequent oil changes waste time and drive up total ownership costs.

There is an alternative technology to oil-sealed vacuum pumps that can remove the nuisance of changing oil, and significantly decrease cost of ownership. Over the last 25 years, dry compression vacuum pumps have dropped in capital cost, making them more accessible for more and more industrial processes today.

Dry vacuum pumps are not technically oil-free. Small amounts of oil are used within the gearbox to lubricate the gears and bearings, but oil is not used within the vacuum-generating mechanism. The oil is isolated from the pumping chamber by seals, therefore, no ingested material comes into contact with the lubricant. By removing oil from the swept volume, all the performance and maintenance issues associated with the oil can potentially be overcome. Consequently, the maintenance profile of dry compression vacuum pumps is quite different than that of oil-sealed vacuum pumps.

In this article, I discuss how dry compression works, and explain the various advantages of dry compression vacuum pumps, including greater accessibility, much lower cost of ownership compared to oil-sealed vacuum pumps, and dramatic differences in reliability.

Why Have Dry Pumps Gone Mainstream?

Dry pumps have been utilized successfully for more than 25 years, but were typically too small and/or expensive for all but the most arduous and high-value processes. However, the development of larger units based upon the experience of the first pumps — combined with the significant advances in machining technology for lower cost production of close-tolerance machines — has led to the development of cost-effective dry pumping capacity. Dry vacuum pumps — which can also be used in conjunction with mechanical boosters — can be used for applications that require a vacuum level to 1 x 10^{-2} torr or potentially even lower.

Why Should I Consider a Dry Vacuum Pump?

Dry pumps are more financially viable than ever, largely due to superior life-cycle costs over traditional oil-sealed vacuum pumps. The financial consideration is not derived solely from the initial purchase price (although these are becoming much closer), but critically from an operational perspective:

- Cost of Ownership (COO)
- Improved production efficiency

The aforementioned operational factors are unique to every user, their process, installation, and maintenance approach. However, the more arduous the process and its associated maintenance, the more compelling the financial prerogative to switch to dry compression vacuum technology.

Defining Total Cost of Ownership

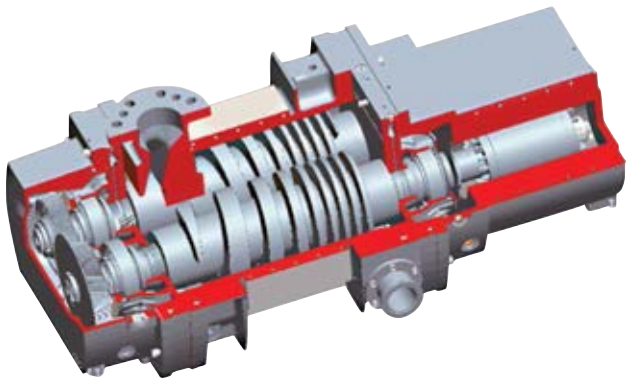
Before I outline the most common arduous application areas where dry pumping has the greatest impact, let me first outline the typical components that encompass Total Cost of Ownership.

1. Purchase Price: Dry pumps typically have a purchase price greater than their comparably sized oil-sealed equivalent. However, this premium for dry pumps has been reducing dramatically over the past few years. Twenty years ago, dry vacuum pumps were 2 to 3 times more expensive than comparable oil-sealed pumps. At the time of publication, they may be about 50 percent higher, and still coming down.

2. Maintenance Cost: Dry pumps typically require an annual gearbox oil change (2 to 3 liters). Oil-sealed pumps need periodic oil changes of a much larger volume. A typical 300-cfm piston pump requires 50 liters for every oil change, which occurs 2 to 4 times annually. Maintenance costs may also include the replacement of other consumable parts, such as filters.

Consider the impact of the increased maintenance on Total Cost of Ownership:

- Purchase of replacement oil
- Disposal cost of waste oil and filters
- Cost for replacement of consumable items
- Exhaust oil mist filters
- Exhaust clapper valves
- Oil filters / filter elements
- Lost production time
- Retention of required maintenance staff



The DRYVAC screw pump features rotors with a progressive pitch profile and an integrated, frequency-converter-driven, high-efficiency motor.

REDUCING TOTAL COST OF OWNERSHIP WITH DRY VACUUM PUMPS

Dry pumps typically need an overhaul every 4 to 5 years due to the fact that they have no touching parts, but this can be longer, depending on bearing life. Oil-sealed pumps have touching parts, and are lubricated and cooled by the pump oil. Consequently, they are very application dependent — the more difficult an application (more water, acid, dust, etc.), the more maintenance required. Generally, an oil-sealed pump's life-cycle costs are higher than their dry-running equivalent when used for arduous applications.

3. Energy Efficiency: The latest generation dry pumps — those utilizing energy-efficient motors integrated into the pump to eliminate less reliable rotating seals — offers an energy footprint in normal operation comparable to oil-sealed pumps. (Older generation dry pumps without advanced screw profiles or variable frequency drives (VFDs) have a higher installed power requirement and consumption).

Additionally, with the appropriate control, running in "stand-by" when the pumps are not required for processing allows additional energy savings and an extension of bearing life/service intervals.

Finally, some dry compressing vacuum pumps come in air-cooled models, eliminating the need for chilled water. Removing chilled water requirements can be a big incentive for many plants to make the switch to dry compressing vacuum pumps. They can also serve as a more energy-efficient and environmentally friendly alternative to steam ejectors.

4. Production Performance: Often overlooked when evaluating purchase price — but frequently the most important financial factor — is the impact upon production efficiency. I consider this to have three components:

A. **Downtime for Planned Maintenance:** The actual cost of maintenance was considered above, but this also has an impact upon effective production time.

B. **Unplanned Repair Work:** By definition, this stops production time until the non-performing item is rectified, even if it is the time to swap out for a spare. Not having a spare pump available may be an option, but in many cases this is not economically viable.

C. **Superior Performance:** In many applications, process elements affect the performance of the pump by extending the pump downtimes of oil-sealed pumps. Deterioration of performance has a direct impact on process time, and reliable, repeatable pumping can have a dramatic impact upon your production output.

What Applications Are Best Suited for Dry Vacuum Pumps?

Dry vacuum pumps are ideal for arduous applications — those that require more frequent oil changes due to the materials coming through the vacuum chamber. In this section, several common contaminants are addressed, along with how they impact oil-sealed pumps.

1. Water: Water vapor is unavoidable in the real world. During the operation of oil-sealed pumps, water vapor comes through the inlet and condenses in the vacuum pump, resulting in a mix of water and oil. Oil-sealed pumps have a finite water vapor pumping capacity, and although measures can be taken (with a gas ballast), this impacts performance and has its own limitations.

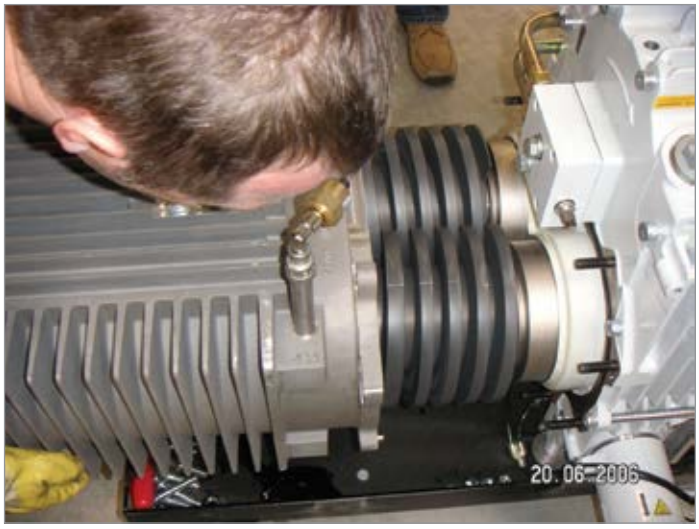
Dry vacuum pumps run internally hotter, so the water vapor doesn't condense within the pump. It is then exhausted, where the water vapor condenses and can be easily managed at atmospheric pressure.

2. Dust: Here is a simple equation that can be ruinous for an oil-sealed vacuum pump:

Vacuum Pump Oil + Dust = Grinding Paste

"The latest generation dry pumps — those utilizing energy-efficient motors integrated into the pump to eliminate less reliable rotating seals — offers an energy footprint in normal operation comparable to oil-sealed pumps."

— Michael Delahunt, Oerlikon Leybold Vacuum USA



Oerlikon Leybold's SCREWLINE screw vacuum pump features cantilevered rotors, enabling the easy cleaning of the gas compression stage by the user.

If your process creates dust and this gets into an oil-sealed vacuum pump, it will work to damage the pump where rotary motion occurs. The impacts on seals, bearings, vanes, pistons, and metal components impair their performance and increase the costs of repair, as they require replacement.

Inlet filtration can mitigate this issue, but this also has costs, impacts pumping performance, and cannot prevent fine dust from passing through into the pump.

Oil Degradation: If your process creates rapid oil degradation resulting in very frequent oil changes, removing the oil has huge benefits. Here are a couple of example processes:

- Rapid and repeated cycling (Thermal degradation)
- Chemical attack

Oxidant Pumping: The use of a Perfluorpolyether (PFPE) in pumping oxidants has been an industry standard for safety. PFPE is effectively mandatory when pumping gases with >21 percent oxygen content, however it has a number of issues:

- Very high cost
- Poor lubrication properties
- Very low surface tension, leading to a high propensity to leak

In these applications, dry pumps would also utilize PFPE, however the quantity would be much less, and the fluid duty is very different.

Making the Switch to Dry Compressing Vacuum Technology

While the *overall* cost of a dry pump can be cheaper than that of an oil-lubricated pump, there are often other, non-financial reasons for selecting a dry pump, including:

- Reduced noise and vibration
- Elimination of oil exhaust emissions
- Reduced footprint of pumping systems

Dry pumps offer a compelling alternative to traditional oil-sealed pumps in industrial applications, especially in harsh applications where the process creates high operational costs and/or reduces production efficiency. BP

For more information, contact Michael Delahunt, tel: (724) 205-8896, email: Michael.Delahunt@oerlikon.com, or visit www.oerlikon.com/leyboldvacuum/usa.

To read more about ***Medium Vacuum Technology,*** please visit www.blowervacuumbestpractices.com/technology/medium-high-vac

SHOW REPORT: VACUUM & BLOWER TECHNOLOGY AT PROCESS EXPO



By Roderick Smith, Blower & Vacuum Best Practices Magazine

Process Expo 2015 was held September 15-18, 2015 at the McCormick Place Convention Center in Chicago. Co-located with InterBev Process and the International Dairy Show, this event draws significant attendance from the food and beverage industries. Show producer, the Food Processing Suppliers Association (FPSA), announced final record attendance numbers with a total combined registration of 19,670 people and a total of 914 exhibiting companies occupying 334,820 net square feet.

"The most impressive feature of this year's PROCESS EXPO was the tremendous quality of customers in attendance," said Gil Williams, Chairman of the Food Processing Suppliers Association (FPSA) and President of Poly-clip System USA and Canada. "During the show we were able to meet with a number of important customers and sit down with prospects that we are confident will lead to new sales in the short to medium term, helping us close out 2015 on a strong note and jump start our sales efforts in 2016."

Oerlikon Leybold Vacuum

Oerlikon Leybold displayed their SOGEVAC® FP rotary vane vacuum pumps typically used in bulk, chamber and modified atmosphere packaging (MAP). They are also used by food processors with their massagers, marinaters, tumblers, blenders, vacuumizer and stuffer production equipment. Other food applications include bottling, freeze drying and vacuum cooking.

"Mink rotary claw vacuum pumps feature high levels of efficiency in terms of cfm per brake horsepower (cfm/bhp) while offering the benefits of a dry running design with no sealing or lubricating oil needed in the pumping chamber."

— Pete Kardok, National Sales Manager, Busch Vacuum Pumps and Systems

The benefits of the base SOGEVAC FP pumps include water vapor tolerance, extreme reliability represented by lifetime lubrication (up to 30,000 hours), simple maintenance and no oil losses due to an integrated oil return line. The SOGEVAC Hydro range is designed to allow high water vapor tolerance by use of two single or one large gas ballast. The SOGEVAC Oxygen range is designed for MAP and has hydrocarbon-free pump parts and inert PFPE oil filling.

Retrofitting vacuum boosters, in food packaging applications, with the RUVAC® WAU2001 FP booster pump is also a point of emphasis. Their model has compatible inlet/outlet connections for simple retrofit, wash-down duty IP55 motor, and an industrial-grade oil dipstick in lieu of typical exposed oiler cups. The units claim a 30% greater rated displacement over comparable models. What caught my eye is the robustness of the rotor. It has 13.7 mm of wall thickness at the shaft (compared with 4.9 mm with other models) to ensure greater durability and reduced rotor replacement. There are 5.5 hp and 10 hp models with nominal pumping speed ratings of 707 and 1,449 cfm respectively.

Busch Vacuum Pumps and Systems

The Mink series of dry-running, non-contacting rotary claw vacuum pumps has a strong presence in the food processing industry. National Sales Manager Pete Kardok said, "These units feature high levels of efficiency in terms of cfm per brake horsepower (cfm/bhp) while offering the benefits of a dry running design with no sealing or lubricating oil needed in the pumping chamber." Product literature, for the complete Mink range, states the pumping speeds go from 23.5 to 677 ACFM, vacuum to 15 Torr (29.3" Hgv) and pressure to 31 psig.

Recently introduced are three new Mink MV models with lower pumping speeds from 23.5, 35.3 and 47 ACFM. The ultimate pressure on these units is 30 Torr. All three models are fitted with a frequency converter and synchronous drivetrain as standard equipment. The control settings of the Mink MV can be adjusted to match the process exactly. Applications for these small horsepower dry units include where vacuum venturis, liquid ring and carbon-vane pumps are used.

Parker Gas Separation and Filtration

Personnel from Parker's GSF Division have always impressed me with their application and end use knowledge. Brian Weltman has spent years helping factories with point-of-use filtration applications where "things happen to air quality" by the time it gets to the production equipment. We reviewed their sterile air filtration systems and the very innovative CAMTU compressed air microbial test unit. Food and beverage processors have no tolerance for microorganisms and use their sterile filters. The CAMTU then permits on-site testing of the compressed air to ensure the specifications are being met.

Michael Kinnucane is also a tremendous resource with his background in nitrogen generation systems. Should a food packager have 99.99999% nitrogen purity or 99.9%? Application engineers with his experience have the answers and more importantly know how to ask the packagers all the right questions regarding their process. Getting nitrogen purity right is paramount to food safety and shelf life – while not over-killing purity can significantly help the energy efficiency of on-site nitrogen generators.

Kaeser Compressors

Kaeser continues to expand their presence in the food industry. Their booth featured the BB89C Trilobe Omega blower package. This unit produces pressures to 15 psig and vacuum to 15" Hg. Its spec sheet

Jim Hupp, Michael Delahunt and Mario Vitale presented SOGEVAC® FP rotary vane vacuum pumps at the Oerlikon Leybold Vacuum booth (left to right).

Pete Kardok, Tom Grommersch and Chris Napier in front of their R5 25 hp vacuum pump at the Busch Vacuum Pumps and Systems booth (left to right).

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"Corning launched a formal Global Energy Management program in 2006. U.S. operations consist of nearly 50 facilities. These management practices have saved more than $328 million in cumulative energy costs."

– Patrick Jackson, Director of Global Energy Management, Corning Inc.

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VACUUM & BLOWER TECHNOLOGY AT PROCESS EXPO

states 5 to 20 hp, 85 to 270 CFM. The Omega Tri-lobe blower profile is a proprietary Kaeser design providing significantly reduced pressure pulsations and lower noise levels. Lower pulsations can mean less stress to sensitive process equipment. The units all come with standard and conservatively-sized EPAct compliant TEFC/IP-55 motors.

The booth also featured their full range of variable frequency drive rotary screw air compressors and a new AS20 belt-drive air compressor with significantly increased efficiency. Their new Sigma Control 2 master controller was on display as was a very cool new "golden" Sigma Profile airend.

ISEL Lubricants

ISEL has recently impressed me as a very technically sound company with a real focus on agility and customer service. I enjoyed speaking with the Sandler Brothers, Michael and Dan, at their booth about air compressor and food-processing lubricants. Their air compressor lubricants are formulated to withstand tough ambient conditions and are rated at 100% fluid life at 212˚F (100˚C). Their standard synthetic formulations have a typical fluid life of 8,000 hours with their extended-life air compressor lubricant rated for 12,000+ hours according to their literature.

Their food-grade formulations are non-toxic and non-hazardous so they can be disposed of in the same manner as mineral oils. They meet H1 requirements for incidental food contact as well as Kosher and Halal specifications. One formulation catching my eye is their advanced food-grade air compressor lubricant providing 8,000 hour fluid life at 212˚F (100˚C) discharge temperature. The standard food-grade lubricant is rated for 4,000-6,000 hours.

Conclusion

The Food Processing Suppliers Association (FPSA) is a global trade association serving suppliers in the food and beverage industries. FPSA members are organized in vertical industry councils focusing on specific needs and concerns that are unique to each industry sector. FPSA councils currently represent the Bakery, Beverage, Dairy, Prepared Foods and Meat sectors. For more information on FPSA visit www.fpsa.org. For more information on the Process Expo 2017 visit www.myprocessexpo.com. BP

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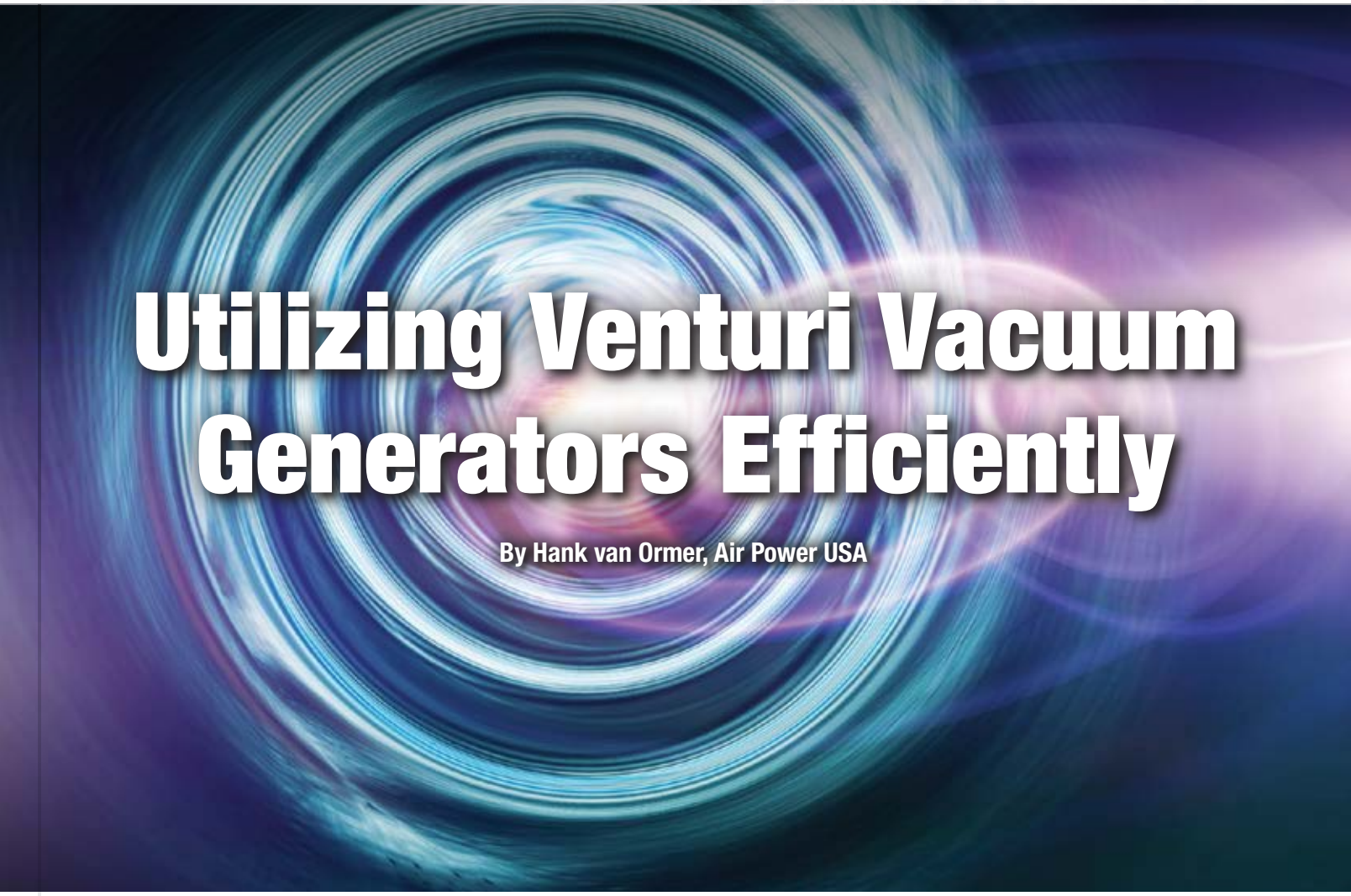
Tony Witter, Rob Williams, Mike Houston and Drew Johnson guarding their new "golden Sigma Profile airend" at the Kaeser Compressors booth (left to right).

Brian Weltman and Michael Kinnucane reviewing sterile compressed air filtration systems and the CAMTU compressed air microbial test unit at the Parker GSF booth (left to right).

Michael Sandler and Dan Sandler reviewed food-grade air compressor lubricants at the ISEL booth (left to right).



Utilizing Venturi Vacuum Generators Efficiently

By Hank van Ormer, Air Power USA

Air-driven Venturi vacuum generators have long been a viable option for fast-response, localized, vacuum-powered systems. Through the last decade, they were considered convenient and flexible solutions with quick response time. However, they were not regarded as energy efficient, probably due to their use of compressed air. Extensive product development with this equipment, particularly the crucial system accessories, often makes the selection of the most energy-efficient items difficult for many localized operations. In this article, we look at proper application and control of Venturi vacuum generators, including a brief introduction to the technology and a case study with energy calculations.

When the 18th century Italian physicist Giovanni Venturi discovered that when air is forced through a conical nozzle its velocity increases and the pressure decreases, neither he nor anyone could conceive that it would ultimately spawn one of the most used and most highly controversial products in industry today — the Venturi vacuum generator.

Many end users, through misinformation, do not fully understand the benefits of this product, or — more importantly — the limitations. To further confuse the issue, various manufacturers call them different names (i.e. pumps, ejectors, vacuum transducer pumps, etc.). The most accepted general category name, in our opinion, is Venturi vacuum generator, which describes exactly what it does.

To some, it is the greatest thing since sliced bread. To others, it is a constant waste of air. In the real world, the truth lies somewhere between these extremes, depending on the application. Continuous product development by industry leaders has made these products, when properly applied, not only convenient and responsive, but often the most energy-efficient selection.

How Do Venturi Vacuum Generators Work?

In its simplest form, the single-stage Venturi generator flows air through a conical Venturi orifice. As the compressed air leaves the conical orifice restriction to the larger open lines, the pressure falls, and the velocity increases. The intensity is such that a vacuum (lower pressure than ambient air pressure) is formed and air to be evacuated from the process is pulled into the flowing airstream and blown out.

The Venturi vacuum generator has many advantages, including:

- No vibration
- No heat generation
- No moving parts
- Vacuum is on and off immediately with the air supply
- Tolerates aggressive conditions very well
- Low cost
- Quick to repair or replace
- Can be located very close to the process, reducing the amount of evacuation air and offering faster cycle times
- Lightweight and mobile
- No electricity required
- Quick changeover time for service and/or component swapping

Single-stage vacuum generators use compressed air by accelerating it through the restrictor tube to create a Venturi effect, which evacuates the required volume of air. These single-stage Venturi generators are somewhat limited in their ability to fit many applications efficiently, since their basic design is set to accommodate either the highest flow or highest evacuation volume requirement. Typically, this type of vacuum generator has a ratio of compressed air consumption (scfm) to vacuum flow (the rate at which atmospheric pressure is removed from a system) of no better than 1:1, and sometimes as high as 2 or 3:1.

Multi-stage vacuum generators were developed to improve this efficiency for many applications. The multi-stage units use a series of ejectors and nozzles that allow compressed air to expand in controlled stages. This usually improves the ratio of compressed air consumption to vacuum flow to a level of about 1:3 or better. Multi-stage units are also significantly quieter and can develop vacuum at lower pressure. This performance will reduce compressed air flow required under the same conditions and/or decrease reaction time and increase productivity.

Coaxial is a multi-stage vacuum generator with the multi-stage valves installed around a coaxially covered tube that significantly streamlines the flow profile through the generator. This design allows the coaxial cartridge to meet and deliver many different flow and pressure requirements. In many cases, the coaxial cartridge inside the generator body can be exchanged with another to allow the same hardware to meet varying conditions with optimum energy efficiency at relatively low cost.

Best Practices for Energy Efficiency

As with many products that do not have a very large capital investment requirement, Venturi vacuum generators, when properly (or improperly) applied and operational, can have a significant impact on energy costs.

Let's review the basic operating characteristics of vacuum generators with regard to compressed air energy efficiency. Unlike mechanical vacuum pumps, whose energy input falls as the vacuum levels go below 14" of Hg, the air-driven vacuum generators will always use more compressed air to reach lower vacuum, because it must remain on (flowing air) longer. In fact, the average Venturi vacuum generator will require 10 times as much energy to increase the level of vacuum from 18" to 27" Hg.

Therefore, it is always an operating advantage to:

- Identify the lowest required vacuum, hold it there, and try not to exceed it.
- Reach this level as fast as possible.
- Engage an automatic compressed air shut off if possible, once at the required level.

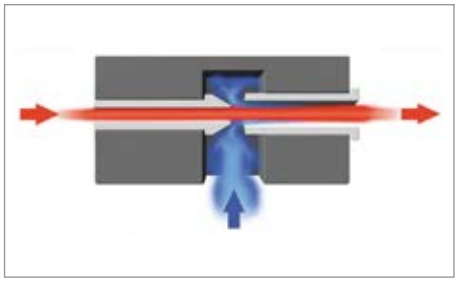


Figure 1: Typical single-stage Venturi vacuum generator

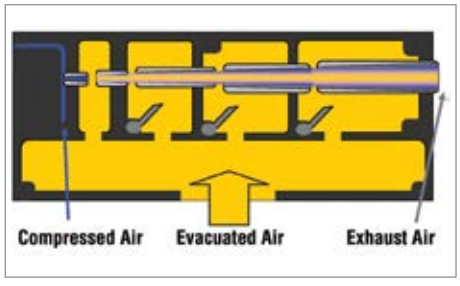


Figure 2: Typical early multi-stage Venturi vacuum generator

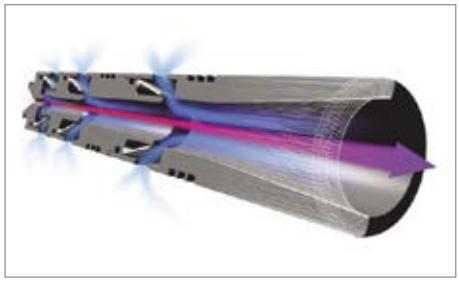


Figure 3: Coaxial multi-stage vacuum generators provide effective air vacuum removal ratios.

UTILIZING VENTURI VACUUM GENERATORS EFFICIENTLY

To accomplish this, some important data is necessary:

- Total volume of system to be evacuated — lines, cups, leaks, etc.
- What is the minimum optimum operating level of vacuum required? This is very important and well worth testing if required.
- How fast do you have to reach this vacuum?
- Do you anticipate any changes in required cycle time in the near future? This information will allow proper line size identification and the proper multi-stage pump selection.
- What types of controls are needed? What are the limitations?

Venturi vacuum generators should generally be located as close as possible to (or on) the actual process:

- An effective Venturi generator offers great flexibility in a decentralized system when well controlled.
- With a decentralized system and Venturi generators mounted close to the suction cups, losses (caused by hoses, bends, fittings, valves, filters, etc.) are eliminated.
- When a proper system design strategy is implemented, it will take advantage of the ability of the Venturi vacuum generator located near the process to react quickly and pull the required vacuum quickly, then shut off the air supply whenever possible.
- Utilizing the current state-of-the-art Venturi vacuum generators (with low-pressure inlet compressed air, auto shut off of the air supply, reduced size, and better cup choices to use the lowest possible vacuum level), changing to a central vacuum system is rarely an efficient choice with regard to compressed air use, energy use, and productivity improvement.

Properly Applying Vacuum Technology to Reduce Energy Costs

Recently developed coaxial multi-stage can be properly applied to lower inlet compressed air pressure, resulting in less compressed air use to generate a similar vacuum level. Coaxial pumps are often interchangeable with a body, allowing easy and economical change in performance to fit new situations (i.e. inlet pressure, evacuation rates, etc.).

The majority of evacuation time is from 12" Hg and deeper vacuum. The increase in the level of vacuum *from* 18" to 27" Hg is 10 times more. Therefore, use a lower vacuum level with larger cups whenever possible. Proper cup selection is very critical to optimize the operating costs and productivity, and new vacuum cup technology continues to expand the opportunities.

Any time you have to run a vacuum generator, it uses compressed air. Conversely, once the full vacuum is reached, it is very energy efficient to shut off the air line to the vacuum and, with proper valving, hold the vacuum without using any air. Some porous materials will not allow this, but many materials do.

Many times these controls are through a PLC software program supplied by the machine manufacturer. There are also vacuum generators with the auto controls totally integrated with the generator housing.

There is a very common error we discover during full plant system analysis. Plant

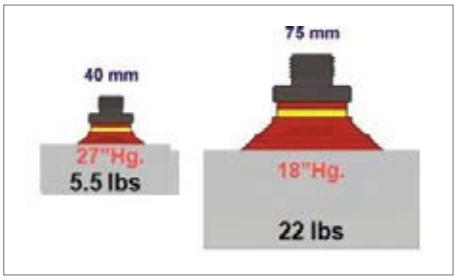


Figure 4: Larger cups at lower vacuum levels will lower energy costs and increase holding force. Less force on cup = longer life.

> "There is a very common error we discover during full plant system analysis. Plant personnel are told to shut off the vacuum generator when not needed — so they close the vacuum line to the process, and the compressed air continues to blow."
>
> — Hank van Ormer, Air Power USA

personnel are told to shut off the vacuum generator when not needed — so they close the vacuum line to the process, and the compressed air continues to blow. We find this evident over 40 percent of the time in situations like: new production machinery just delivered; older production machinery whose systems have been upgraded; and newly installed air-driven Venturi generator systems on older production machinery. The ultimate irony is in many cases we find the shut off control on the air line on some and the vacuum line of other on the same machine.

Case Study: Automatic Controls for Robotic Palletizers

On a recent plant audit, a set of six palletizers, at the end of packaging lines, were reviewed. Each palletizer has a robotic arm with six suction cups and two Venturi vacuum generators, both running and drawing 6 cfm at 60 psig.

A software program had the robotic arm pick up the slip-sheet from the side and hold until the signal from the pallet activated. The slip-sheet was then set down and released, and the air was shut off. The robotic arm then went immediately to the stack and picked up another slip-sheet, holding it until the next release signal.

The result of this was an average over an hour of holding and movement with the compressed air on 52 seconds, and an average of 9.3 seconds of movement with the air off. Average cycle time was 61.3 seconds.

The basic operating data included:

- Production hours = 6,240 per year
- Blended annual power rate = $0.115/kWh
- Two single-stage vacuum generators at 6 scfm each; full flow at 60 psig per palletizer for a total of 12 scfm each unit
- Air on/off time total = 52 seconds on + 9.3 seconds off = 61.3 seconds
- Annual operating hours air and suction on: 85% time x 6,240 hours = 5,304 hours/year
- Average cfm: 52 seconds ÷ 60 seconds = 87% of full load flow / 5.2 scfm each valve open, or 10.4 scfm for 2

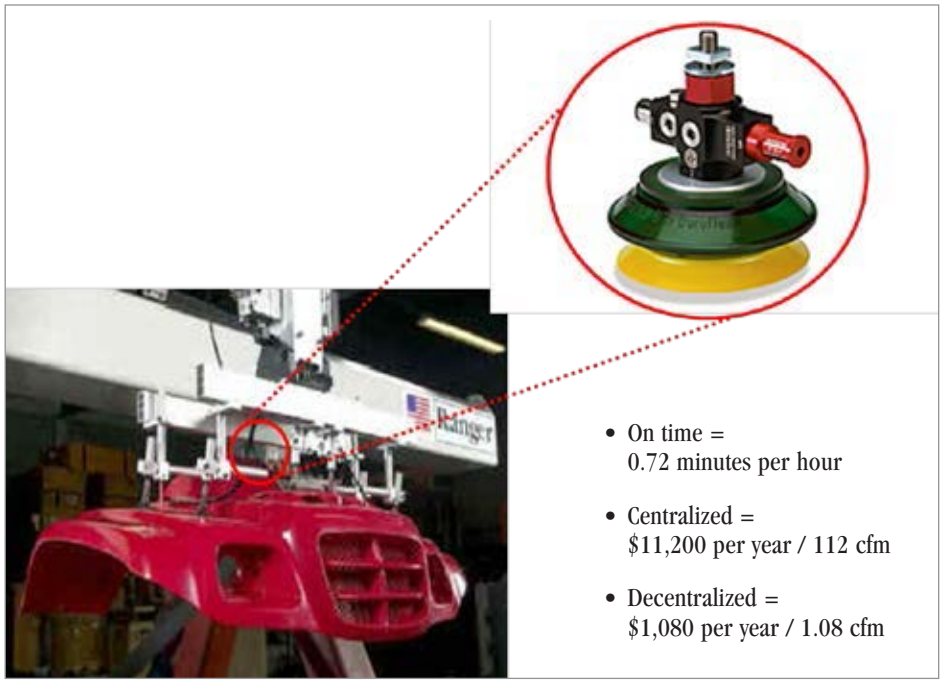


Figure 5: Venturi vacuum generator with auto start/stop

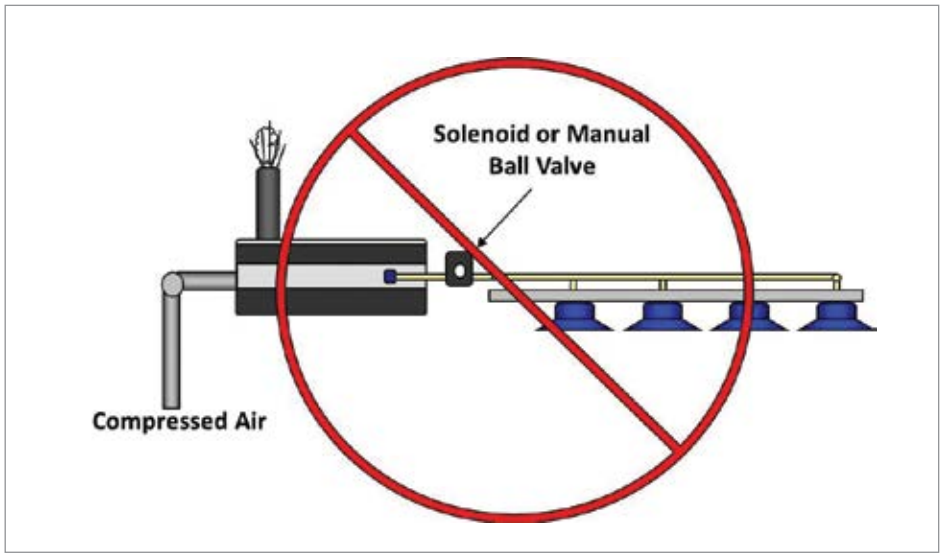


Figure 6: Shut off the air supply, NOT the vacuum line.

UTILIZING VENTURI VACUUM GENERATORS EFFICIENTLY

- Annual electrical energy operating cost: 10.4 ÷ 4 each/scfm = 2.6 hp for each palletizer, or 2.6 hp x .746 ÷ .90 = 2.16 kW input energy
- 2.16 kW x $0.115/kWh x 5,304 hours/year = $1,318/year per unit
- Total for six units = $7,908/year

Our first suggestion to the plant was to change the software program so that the operating profile was on just the 15 percent of the time and off 85 percent of the time. This provided potential annual electrical energy savings of:

- 2.16 kW x $0.115/kWh x 936 hours = $233/year
- $1,085/year electrical energy savings each unit ($6,510/year for six units)

This was only figuring the electric energy cost savings that goes immediately to the bottom line. There were no allowances for the other compressed air costs (i.e. maintenance, repairs, depreciation, etc.). The reply was immediate: *"There is no way anyone is going to touch that software. This machine was made overseas, and no one here is trained on it. End of discussion."*

Our next suggestion had a little more bite. Replace the current Venturi vacuum generators with one vacuum generator integrated system with a built-in auto shut-off system. This type product is a Venturi vacuum generator packaged with accessory components to automatically shut off the air supply when the target vacuum is reached, and restart (if required) to hold the vacuum. Complete automatic control is accomplished within the vacuum generator assembly, and there is no requirement to modify or touch the host machines control software. With the same operating conditions, we now have the following operating electrical energy cost analysis for compressed air use:

- Production hours of 6,240 per year
- Power rate of $0.115/kWh
- One auto stop Venturi vacuum generator with a full load flow = 10.4 scfm at 60 psig
- Suction time: 85% of 6,240 hours/year = 5,304 hrs/year
- Generator compressed air on time of 0.7 seconds / 50 seconds / 0.12 minutes = 0.72 minutes/hour
- 0.72 minutes per hour (0.72 ÷ 60) = .012% hours
- 5,304 production hours suction or 5,304 x .012 = 64 hours/year air on

Average scfm flow

- Full load flow of 10.4 scfm
- Actual flow of .012 minute = 10.4 scfm x .012 for .125 scfm each generator
- Total for six units = .750 scfm (÷ 4 hp/cfm input power) for .187 average hp (x .746 ÷ .9 ME) of 0.155 average kW input
- Annual electrical energy cost of operating six units (0.187 kW x $0.115 /kWh x 64 hours) = $11.40/year

The applications went from an annual electrical energy operating cost of $7,908/year for six units to $11.40/year for six units. Or, from a significant to an almost insignificant cost by changing to a more appropriate type vacuum generator for the conditions, including proper, well-sealed cups. BP

For more information, contact Hank van Ormer, Air Power USA, email: hank@airpowerusainc.com, or visit www.airpowerusainc.com.

To read more about ***Vacuum Generation,*** please visit www.blowervacuumbestpractices.com/system-assessments/vacuum-generation

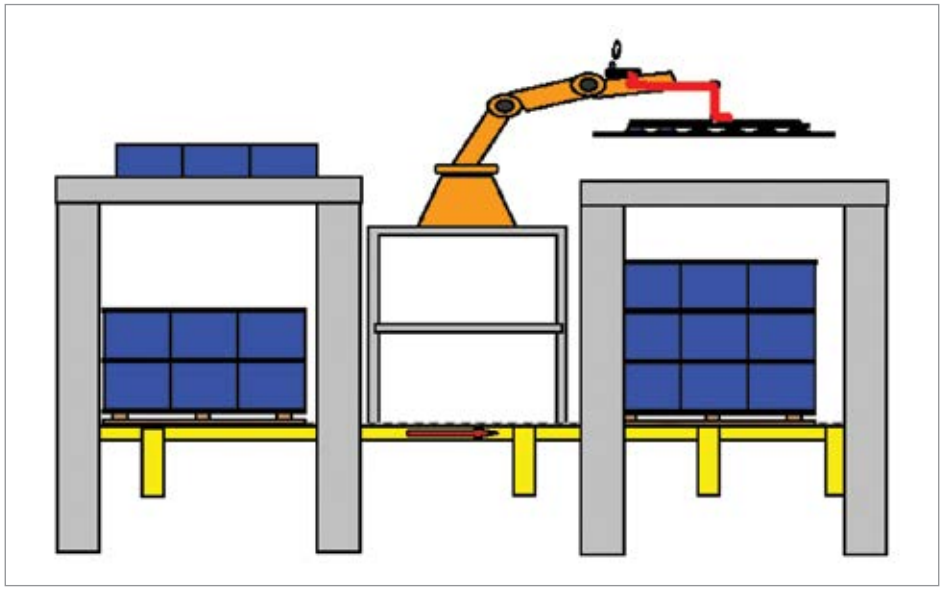


Figure 7: Packaging line palletizers with auto shut off Venturi generator

SHOW REPORT

AERATION AND INDUSTRIAL BLOWERS AT WEFTEC 2015

the water quality event™

By Clinton Shaffer, Associate Editor, Blower & Vacuum Best Practices

The team at Blower & Vacuum Best Practices Magazine recently made a trip to McCormick Place in Chicago, Illinois, to check out the Water Environment Federation's 88th annual Technical Exhibition and Conference (WEFTEC).

Held in McCormick's 312,000-square-foot exhibit hall, WEFTEC 2015 set records in both attendance and exhibition numbers with 25,048 registrants and 1033 exhibitors. It also offered more than 130 technical sessions, 29 workshops, and a plethora of other events.

"For more than eighty years, WEFTEC has been the world's leading forum for water quality management. It's the place to innovate, exchange knowledge, and connect with experts from across the continent, and around the world," said WEF Executive Director Eileen O'Neill. "The record-breaking success of this year's event is a testament to the value, diversity, and depth for which WEFTEC is known and respected."

Exhibitors maintained a keen focus on energy management for wastewater treatment plants (WWTPs) and wastewater treatment applications for industry. When discussing either of those topics, aeration blowers become a central topic. As such, we scoured the exhibition hall to cover some of the newest and most exciting blower technologies the show had on display. Blower manufacturers we visited

AERATION AND INDUSTRIAL BLOWERS AT WEFTEC 2015

Darrel Hill, National Sales Manager, Aerzen USA, standing next to a positive displacement DeltaBlower

Carmen Cerrelli, Sales Engineering Manager, APG-Neuros, standing alongside an NX Series Air Bearing Turbo Blower

The Atlas Copco team standing in front of their newly introduced ZB blower

included Aerzen, APG Neuros, Atlas Copco, Gardner Denver, Howden Roots, Kaeser, Lone Star Blower, PillAerator, and Sulzer.

Aerzen

Facility management professionals at WWTPs are asking one key question: "How can I make a zero net energy (ZNE) plant?" Part of the answer lies in the blower system at the plant. Many people are turning to turbo blowers as the answer, but, as we learned during our discussion with Ralph Wilton, Marketing Manager at Aerzen USA, simply switching to turbo blower technology doesn't automatically generate energy savings.

Using turbo blowers in facilities not designed for the technology is analogous to installing an Apple program on a Windows platform — even with careful oversight, issues commonly arise. In addition, the issues can be exacerbated in smaller facilities, which may lack the resources required to program the electronics of a turbo blower. One solution to these issues, according to Wilton, is a hybrid blower, which is a combination between positive displacement (PD) blower technology and screw compressors. These alternatives reach higher pressure ranges than traditional PD blowers while generating nearly the same energy savings as their more contrived turbo blower counterparts.

Wilton also stressed the need to be careful when integrating turbo blowers. They need to be vertically integrated by starting on the demand side and working back to the supply side. A WWTP designed around the demand side is much more efficient — and less problematic — than one that installed a turbo blower retroactively without careful consideration. Turbo blowers, when properly applied, can result in significant energy savings.

APG-Neuros

As previously mentioned, turbo blowers have proved to generate significant energy savings at WWTPs. APG-Neuros, a prolific manufacturer of turbo blowers with installations doubling to 1000 total over the last three years, presented several technologies at WEFTEC 2015. Notably, the company presented a remote monitoring system to help monitor energy performance and provide preventative maintenance. The system can be connected at an individual blower, at the master control panel, or at the SCADA level, and it streams real-time data to engineers at APG-Neuros. They can then ensure optimal performance by analyzing trends and detecting any abnormalities.

Also on display was APG-Neuros' upgraded NX Series Air Bearing Turbo Blower, which, according to Elana Podvalniuk of APG-Neuros, has undergone small and incremental improvements. The patented air-foil bearing is a prominent feature of the NX Series of turbo blowers. It does not require lubricating oil, removing the need for the associated maintenance. In addition, it runs quietly with little vibration from the rotors during operation.

Atlas Copco

There was a lot of buzz around the Atlas Copco booth — and for good reason. At WEFTEC 2015, they unveiled the new ZB 100-250 VSD Direct Drive Centrifugal Air Blowers, in addition to announcing an extended range of screw blowers. Tamas Bakos, Product Manager at Atlas Copco, spoke with us about the recently introduced ZB blower packages. According to Bakos, there is a big shift from air-foil to magnetic bearing technology, largely because aeration applications demand safety and reliability above all else.

The ZB series of blowers replaces Atlas Copco's legacy HSI units, providing better safety systems with a shaft that is more resistant to large electrical shorts. The ZB blower packages offer a wide capacity range and good efficiency, resulting from the VSD controls. The Elektronikon® system is also worth mentioning, as it allows monitoring for the entire blower installation.

Atlas Copco's other announcement involved its positive displacement screw blowers. According to Bakos, "it is very important for Atlas Copco to see how units work in the field," so the company gathers data for each vertical market before releasing it. This was certainly a painstaking process for Bakos as the Product Manager of the new ZB blowers, and that is what Atlas is currently doing for its extended line of screw blowers, which are set for release in February 2016.

Gardner Denver

While many of the exhibitors focused on blower packages for WWTPs, Gardner Denver presented a unique technology that can be used in blower packages and for OEM integration. In our talk with Kenny Reekie, Product Manager – Blower and Vacuum Products, Gardner Denver, he told us that Gardner Denver is the only manufacturer to make its blower available in "bare blower form" for use in OEM applications. He also emphasized Gardner Denver's long-standing history with blower technology. The company made its first rotary screw blower in 1958, it was first to market with helical lobe blowers, and has been improving those products ever since.

Gardner Denver Product Manager Kenny Reekie presenting their recently improved CycloBlower® H.E. Series

Mike Neiswender, Sales Manager at Howden Roots, presenting his company's centrifugal wheel split-vane technology.

Kaeser's team standing by a live demonstration of their BBC and CCB Series blowers

AERATION AND INDUSTRIAL BLOWERS AT WEFTEC 2015

Standing at the Lone Star Blower booth (left to right), James Cook, VP of Sales, and Andrew Balberg, President

Standing in front of the PillAerator MP 6000 magnetic bearing blower (from left to right), Manuel Dias, Glenn Shultz, Matt Timber, and Chris Whitman

Presenting the Sulzer ABS HST 20 Turbocompressor (left to right), David Berthiaume, HST Group Manager, Dave Parsons, Product Manager and Edward Paro, Portfolio Manager.

Gardner Denver's CycloBlower® H.E. Series of positive displacement blowers was prominently on display at WEFTEC 2015. The CycloBlower series recently expanded with new models capable of tackling up to 2650 cfm at 36 psi. The blowers also feature three different housings, or discharge ports, capable of customizing the unit based on specific performance needs. The three energy efficiency "sweet spots" for the discharge port options are at approximately 1900 cfm at 8 psig, 2300 cfm at 16 psig, and 2500 cfm at 30 psig.

Howden Roots

We also had the chance to catch up with Tim Hilgart, Sales Manager at Howden Roots, at WEFTEC 2015. Off the heels of an acquisition, Howden Roots was at the show presenting its traditional product line of Roots™ Blowers, Compressors and Controls. The Howden product line covers both industrial and municipal operations with a comprehensive range of blowers, starting with the Universal RAI Blower — which covers flows up to 2370 cfm — and continuing all the way up to heavy-duty gas blowers like the RGS-J capable of hitting flows up to 43,200 cfm.

These blower systems also come with aeration controls and services designed to help clients save energy and continually tune their aeration process. As conditions and plant demands change, so do the performance requirements of a blower system. With that in mind, Howden provides service contracts that include preventative maintenance, system monitoring, and on-site field service.

Kaeser

At WEFTEC 2015, Kaeser Compressors was advocating a "split system" approach to the design of WWTPs. During our visit to their booth, Michael Camber helped explain the concept, which entails using a master controller, several fixed-speed machines, and a variable frequency drive (VFD) blower. As the overseer of the system, the master controller modulates the VFD machine based on the pressure signal, while the fixed-speed machines run constantly at their energy-efficient "sweet spot." According to Camber, the introduction of the SAM 2, Kaeser's new master controller, will help bring that type of intelligence to blower systems — particularly wastewater treatment facilities.

The Kaeser booth had a working split system in place, with a CB 131C Blower and a BB 69C Blower being controlled by a SAM2 unit. The smaller BB 69C Blower can provide flow rates between 60 and 209 cfm at pressures up to 15 psig, while the CB 131C Blower can provide the same pressure at flows between 159 and 419 cfm. Each model is a tri-

lobe blower from Kaeser's Omega blower family, and their live operating statuses were visible on the SAM 2 located close-by.

Lone Star Blower, Inc.

Lone Star Blower, Inc. made their debut at WEFTEC 2015 in Chicago, seeking "to drastically change the competitive landscape in the blower industry." Founded by 20-year industry veterans and partnered with world-class principals with over 2500 installations, Lone Star seeks to offer a high service alternative and the widest selection of technologies to customers in North and South America.

The booth featured the world's only 500-hp air-foil bearing gearless turbo and a modern-designed geared turbo blower with variable inlet and discharge guide vanes. Lone Star also manufactures a full line of multi-stage turbo blowers. These efficient turbo technologies range from 20 to 4000 hp. According to Andrew Balberg, President of Lone Star Blower, the addition of complete aeration process controls is expected to drive market growth in many industries, including wastewater treatment.

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AERATION AND INDUSTRIAL BLOWERS AT WEFTEC 2015

Piller TSC Blower

Business has been going well in the U.S. for the folks at Piller TSC Blower. Since their first WEFTEC show in 2011, where they presented one machine in a half-sized booth, their sales have doubled every year. When talking with Glenn Schultz, National Sales Manager at Piller TSC, he mentioned that they are now entering industrial markets, including yeast fermentation facilities.

In our discussion, Schultz also weighed the benefits and drawbacks of magnetic bearing centrifugal blowers and air-foil bearing machines. "They both work," he said, "But it has to be the right application." For yeast facilities, Piller's magnetic bearing machine, a centrifugal blower, is ideal because it doesn't use the dirty and corrosive ambient air. While magnetic bearing machines have had maintenance issues during power outages, the design engineers at PillAerator have worked to address those problems. Instead of letting the bearing fall, PillAerator blowers have a brake mechanism that secures the shaft.

Sulzer

The team at Sulzer presented the newest version of their HST 20 family of blowers — the third generation of the technology. We spoke with Dave Parsons, Product Manager at Sulzer, about the new features and capabilities of the HST 20. With advanced electronics and controls, the new units come standard with communications that link with all the blowers in a system, along with upper-level controls. The engineers at Sulzer also made improvements to the magnetic bearing technology, allowing for greater wire-to-air efficiency.

The HST 20 Turbocompressors can provide flows of 1300 to 4400 scfm at pressures between 4 and 13 psig. Parsons also stressed that Sulzer provides input horsepower required by the whole package — 150 to 250 hp for the HST 20 — to avoid any confusion about stated efficiency.

WEFTEC 2015

Overall, there was a lot of different, highly competitive blower technology on display at WEFTEC 2015, but it wasn't strictly for wastewater treatment applications. Blowers are common throughout industrial facilities, and are nearly as omnipresent as compressed air systems. Blower & Vacuum Best Practices will continue to cover advancements in blower technology in 2016 by expanding to quarterly publication. BP

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