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COLUMNS

FROM THE EDITOR | Aeration Blowers

Industrial vacuum pumps are beginning to be the subject of more energy efficiency system assessments than ever before. Tim Dugan, from Compression Engineering Corporation, provides an excellent article on how he conducts a system assessment. Information provided includes what measurements to take. The article uses paper machines as an example. Paper machines use vacuum in the forming, press, and drying sections.

In his article, "7 Questions to Ask Before Buying a Vacuum Pump", Greg Marciniak from the Industrial Vacuum Division at Atlas Copco, provides end users and sales engineers with a set of questions to consider to properly select a vacuum pump. Many of these questions may warrant a system assessment before answering.

Tom Jenkins, from JenTech Inc., has counseled and trained many leaders in the aeration blower industry. In his article, "Aeration Blower Turndown", he discusses how to calculate turndown and the many variables to consider when making the calculations. The article starts with a strong statement, "Blower turndown is a parameter that is generally more important than efficiency in optimizing energy use."

The 2016 WEFTEC Technical Exhibition and Conference was held at the New Orleans Morial Convention Center in New Orleans, La. The 2016 event made the list of the top five largest and best-attended events in the conference's 89-year history. A total of 20,113 registrants and 1,006 exhibitors using a net of 28,000 m^2 (301,900 ft^2) of space attended WEFTEC. We hope you enjoy our coverage of the aeration blower technologies on display at the show.

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

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2017 Expert Webinar Series

Join Tom Jenkins and Blower & Vacuum Best Practices Magazine for a Webinar titled, "Aeration Blower Turndown Efficiency Variations Across Operating Ranges."

Register and view our 2017 Webinar Calendar at www.blowervacuumbestpractices.com/magazine/webinars.

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TECHNOLOGY PICKS

Atlas Copco Launches DZS Range of Dry Claw Vacuum Pumps

Atlas Copco has added the new DZS dry claw vacuum pump to their portfolio. Claw vacuum pumps offer non-contact and dry pumping chambers with high performance and power efficiency, making them suitable for many applications including pneumatic conveying, CNC routing and milking parlors. Atlas Copco was the first company to innovate multi-claw technology for compressors.

"We've worked for many years with claw technologies within the compressor and vacuum industries," said Koen Lauwers, Vice President Industrial Vacuum at Atlas Copco. "This is a pump built on simplicity and durability that will be with your facility for years to come."

The new DZS design offers removable stainless steel claws that are easy to clean and features easily changeable seals. Because of its innovative structure, the DZS can be reassembled without touching the drive train, saving a massive amount of downtime and expense. The modular design of the pumping chamber, gearbox and silencer allows for replacement of individual components in the case of failure due to process upsets, resulting in higher efficiency and lower life cycle costs. This design also offers major advantages with heat dissipation, employing Atlas Copco's patented cooling design concept for efficient and quiet air distribution.

The new DZS design offers removable stainless steel claws that are easy to clean and features easily changeable seals.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

"The DZS provides reliable operation even in the harshest conditions," said Jerry Geenen, vice president of North American utility vacuum with Atlas Copco. "Most process gasses eventually pass through the pump, which can lead to premature failure. The new DZS range provides a corrosion-resistant chamber to prevent maintenance downtime." The DZS joins Atlas Copco's wide range of vacuum pump offerings.

About Atlas Copco

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

About Atlas Copco Compressors LLC

Atlas Copco Compressors LLC is part of the Compressor Technique Business Area, and its headquarters are located in Rock Hill, S.C. The company manufactures, markets, and services oil-free and oil-injected stationary air compressors, air treatment equipment, and air management systems, including local manufacturing of select products. The Atlas Copco Group, which celebrated its 140th anniversary in 2013, is among the Top 100 sustainable companies in the world and a member of the Dow Jones World Sustainability Index. Atlas Copco has also been recognized by Forbes, Thomson-Reuters and Newsweek, among others, for its commitment to innovation and sustainability. Atlas Copco Compressors has major sales, manufacturing, production, and distribution facilities located in California, Illinois, Massachusetts, North Carolina, South Carolina, and Texas.

About Vacuum Solutions

Vacuum Solutions is a division within Atlas Copco's Compressor Technique Business Area. It develops, manufactures and markets vacuum pumps, abatement systems, valves and related service products mainly under the Edwards and Atlas Copco brands. The main market segments served are: semiconductor, flat panel display, solar, scientific and utility vacuum. The division's focus and main drive is to further improve its customers' productivity. The divisional headquarters are in Crawley United Kingdom.

For more information, visit www.atlascopco.us or for more information on the DZS line of vacuum pumps, visit http://www.atlascopco.com/vacuumus/products/dry-vacuum-pumps/dry-claw-vacuum-pumps/.

MPAK2000 with inlet filter

MPAK2000 enclosed

Tuthill Introduces New MPAK Blower Package

Tuthill Vacuum & Blower Systems introduces the new MPAK 2000 blower package. Each MPAK 2000 is value-engineered to meet specific applications for optimized efficiencies. Its design allows for simple installation and use. Features include: air or gas blowers, accurate blower sizing for an application including Tuthill's PD Plus, CP Series or Qx models, open or closed package design with field retrofittable enclosure option, and high endurance and Tuthill reliability.

The MPAK 2000 blower package provides CFM up to 2200, pressure up to 18 PSI, and vacuum down to 17" Hg. MPAK blower packages are manufactured at the Tuthill Vacuum & Blower Systems site in Springfield, Missouri, USA.

TECHNOLOGY PICKS

About Tuthill Vacuum & Blower Systems

Tuthill Vacuum & Blower Systems, manufacturer of KINNEY® vacuum pumps and M-D Pneumatics™ blowers and vacuum boosters, is a leader in the design and manufacture of high performance, reliable positive displacement blowers, mechanical vacuum pumps, vacuum boosters and engineered systems ready to install and run. Since 1969, Tuthill Vacuum & Blower Systems has been manufacturing at its main facility located in Springfield, Missouri.

For more information, visit www.tuthillvacuumblower.com

New Kaeser 20-50 hp DBS Screw Blowers

Kaeser Compressors has expanded its award-winning screw blower product line with the addition of the new DBS series. These integrated package blowers are available with motor sizes from 20 to 50 hp and flows from 150 to 770 cfm and boast an energy efficiency advantage over conventional blowers of up to 35%.

The DBS series includes the same design features as Kaeser's other screw blower packages, such as high efficiency motors, silencers, inlet filters, starters/drive, a full enclosure, an onboard controller, and a full complement of sensors. These units

Kaeser's DBS screw blowers are up to 35% more efficient than conventional blower designs.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

are designed, built, and tested to meet international and domestic performance and safety standards, and are available in both STC (wye-delta start) and SFC (Variable Frequency Drive) versions.

Models also come standard with Sigma Control 2™. In addition to monitoring all onboard sensors, Sigma Control 2 features expanded communication features. With an Ethernet port and built-in Web-server, Sigma Control 2 enables remote monitoring and email notifications for service and alarms. Optional industrial communication interfaces such as ModBus, Profibus, Profinet, and Devicenet are available to provide seamless integration into plant control/monitoring systems such as Kaeser's Sigma Air Manager 4.0 (SAM 4.0).

About Kaeser

Kaeser is a leader in reliable, energy efficient compressed air equipment and system design. We offer a complete line of superior quality industrial air compressors as well as dryers, filters, SmartPipe™, master controls, and other system accessories. Kaeser also offers blowers, vacuum pumps, and portable diesel screw compressors. Our national service network provides installation, rentals, maintenance, repair, and system audits. Kaeser is an ENERGY STAR Partner.

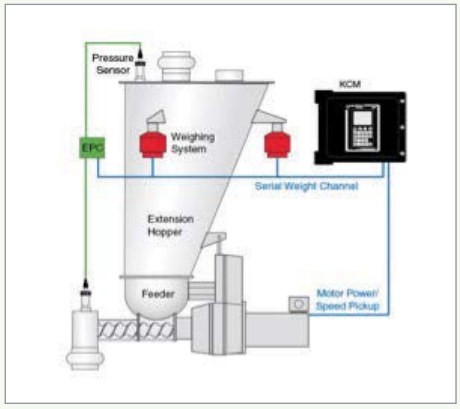
For more information, visit www.kaesernews.com/DBS

To be connected with your representative for additional information, please call (877) 596-7138.

Coperion K-Tron Introduces New Electronic Pressure Compensation System

Coperion K-Tron displayed, at the 2016 Powder Show, the unique new Electronic Pressure Compensation (EPC) system for their high-accuracy loss-in-weight feeders. The main advantages of the new system include improved accuracy and reliability as well as lower initial cost and easier installation compared to traditional mechanical pressure compensation systems. Retrofitting options for existing feeders are available. EPC can be installed on a majority of Coperion K-Tron gravimetric feeders in almost any application and all industries.

In a closed feeding system, pressure build-up inside a feeder can significantly impair weighing accuracy. The commonly installed mechanical pressure compensation systems are sensitive to structural factors and machine alignment and therefore may be intricate or even unreliable. Coperion K-Tron has now developed a clever but simple electronic solution for accurate and steady pressure compensation in feeder hoppers. The modular design incorporates pressure sensors and electronics tailored to interact smoothly with Coperion K-Tron's KCM feeder control system.



Basic principle of EPC electronic pressure compensation applied in gravimetric feeding system in a schematic presentation; KCM: feeding control

About Coperion and Coperion K-Tron

Coperion K-Tron is a business unit of Coperion and is a global leader and single source supplier of material handling and feeding systems. Coperion K-Tron has defined the leading edge of technology for material handling and feeding applications in the process industries.

Coperion is the international market and technology leader in compounding systems, feeding technology, bulk materials handling systems and services. Coperion designs, develops, manufactures and maintains systems, machines and components for the plastics, chemicals, pharmaceutical, food and minerals industries. Within its four divisions – Compounding & Extrusion, Equipment & Systems, Material Handling and Service – Coperion has 2,500 employees and nearly 40 sales and service companies worldwide.

For more information, visit www.coperionktron.com

TECHNOLOGY PICKS

New Robuschi ROBOX Compressors Help an Italian WWTP

Robuschi, a Gardner Denver brand, has developed a new screw compressor called ROBOX™ Energy that improves energy efficiency and reduces operating costs. The compressor has immense flexibility and combines the unique characteristics of the screw compressor with the innovative permanent magnet motor. More information is available in a case study that describes how Robuschi's ROBOX™ Energy compressors helped Italy's Iren Group with the restructuring of one of its wastewater treatment systems. The case study also provides useful information on the technology used and how facilities can reduce costs and become more energy efficient.

Click here to access the case study. http://igdg.gardnerdenver.com/robuschi-energyatwork

FPZ Regenerative Blowers Meet New Motor Efficiency Standards

FPZ, Inc. announced their regenerative blowers meet new federal energy efficiency requirements for commercial and Industrial electric motors under the U.S. Energy Policy Act (e-pact 431 subpart B/X), affecting 3-phase, 1 HP or greater motors.

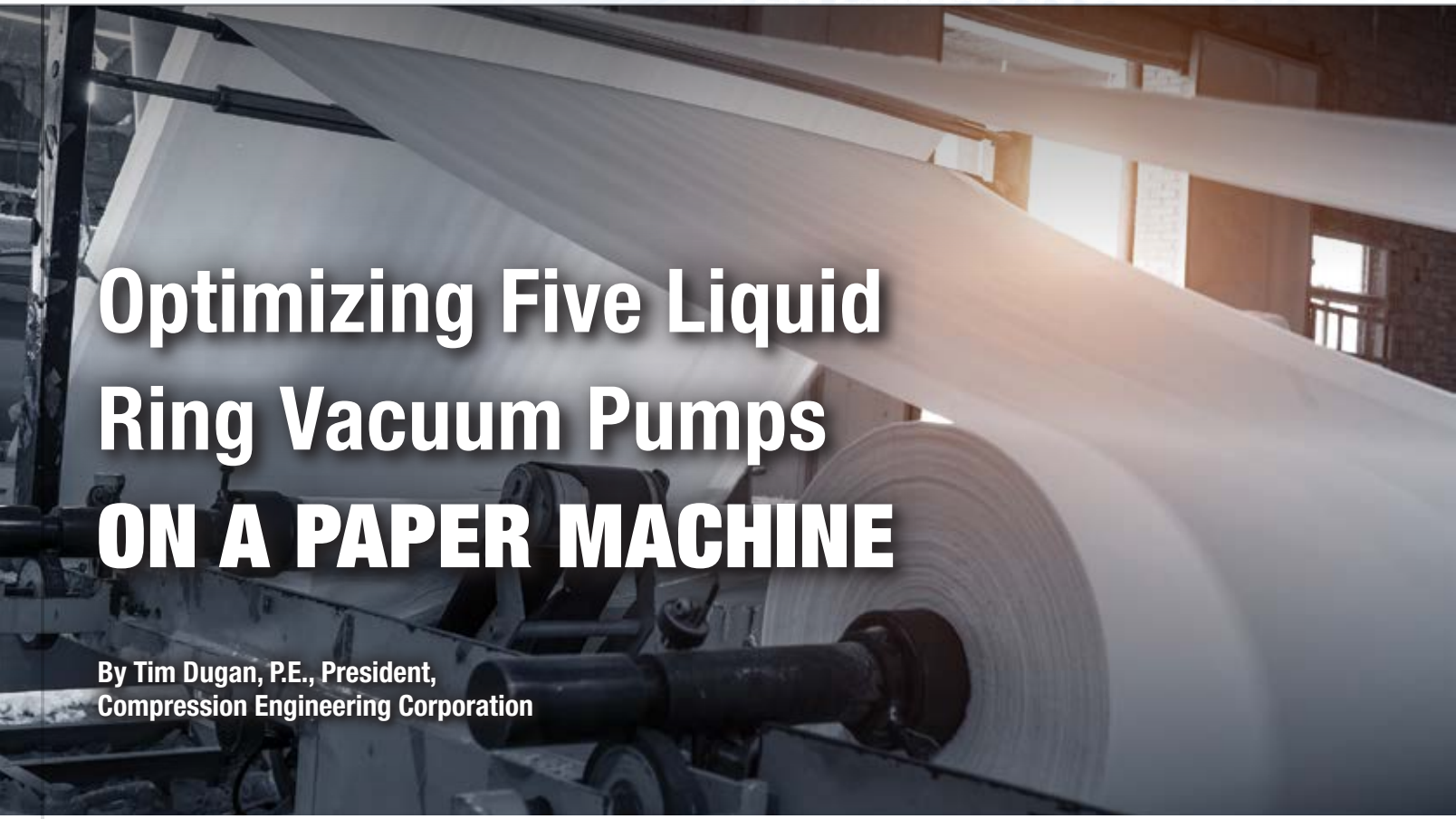
These high-efficiency motors are now standard across the FPZ product line and available ex stock from their Saukville (Milwaukee), Wisconsin facility.

The blowers feature clean, oil-free and maintenance-free operation, with flows to over 1400 scfm and pressure differentials to 10.8 psig / 14.7 hg.

FPZ's premium efficient blowers meet the DOE's motor efficiency requirements outlined in Nema table 12-12.

FPZ, Inc. sells on a "factory-direct" basis and all blowers come with a 3-year warranty.

For more information visit www.fpz.com, email: usa@fpz.com, tel: 262-268-0180



Optimizing Five Liquid Ring Vacuum Pumps ON A PAPER MACHINE

By Tim Dugan, P.E., President,
Compression Engineering Corporation

Industrial process operating loads and optimal set points are not usually accurately known at the time of design, so often there is significant mismatch between equipment and the process it serves. To overcome this uncertainty, designers typically oversize equipment. Over time, process changes and equipment efficiencies decline, so equipment might be operating less efficiently than at start-up. Or, equipment can be undersized, thereby hampering the entire system and causing other inefficiencies to compensate. For instance, too much steam usage in the dryer section of a paper machine can occur because of inadequate vacuum at the wet end.

Proper tuning and commissioning rarely happens, so it is not known if the system is operating per the intent of the original design. Typically, there is insufficient monitoring data to even know if the system is still operating at its commissioned level. Finally, system set points usually change over time, and the vacuum system design is usually not set up properly to be able to be adjusted easily and efficiently.

For all these reasons, some vacuum systems need a complete retrofit to meet current and future standards and process requirements. However, most vacuum systems can be improved quite a bit just by being "re-commissioned." The easiest re-commissioning is to tweak the vacuum pump speeds (assuming they are belt-driven). As an

"Industrial process operating loads and optimal set points are not usually accurately known at the time of design, so often there is significant mismatch between equipment and the process it serves.."

— Tim Dugan, P.E., President, Compression Engineering Corporation

example, a paper machine vacuum system will be used to illustrate how constant flow vacuum systems work. The example also illustrates one simple way to optimize a constant flow vacuum system—speed adjustment. Any constant flow process can do the same.

The principles I will use in this article are summarized as follows:

1. The "system curve" needs to be known.
2. The vacuum "pump curve" needs to be known.
3. The system curve and pump curve cross at the "operating point," and should be as close as possible to the best operating point for the system and for the pump.

Principle 1: The System Curve Needs to be Known

A "system curve" is the relationship between vacuum (pressure differential, really) and flow. It tells you how the system "behaves." How much flow do you need to "feed" it to keep it satisfied, at every potential desired operating point? It's a bit tricky in a vacuum system, especially if the reader is familiar with the standard liquid system curve (pressure drop is proportional to flow squared). With gas flow at low pressures, pressure differential is proportional to the square of mass flow, and inversely proportional to density—and density changes a lot. So how do you find the system curve in your real process?

First, you need to make some measurements. Trend logging is always better, but if all you have are spot measurements, it can still work. Assuming there is only one operating point for a constant flow system (or subsystem), you only need to measure at that one point. The following measurements are needed:

- Ambient pressure
- Vacuum, at the pump inlet, after any throttling valves
- Vacuum, at the system "exit" point, but before any throttling valves
- Flow or flow proxy

Ideally, you need to measure with an orifice plate at the inlet or discharge of the vacuum pump, wherever it is practical to have a meter run. Some vacuum systems have these flanges and taps already installed, because the system was flow tested at initial commissioning. The rigorous approach is to use the ASME 9 or 10 procedure, depending on whether it is positive displacement or centrifugal, and

OPTIMIZING FIVE LIQUID RING VACUUM PUMPS ON A PAPER MACHINE

the ASME 19.5 method for flow measurement (See References 1 through 3). Or, flow proxies can be made. Your vacuum pump vendor or an outside consultant should know how to do that. A few alternate methods include:

- Use pump curve, Amps and vacuum. This is the least desirable, since you should always question the validity of any curve.
- Use a straight run of pipe and a differential pressure (DP). This is essentially a crude flow meter. You really need one DP transmitter, and then use the piping friction tables to estimate flow.
- Use process instrumentation or test data, correlated with vacuum.

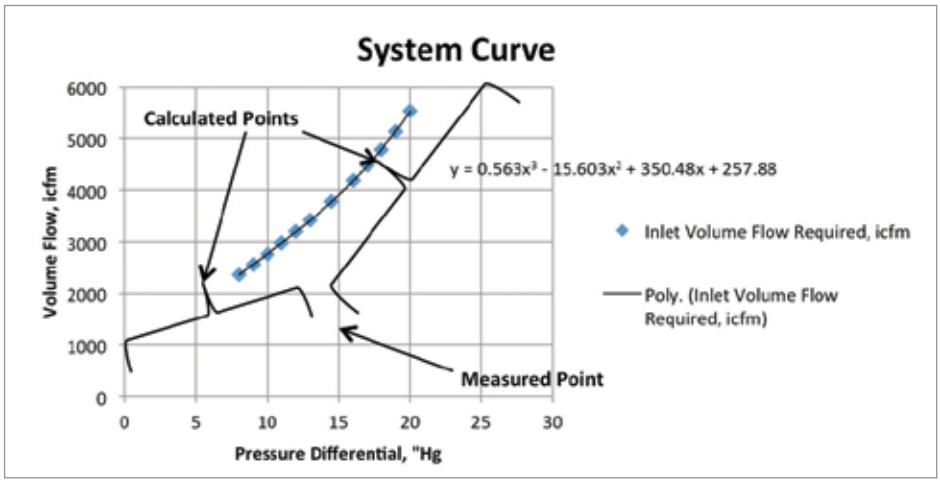


Figure 1: Example Vacuum System Curve

Analysis

Convert flow to icfm at the system outlet (before the regulating valve, if there is one).

Calculate alternate flows for other vacuum levels, in 1"Hg increments.

See Table 1 and Figure 1 for an example system curve and estimate of optimal power at each system curve point.

Principle 2: The Vacuum Pump Curve Needs to be Known

Positive displacement vacuum pump curves all tend to look similar, pretty flat flow for all vacuum levels, except at the extremities. Centrifugal exhauster curves look more like a centrifugal pump curve, with flow reducing as head (vacuum) increases, and vice versa. This example is for pulp and paper dewatering, so we are using a curve of a liquid ring vacuum pump.

In reality, no pump matches the curve exactly. If the above flow measurement method can

TABLE 1: EXAMPLE SYSTEM CALCULATIONS

PRESSURE DIFFERENTIAL (VACUUM), "HG	ABS PRESS, "HG	MASS FLOW, LB/MIN	NORMALIZED FLOW, SCFM	INLET VOLUME FLOW REQUIRED, ICFM	APPX VACUUM PUMP POWER REQ'D	PERCENT OF HP AT 14.5"HG (IDEAL)
20	9.9	138.0	1835	5535	545	389%
19	10.9	141.1	1877	5142	481	343%
18	11.9	143.5	1908	4790	425	303%
17	12.9	145.2	1931	4471	374	267%
16	13.9	146.2	1944	4179	330	236%
14.5	15.4	146.5	1948	3780	140	100%
13	16.9	145.3	1932	3417	113	81%
12	17.9	143.6	1910	3190	98	70%
11	18.9	141.3	1879	2972	84	60%
10	**19.9**	**138.3**	**1839**	**2762**	**71**	**50%**
9	20.9	134.4	1788	2557	59	42%
8	21.9	129.7	1725	2355	48	34%

Assumptions:
1 System equivalent orifice is not changed
2 DP is proportional to Qm^2 / density
3 Qm is proportional to (density x DP)^0.5
4 Power is proportional to icfm and vacuum
5 Pamb 29.92 "Hg

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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.

"A more recent innovation is to control the aeration blowers off of total air flow instead of header pressure."

– Julia Gass, P.E., Black & Veatch (September 2016 Issue)

"Busch designed a customized central vacuum system for the furniture manufacturer, consisting of eight identical Mink claw vacuum pumps, each equipped with a suction capacity of 300 m³/h."

– Uli Merkle, Busch Vacuum Pumps and Systems (feature article in July 2016 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.

"Our engineering optimizes blower packages for each field – identifying, for example, the optimal conveying velocities for over 50 types of wheat flour!"

– Todd Smith, General Manager, Coperion K-Tron (Powder Show Report in a 2016 Issue)

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OPTIMIZING FIVE LIQUID RING VACUUM PUMPS ON A PAPER MACHINE

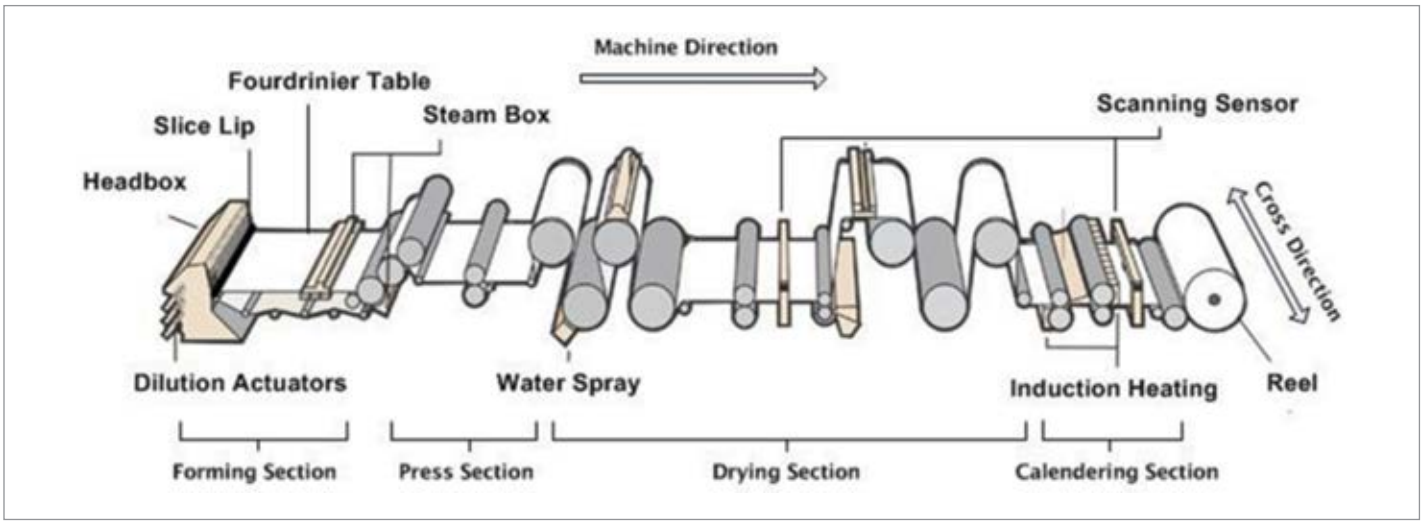

Figure 2: Typical Paper Machine

Figure 3: Typical Uhle Box of a Paper Machine (Vacuum Connection on Back Side)

be accomplished for the system curve, you can generate the vacuum pump curve with no trouble, as follows:

- Install data logging for pump inlet vacuum (not system vacuum) and Amps (or power).
- If flow can be trend logged, great. Otherwise, make a spot calculation of flow at each operating point.
- Vary flow higher by a false bleed-in.
- Vary flow lower by throttling the vacuum pump intake/ isolation valve.
- Correlate flow with vacuum and power with vacuum.

Principle 3: Optimize Vacuum Pump Performance for an Alternate Speed

If the vacuum level is too high, the pump is "pulling too hard" on the system. If you reduce the speed, the vacuum will drop along the system curve, as described above. Power will also drop. Savings can be significant. I will explain that for one of the five pumps in the example project. It can be done as follows:

- Adjust vacuum pump speed to move the operating point as close as possible to the needed vacuum level. For belt-driven vacuum pumps, this is simple. For direct drive, it would require a VFD.
- Stay within the pump curve speed range limits.

Example Paper Machine Project with Five Vacuum Pumps

Paper machines use vacuum in the forming, press, and drying sections, as can be seen in Figure 2. In forming, the largest flow requirement exists. Vacuum and gravity pull a large amount of water out from liquid stock (starting at only 4 percent solids in the "headbox"). This is known as sheet formation, where the fibers start to spread

and consolidate into a thin mat. It looks like a white fleece in this section. The web of wet paper is then lifted from the wire mesh and squeezed between a series of presses where its water content is lowered to about 50 percent by squeezing between rollers. It then passes around a series of cast-iron cylinders in the drying section, heated to temperatures in excess of 200°F, where drying takes place. Here, the water content is lowered to between 5 and 8 percent—its final level.

The vacuum process evaluated in this article is in the press section. In this part of the paper machine, air is sucked through the web in long slots on the top of a box called an "Uhle box" (Refer to Figure 3). The press section has several Uhle boxes, each designed with exactly the right slot geometry and vacuum level to remove water step by step.

The example project's vacuum system served the press section of a paper machine, and it is shown in Figure 4. It uses positive displacement vacuum pumps called liquid ring vacuum pumps, that use a "liquid ring" for the cylinder wall and a rotor that is immersed in the ring, as shown in Figure 5. They can handle high condensable loads, and they are common in wet applications like pulp and paper. Centrifugal exhausters are starting to make inroads into pulp and paper, and have efficient turn down, which is valuable if a paper machine changes products and requires multiple vacuum set points. In typical paper machines that run the same product all the time, liquid ring pumps are usually the most economic choice overall. They are fairly efficient and highly reliable. However, they do have limited speed ranges.

All of the vacuum pumps in this example system operate at different vacuum levels. The exact levels required for each were not known by the customer at the time of the assessment. It was proposed that 10"Hg should be a starting point, since several of the Uhle boxes were operating at 10"Hg.

Speed Adjustments Optimize Vacuum System

The remainder of this article will show the savings accrued by adjusting the speed of VP1 so that it could operate at 10"Hg. Please refer to the vacuum pump curve, superimposed with the system curve, in Figure 6. The curve is not validated by testing. It is just the manufacturer's data. The operating point, vacuum and power were measured. Flow was estimated from the curve.

To hit the lower vacuum level, 10" HgV, on the system curve, the pump would have had to operate at a lower speed than the minimum of 300 rpm. Thus, the unit must operate at 300 rpm. Figure 6 shows the dramatic power reduction that can be gained by merely changing the sheaves on the belt drive so the

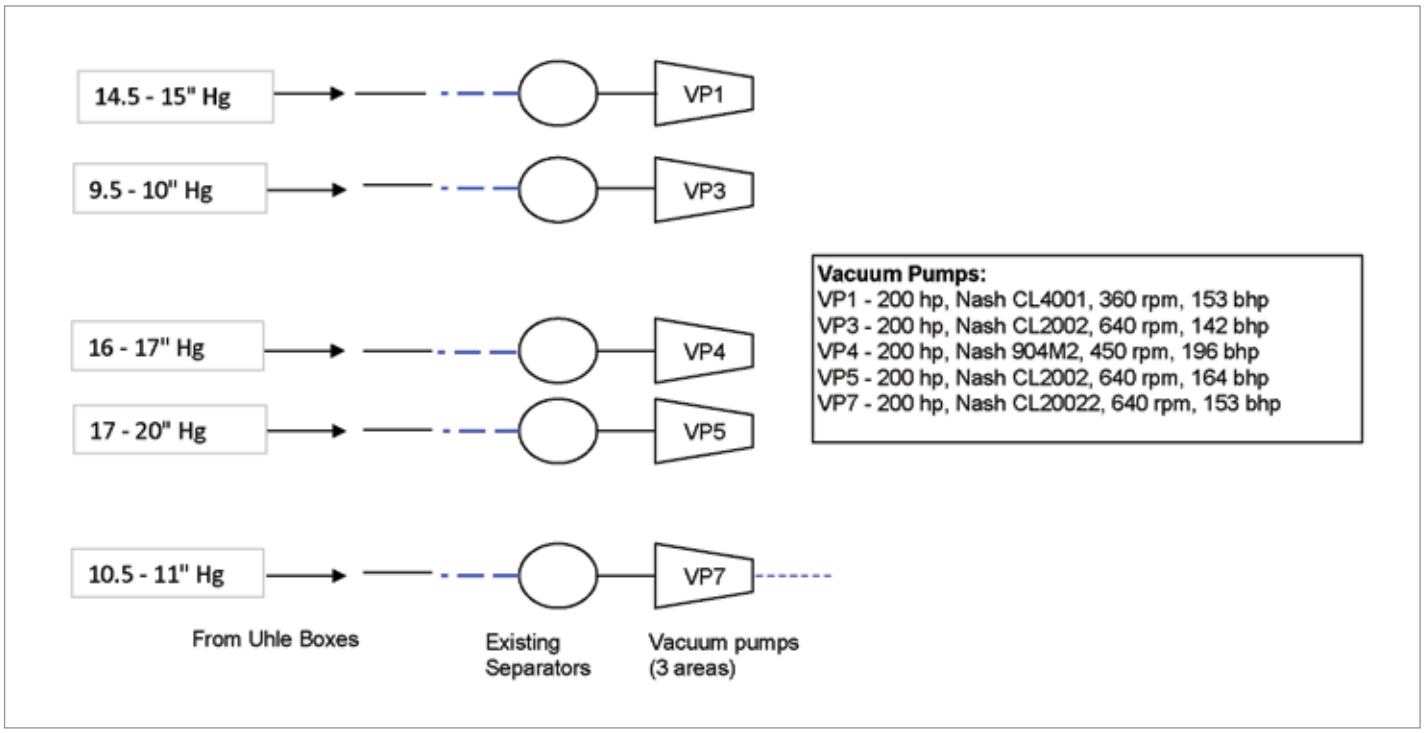

Figure 4: Project System Diagram

OPTIMIZING FIVE LIQUID RING VACUUM PUMPS ON A PAPER MACHINE

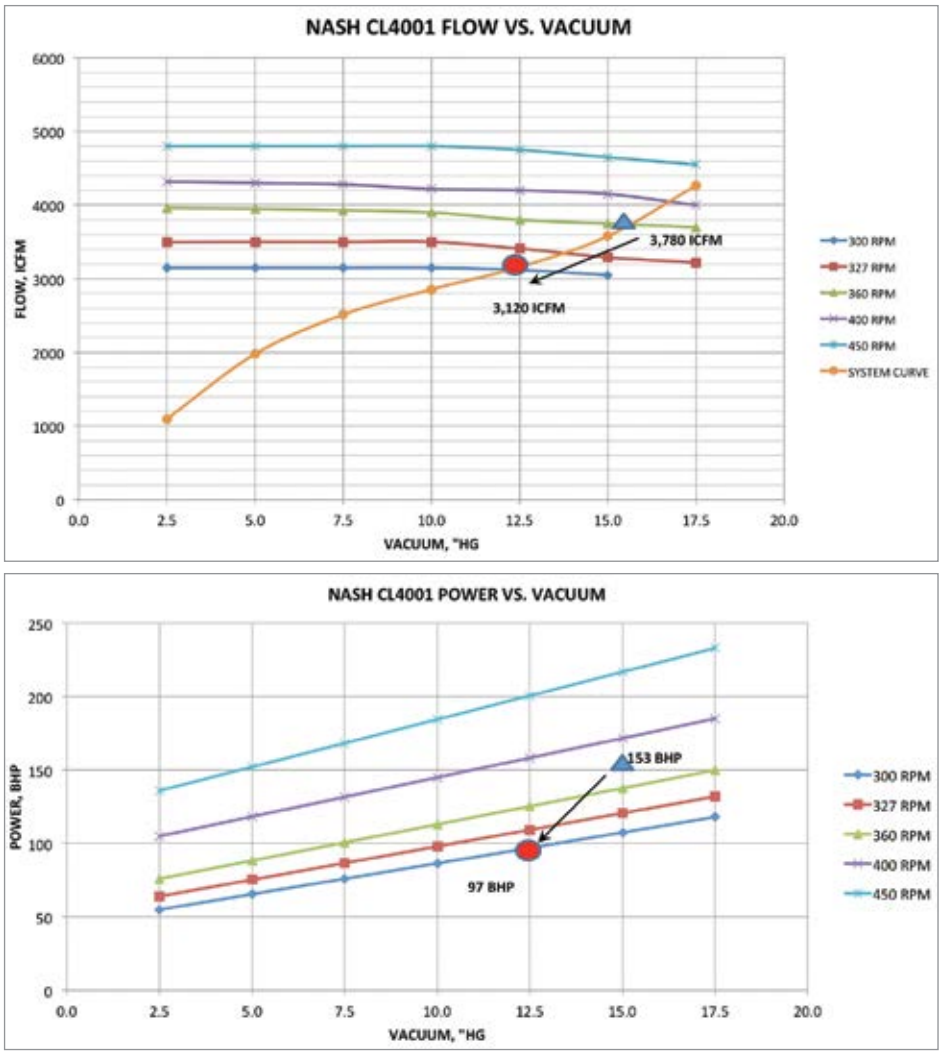

Figure 5: Vacuum Pump #1 Performance Curves

that pump operating speed would be reduced from 360 to 300 rpm. Power reduction would be about 37 percent—not as much as the ideal 50 percent (if the pump speed could be further reduced).

If a constant-flow vacuum pump is operating at a higher vacuum than needed, simply reducing the speed can garner significant savings. However, the system curve and pump curve need to be known, so the pump operates at the correct operating point. BP

For more information, contact Tim Dugan, tel: (503) 520-0700, email: Tim.Dugan@comp-eng.com, or visit www.comp-eng.com.

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To read more about ***Vacuum Pump System Assessments,*** please visit www.blowervacuumbestpractices.com/system-assessments.

> "If a constant-flow vacuum pump is operating at a higher vacuum than needed, simply reducing the speed can garner significant savings. However, the system curve and pump curve need to be known, so the pump operates at the correct operating point."
>
> — Tim Dugan, P.E., President, Compression Engineering Corporation

7 QUESTIONS TO ASK BEFORE BUYING A VACUUM PUMP

By Greg Marciniak, Product Marketing Manager, Industrial Vacuum Division, Atlas Copco

Vacuum pumps are used for a wide range of applications in a variety of industries, but not all vacuum pumps are created equal. Before selecting a vacuum pump, take a look at the following questions. Knowing the answers will not only help you streamline your purchasing timeline, it will also ensure you get the right vacuum pump for your application.

1. What's the required operating pressure?

Understanding the required operating pressure for your application is vital. Operators almost universally know this. But when purchasing new or replacement equipment, some conflate required operating pressure with ultimate pressure. Operating pressure is the pressure required for a certain process, while ultimate pressure is the deepest operating pressure a given pump can produce. If a machine specification states the ultimate pressure as 0.01 mbar, this does not necessarily mean this is the normal operating requirement for a process.

2. What is the required flow?

Flow can be expressed in a few different ways. Some of the more common terms are SCFM and ACFM. Understanding the difference between the two is critical. SCFM, or standard cubic feet per minute, is an expression of flow at a specific set of conditions. SCFM assumes that the temperature is 60°F, the pressure is 14.7 psia and the relative humidity is zero percent. ACFM, or actual cubic feet per minute, is the flow at actual conditions. Mixing these terms up can result in greatly undersized or oversized equipment.

3. Is contamination a risk?

Because vacuum pumps pull the process toward the system rather than pushing air away, it's vital you discuss how wet or dry your application is with any vacuum pump provider, as each poses certain risks to a vacuum

An Atlas Copco GHS VSD+ vacuum pump. Industrial vacuum pumps are used in a wide variety of applications.

7 QUESTIONS TO ASK BEFORE BUYING A VACUUM PUMP

pump system. Wet or humid applications are extremely common, especially in the food packaging industry. With some processes, there's a chance the moisture will be pulled back into the pump. That information helps vacuum pump providers specify the correct technology and protect the vacuum pump from contamination, adverse reactions or premature failure.

Dry applications also pose potential issues. Some operators use vacuum pumps to move bulk material for concrete, plastic pellets, etc., which can ultimately end up in the pump without adequate filtration. Regardless of how wet or dry your process is, knowing how the vacuum pump will be used will ensure that the correct protection is in front of the pump.

If contamination does occur, it can cause any number of unfavorable effects. The oil used for lubrication, cooling and sealing can be damaged, causing the pump to malfunction or operate on a less-than-efficient level. Contamination can also harm the pump itself, leading to more required maintenance and a shorter lifespan.

4. What are the evacuation time and pressure parameters?

Evacuation time is the amount of time it takes to create the required level of vacuum. Whether you require two seconds or 10 seconds depends on your application. In some delicate applications, drawing a vacuum too quickly can lead to damage. For example, the suction cups that lift eggs from the conveyor belt and place them into cartons cannot draw too quickly or deeply without breaking the shells. This holds true for other sensitive materials, like paper, which will dent or tear with too much suction.

On the other hand, some applications require a high level of vacuum to successfully execute various processes. Either way, product quality can be directly affected if the wrong equipment is used or not correctly applied.

5. Is there temperature-related information to consider?

Like the wet/dry nature of your process, the temperature of the application can affect the health of your vacuum pump system. Because the air is being pulled into the system, extreme temperatures impact vacuum pump functionality.

Welding operations are frequently done under vacuum because it reduces contamination, but the gas is much hotter than average vacuum processes. Without proper protection, high heat can ruin the oil responsible for cooling the system, lubricating the pump and creating a seal. By shortening the life of this oil, you can cause permanent damage to equipment.

Cooler than average temperatures can also present a challenge. Some production facilities in the food industry are kept at reduced temperatures, significantly colder than typical ambient air. Air entering a vacuum pump system at that temperature can make the oil thicker and more viscous, thereby reducing its cooling properties and leaving the system vulnerable to complications.

6. Are initial capital costs or running costs more important?

Every company is concerned with initial capital costs and running costs. Knowing which is more important to you will help determine your ultimate vacuum pump purchase. If limiting upfront capital costs is your primary concern, manufacturers can generally offer lower cost alternatives. However, these may require more maintenance and higher operating costs in the long term.

Large-scale industrial companies may be more interested in the technology and controls a sophisticated vacuum system can offer. These smarter systems tend to be a larger initial capital investment, but they can be integrated into building management systems that provide data on functionality and operational efficiency that can ultimately help reduce energy and maintenance costs.

Have your goals for operation cost, energy savings, connectivity and monitoring on hand when working with a vacuum pump manufacturer. Discussing these early will ensure you get a vacuum pump that meets your facility and wallet requirements.

7. Are there space or location considerations?

Space and location considerations are often overlooked when purchasing a new vacuum pump. Most of the upfront preparation is done around cost, functionality and connectivity, and while these are undoubtedly essential aspects, none of them will matter if your vacuum pump doesn't fit in your facility.

Whether you have limited floor space or narrow doorways, make sure you communicate this with your vacuum pump provider. Some users worry space restrictions will limit the power of vacuum pump they can install, but that's not necessarily true. There are many vacuums that can offer higher flows compared to their physical size.

There are many factors at play when choosing a vacuum pump. Most of the time, there isn't a one-size-fits-all option. Having as much information as you can about your process requirements, financial goals and space restrictions will help you choose the system that will most efficiently and effectively serve your application for years to come. BP

For more information, please contact Greg Marciniak, Atlas Copco, tel: 803-817-7310, email: greg.marciniak@us.atlascopco.com, or visit www.atlascopco.us

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Aeration Blower Turndown

By Tom Jenkins, JenTech Inc.

Blower efficiency is a justifiable concern during the design and selection of aeration equipment. However, efficiency may not be the most important consideration in aeration blower applications. In many cases the blower with the highest efficiency will not provide the lowest energy consumption! Blower turndown is a parameter that is generally more important than efficiency in optimizing energy use.

A blower system for a municipal water resource recovery facility (WRRF) always includes multiple blowers. Regulatory requirements dictate that the system has standby capability. The system must be able to deliver design maximum air flow with the largest unit out of service.

Turndown may reference an individual blower's operating range or the operating capability of the entire blower system. Turndown is often expressed as a percentage:

Turndown % = ((qmax – qmin) / qmax) x 100

Turndown = ability to reduce air flow rate, %

qmax, qmin = maximum and minimum blower or system flow rates

Another common way of expressing turndown is as a ratio of maximum to minimum flow – for example, a system with 6:1 turndown is equivalent to 83% turndown.

Importance of Turndown

Aeration blowers are a major concern in the typical WRRF for both process performance and for energy consumption.

In the activated sludge process, pollutants are removed by a biological process. Microorganisms use oxygen diffused into

"Good design practice requires that the blower system be capable of meeting the projected worst case load. This must include both maximum anticipated hydraulic loading and maximum anticipated organic loading."

— Tom Jenkins, JenTech Inc.

the aeration basin to metabolize organic compounds and to convert ammonia to nitrate. If the blowers can't deliver the required air to the aeration basin the treatment process will fail.

Since aeration consumes 50% to 70% of the energy used in most WRRFs, optimizing the blowers is key to minimizing energy cost. Providing more air than necessary to the process doesn't improve pollutant removal, but it does greatly increase operating cost. Being able to modulate the air flow rate to match but not exceed the process demand is the key to minimizing energy consumption. That means that the blower system must have sufficient turndown to match the minimum process needs.

Basis of Turndown Requirements

The hydraulic load (wastewater flow rate) and the organic load (mass of pollutants) entering a typical WRRF are constantly varying.

The most obvious variation is the daily (diurnal) fluctuation in hydraulic load. (See Figure 1.) The concentration of pollutants also varies during the day, but for most plants this isn't as significant. Design calculations and permits usually reference a plant's average daily flow (ADF), and this value is usually identified as the plant's capacity. However, the flow rate is seldom exactly equal to the ADF. The ratio of daily peak flow to minimum rate is approximately 2:1.

The timing of diurnal flow variations generally match on-peak and off-peak electric energy rates, with peak flow coinciding with on-peak energy rates. When calculating energy costs of various alternatives some simplifying assumptions may be made:

- Average air required during on-peak rates = 115% of air required at ADF
- Average air required during off-peak rates = 85% of air required at ADF
- Highest air required, determining demand charge = 120% of air required at ADF

Municipal WRRFs are designed for a twenty-year life, and most designs include a generous allowance for increased loading due to population growth. This means that for most of the facility's life it is operating at hydraulic loads less than the design ADF. The EPA has estimated that most WRRFs operate at 1/3 of the design ADF.

Good design practice requires that the blower system be capable of meeting the projected worst case load. This must include both maximum anticipated hydraulic loading and maximum anticipated organic loading. The assumed concentration of pollutants at the end of the twenty-year design life is usually higher than the actual concentration experienced. This further increases the difference between maximum and minimum required blower system capacity.

In some WRRFs short-term loading may dictate the maximum design air flow rate. Short-term loads include rain events. These increase hydraulic loading and flush accumulated solids

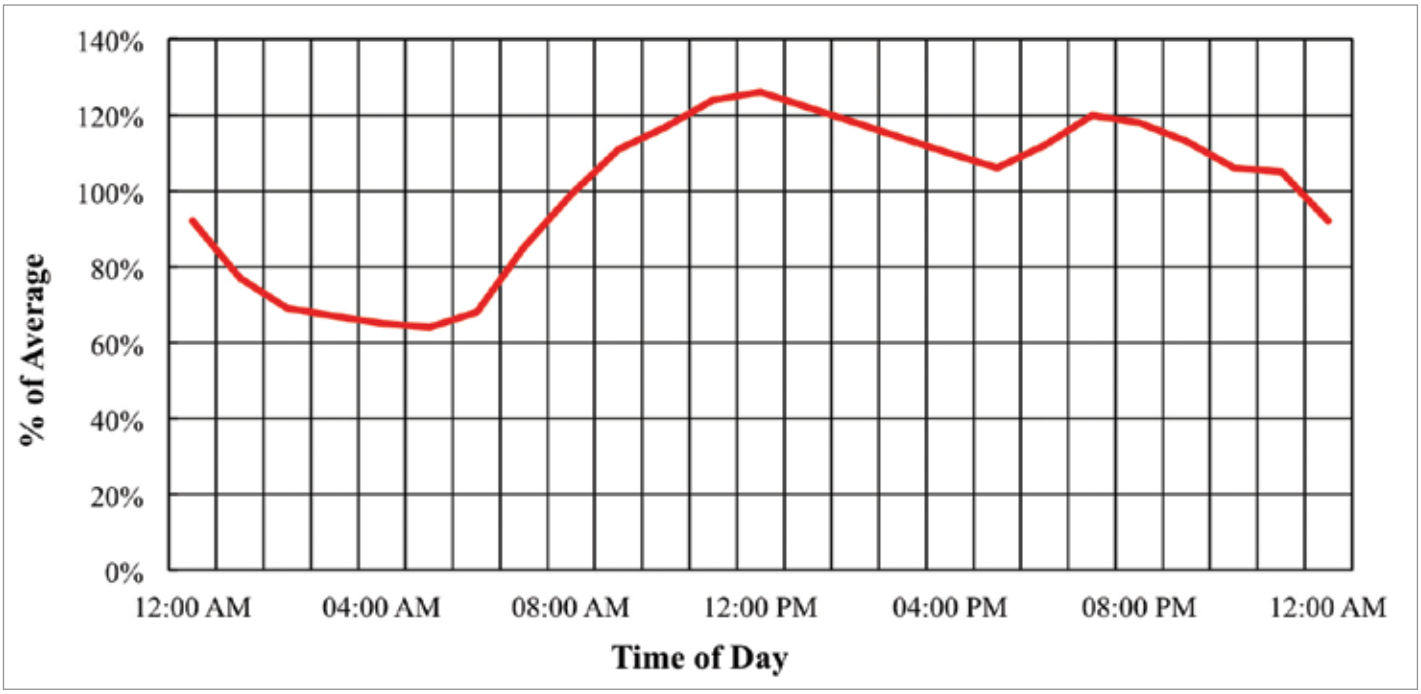


Figure 1: Typical Diurnal Loading Pattern

AERATION BLOWER TURNDOWN

from sewers, increasing organic loading. Industrial facilities are notorious for releasing slug loads with a high concentration of pollutants into the sewer system. Internal WRRF side streams from sludge treatment may also create a short-term increase in organic load.

Factors other than loading may affect the demand for air. For example, a minimum air flow may be required to maintain proper mixing of the operating aeration basins.

The combined effect of these variables is the need for a blower system with a wide operating range. The system turndown should be at least 6:1 (83%), but to optimize both energy and process performance an 8:1 turndown (88%) is preferred.

Alternate Ways to Achieve Turndown

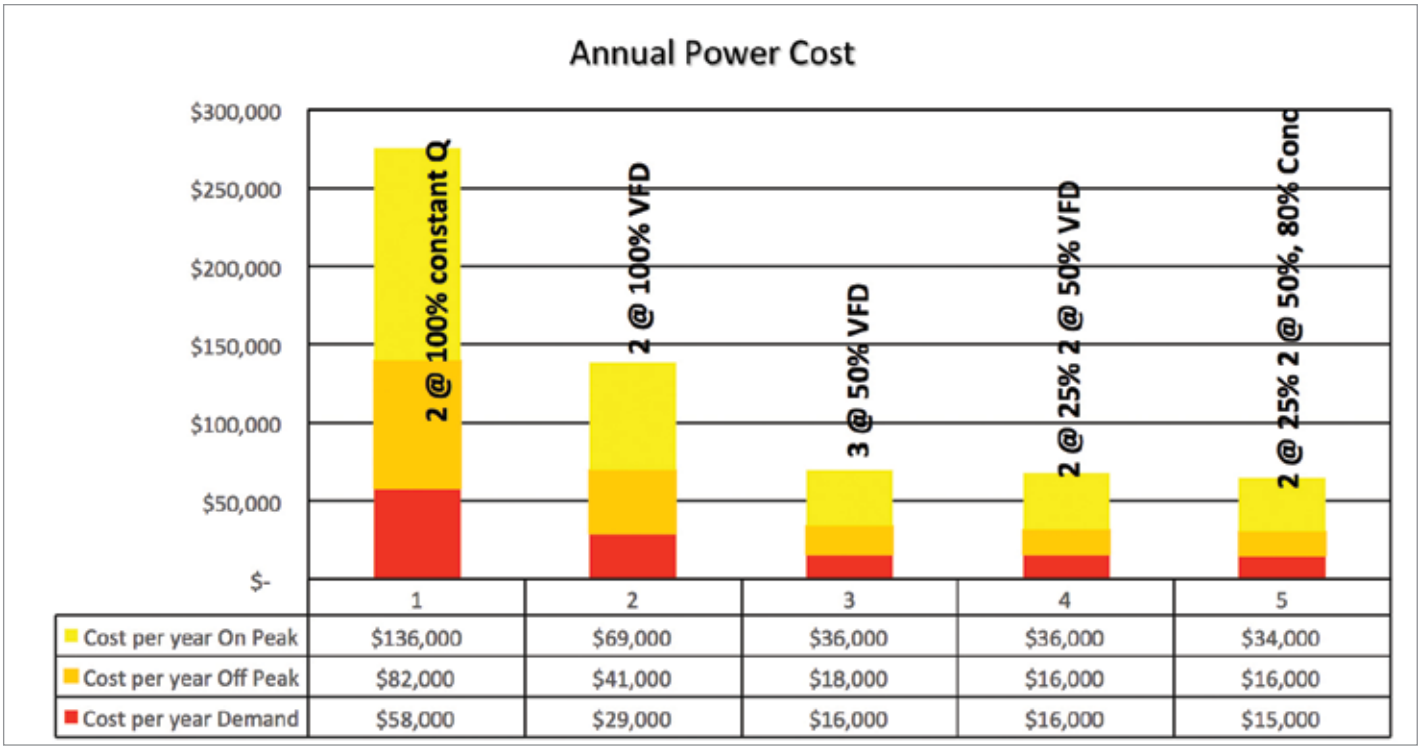
Most individual blowers provide approximately 50% turndown (2:1). The actual turndown varies with the blower technology, control method used to modulate air flow, and the available sizes from a given manufacturer. For many applications ambient conditions place additional restrictions on the turndown for each blower. To achieve more than 50% system turndown, it is necessary to use multiple small blowers and vary the number operating as well as the flow rate for each bower.

There are many design approaches used to establish blower configurations. Using two blowers, each sized to meet 100% of the maximum air flow demand at the twenty-year design load, is not uncommon. This severely limits system flexibility and provides no opportunity for energy optimization.

With increasing energy costs and operator demands for process flexibility, most new blower systems are designed with multiple operating blowers. In small WRRFs the blowers may not include any capability for modulating air flow. The result is unnecessarily high energy cost and limited process flexibility. These systems have the advantage of low cost and simplicity, but it is more common to provide air flow rate control for each blower. Depending on the blower technology, control may be accomplished by throttling, adjustable guide vanes and diffuser vanes, or variable speed control.

A common system approach is to install three equal sized blowers, each capable of delivering 50% of the maximum air flow at design conditions. This will generally provide 75% turndown (4:1). Another common arrangement is four blowers, each sized to provide 33% of maximum air demand. This yields 83% turndown (6:1), which is adequate for some applications.

One way to achieve the preferred 8:1 turndown is to install four blowers, two capable of providing 50% of maximum flow and two sized to provide 25% of maximum flow. This system



	1	2	3	4	5
Cost per year On Peak	$136,000	$69,000	$36,000	$36,000	$34,000
Cost per year Off Peak	$82,000	$41,000	$18,000	$16,000	$16,000
Cost per year Demand	$58,000	$29,000	$16,000	$16,000	$15,000

Figure 2: Example Annual Power Cost

meets both the requirement for redundancy and provides high turndown.

Some designers resist providing more than two or three blowers because of potentially higher equipment and installation cost. This can be the case, but often the higher cost of multiple blowers is offset by the lower cost of each smaller unit. More importantly, this system can optimize energy use. Over the course of the life of the blower system, the initial equipment cost is much lower than the cumulative cost of twenty years of energy consumption.

Comparison of Energy Demand

The importance of turndown to energy cost can be illustrated by an example analysis of alternate systems. Note that every system is different, and the results of the example are typical but not universal. Blower size, electric power rates, control methods, and load variability all influence the comparison.

This example uses variable speed multistage centrifugal blowers. The blower size was based on a typical mid-size WRRF, and energy consumption was taken from the manufacturer's performance curves. For comparison, a single constant speed blower, with no turndown, was also evaluated. Assumed aeration system requirements are:

- Max design air flow @ 20 years = 6,000 SCFM
- Discharge pressure at 100% design air flow = 9.0 psig
- Evaluation barometric and inlet pressure = 14.7 psia
- Evaluation inlet temperature = 68°F
- Diffuser submergence = 17'-5" = 7.54 psig static pressure
- Typical diurnal flow variation
- Current max air demand = 1/3 of maximum design air demand
- $0.18/kWh on-peak 60 hours per week, air flow = 115% of air required at ADF
- $0.06/kWh off-peak 108 hours per week, air flow = 85% of air required at ADF
- $20.00/kW monthly demand charge, air flow= 120% of air required at ADF

An additional analysis was performed, assuming an organic load concentration at 80% of the design value. This illustrates the benefit of 8:1 turndown in a typical application. The results of the analysis show that a further 8% reduction in energy consumption can be obtained by increasing the turndown from 6:1 to 8:1. (See Table 1.)

The results of the analysis clearly show the impact of a blower system that has adequate turndown to match process loads. The comparison shows the total annual power cost for each alternative. (See Figure 2.)

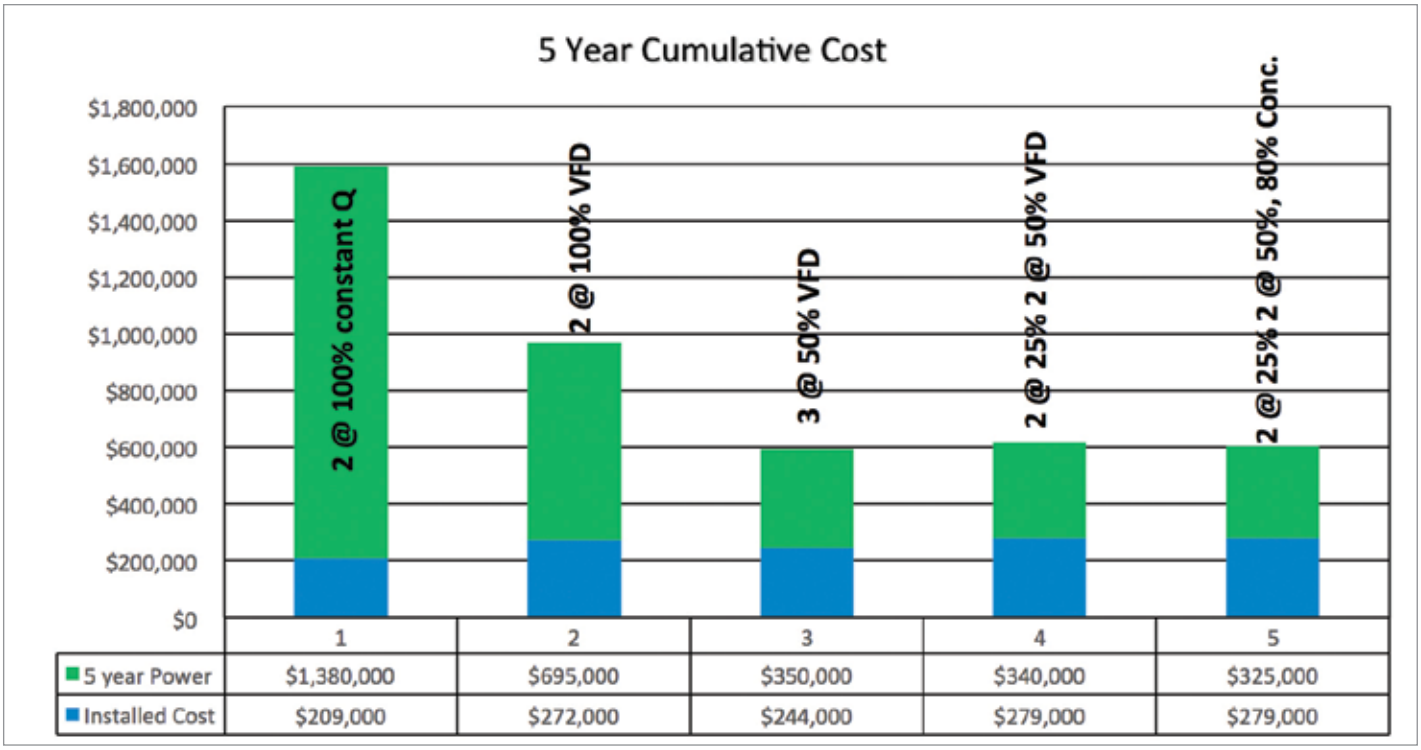


Figure 3: Example Cumulative Five-Year Cost

AERATION BLOWER TURNDOWN

Figure 4: Example Blower Efficiencies

The cost of the first five years of operation, including equipment cost, was also calculated. (See Figure 3.) A five-year total was used because after that time operating loads are assumed to increase. This reduces the need for high system turndown during the remaining life of the facility.

The analysis used the blower system efficiency, which included the blower, the motor, and the variable frequency drive (VFD) efficiencies. This is often referred to as "wire-to-air" efficiency. System efficiency is not a constant value, but varies throughout the operating range. (See Figure 4.) However, even though the four-blower system includes a blower with lower peak efficiency than the baseline, the total energy cost is lower because of the lower minimum flow achieved. Too much air, even at high efficiency, wastes power!

Summary

Blowers for wastewater aeration are part of a complex treatment system. The process demand for air is constantly changing. Optimizing energy cost requires modulating the blower system air flow rate to meet the system requirements without delivering excess air to the aeration basins. Accomplishing this requires blower systems selected to maximize turndown, matching the air supply to the full range of process needs. 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. Find it here: http://www.wiley.com/WileyCDA/WileyTitle/productCd-1118389980.html

To read more ***Aeration Blower Technology*** articles, visit www.blowervacuumbestpractices.com/technology/aeration-blowers

"Optimizing energy cost requires modulating the blower system air flow rate to meet the system requirements without delivering excess air to the aeration basins."

— Tom Jenkins, JenTech Inc.

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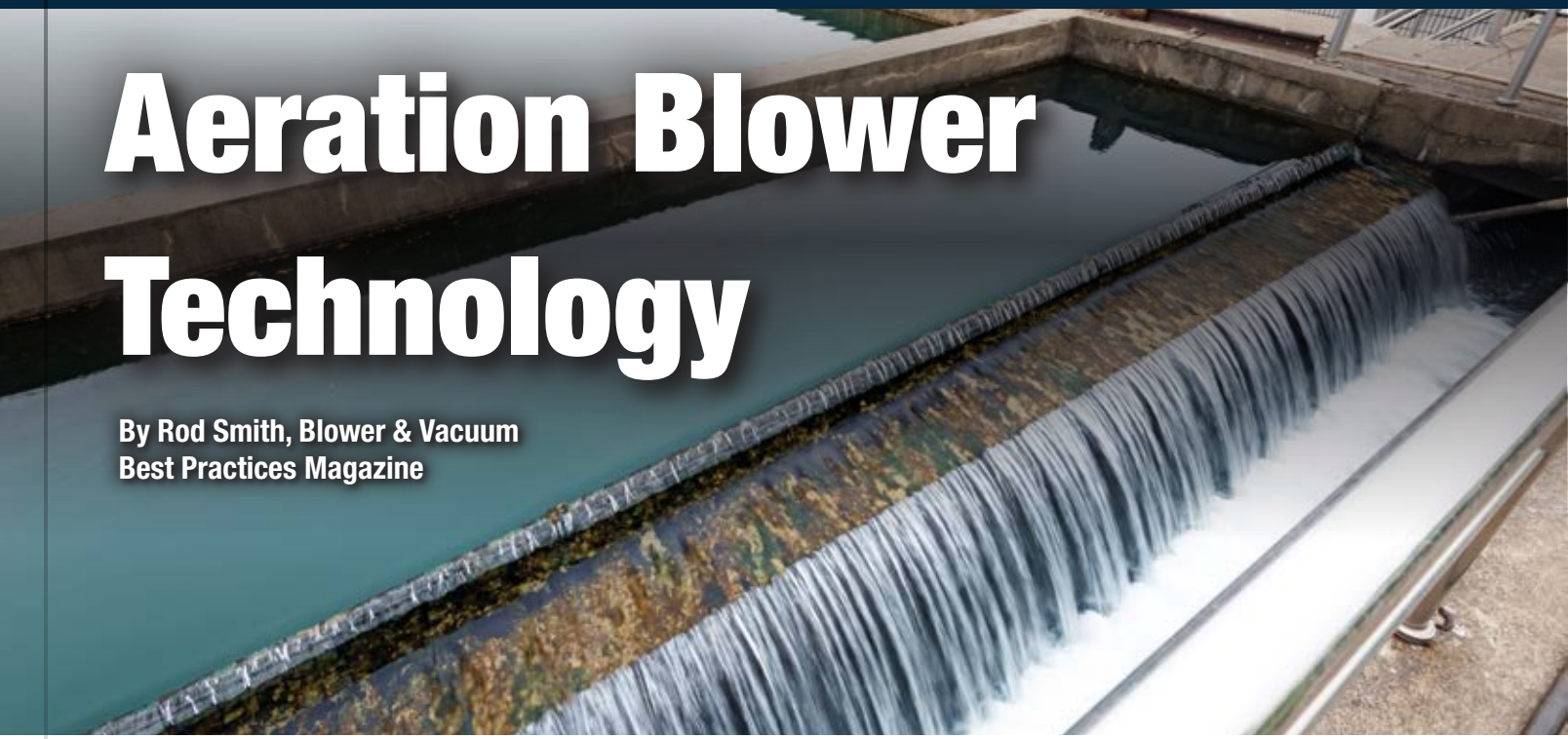
Aeration Blower Technology



By Rod Smith, Blower & Vacuum Best Practices Magazine

The 2016 WEFTEC Technical Exhibition and Conference was held September 24-28 at the New Orleans Morial Convention Center in New Orleans, La. The 2016 event made the list of the top five largest and best-attended events in the conference's 89-year history. A total of 20,113 registrants and 1,006 exhibitors using a net of 28,000 m^2 (301,900 ft^2) of space attended WEFTEC. The event featured 130 technical sessions, 29 workshops, 9 facility tours, and numerous other educational and networking events.

"The success of this year's conference reflects WEFTEC's decades-long tradition of innovation, education, and dedication," said WEF Executive Director Eileen O'Neill. "From programming to attendance, WEFTEC 2016 was another outstanding chapter in WEFTEC's history."

Ralph Wilton and Eric Bennett (left to right) presented the Aerzen AERprocess and AERsmart DO and blower control systems.

José Manuel Almeida Dias, Glenn Schultz, and Joachim Schmitz (left to right) at the PillAerator booth

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 Air Best Practices® Magazines were pleased to be in the literature bins at the 2016 WEFTEC! With this article and with a nod to Tom Jenkins, of JenTech Inc., I hereby announce (trumpets blare) our official switch to the term Water Resource Recovery Facility (WRRF). The magnitude of the energy-efficiency opportunity in the global WWRF market cannot be overstated. A note in the PillAerator brochure caught my eye, "In Germany alone, 10,000 WWRF's clean more than 350 billion cubic feet of water per year, fed by a sewage network spanning 320,000 miles!"

Aeration Blower Controls Tuned for Most Open Valve (MOV) Air Distribution

The Aerzen booth focused on their AERprocess and AERsmart control systems. The AERprocess dissolved oxygen (DO) control system is for system designers using a flow based, Most Open Valve (MOV) method for air distribution. This system measures DO in each control basin and adjusts both the valve settings in the individual aeration zones while optimally sequencing blowers. The system uses plant-specific airflow design equations instead of a PID feedback controller to respond to variations in DO set points. Aerzen booth personnel said they have 28 installations running with AERprocess DO Control. They also said it is effective controlling surge on turboblowers and eliminating nuisance alarms from improper operation.

For WRRF's not using MOV systems, AERsmart is able to take over complete control of up to twelve (12) aeration blowers, regardless of the technology type and manufacturer. The required amount of oxygen is communicated as a set value to the PLC and AERsmart chooses the optimal machine combination and the most efficient load distribution. Because Aerzen offers many blower technologies (turbo, rotary lobe and hybrid rotary screw), their approach is very much system-focused.

Howden Roots, led by Sales Manager Tim Hilgart, has demonstrated experience with what they call "DO-to-Flow" concepts to ease header pressure. Part of this "DO-to-Flow" concept is the use of "true" Most-Open-Valve logic, where at least one valve always remains in the fully open position. This sets a positive domino effect in motion that eases system header pressure, lessens the load on the blowers, and finally reduces the amount of energy needed to move the required volume of air. Their Roots IntelliView Control system has been deployed at more than 300 U.S. WWRF's successfully, including at the Bird Island WWRF plant in Buffalo, N.Y.

Turbo Compressors/Blowers with Magnetic Bearings

PillAerator is a German company focused on the durability of their machines. Led by North American Sales Manager Glenn Schultz, they tout the reliability of magnetic bearing technology as being always centered and contact-free, eliminating the need for lubrication. Frequent start-stop processes are possible without problems. The water-water and air-water combination cooling system protects the motor and electronic components even at high temperatures. The sound attenuating enclosure keeps the unit below 80 dBA. The motor

Dave Parsons and William Cochran (left to right) at the Sulzer booth next to their Turbocompressor Type ABS HST 40.

Standing next to their ZB250 variable speed, direct drive, centrifugal Air Blower are Gatlin Gold, John Brookshire, Travis McGarrah, John Conover, Lee Ann Hellums, Stan Laeremans, Shane Wood, Tamos Bakos, Edgar Arreaza, Hakan Nilisson, Neil Breedlove, Trey Poer, Chris Grafe (left to right) at the Atlas Copco booth.

SHOW REPORT: 2016 WEFTEC

Kenny Reekie and Gary Gillespie next to the new Gardner Denver Robuschi ROBOX energy Triple Impact rotary screw blower (left to right).

Patrick Reilly, Al Moreno and Stephen Horne displayed the new Kaeser DBS Screw Blower (left to right).

Tom Hodanovac presented the MB Blower Package at the Eurus Blower booth.

is also gas-tight and cannot be polluted by the ambient air. Booth personnel said the reliability complements the energy efficiency delivered by the frequency converter allowing operation between 15% and 100% load with an efficiency of up to 88%.

Sulzer high-speed Turbocompressors are presented as offering quality and reliability due to having only one moving part. This single shaft functions as the motor's rotor, upon which the impeller and cooling fan are mounted. This leaves no need for inlet or diffuser vanes with complex mechanics. The magnetic bearings used eliminate physical contact and thereby all mechanical wear – even during starts and stops. Sulzer's Dave Parsons commented they've never had a failure on their magnetic bearing after 225 installations in the U.S. and more than 3,000 installations worldwide. He also said they are seeing growing acceptance of magnetic bearing technology, due to it's reliability, in the U.S.

Atlas Copco has also invested in magnetic bearing technology in their ZB VSD (variable speed drive) centrifugal air blower range. This direct-drive range of blowers offers models from 135 to 335 hp (100-250 kW) in a complete "all-in" package. Blower and Low Pressure Compressor Sales Manager, John Conover, reviewed the importance of magnetic bearings' ability to withstand "ride-through" surge conditions and how the contactless design provides for unlimited start-stops. The ZB package integrates many components including; low pressure-drop air inlet filter, integrated blow-off silencer and actuator, integrated stainless steel check valve, stainless steel or aluminum impeller, closed cooling water circuit, air outlet and modulating blow-off valve and the Elektronikon® Mk 5 system monitor controlling blower operation, integrated frequency converter and bearing controller. High "wire to air" efficiency is also accomplished with VSD technology reducing blow-off air and providing tighter pressure bands and lower average working pressures.

Positive Displacement Rotary Screw and Lobe Blowers

Kaeser Blower Product Manager, Stephen Horne, was as excited as I've seen him. Why? Kaeser introduced, at WEFTEC 2016, the DBS 20-50 hp screw blower line. Designed, from the ground up for blower applications, these integrated package blowers provide flows from 150 to 770 cfm and boast an energy improvement over conventional PD blowers of up to 35%. The units run at 12,000 rpm and are gear-coupled. To minimize over-compression, there is a "L" range for 4 to 9 psi and a "M" range for 8 to 16.5 psi. The DBS series package comes with high efficiency motors, silencers, inlet filters, starters/drive, a full enclosure, an onboard controller, and a full complement

of sensors. The units are available in both STC (wye-delta start) and SFC (Variable Frequency Drive) versions. Models also come standard with Sigma Control 2™. In addition to monitoring all onboard sensors, Sigma Control 2 features expanded communication features and can be seamlessly integrated into plant control/monitoring systems like the Kaeser Sigma Air Manager 4.0.

Gardner Denver Robuschi was also pumped (ha!) to introduce their brand new ROBOX energy Triple Impact rotary screw compressor. Gardner Denver's Director for Blower & Vacuum Products, Kenny Reekie, called the technology "totally unique on the market" as it has no bearings and no issues with surge – while providing energy savings of up to thirty percent (30%) over PD rotary lobe technologies. The technology involves a patented combination of the RSW core compressor with a permanent magnet motor directly fitted onto the conductor shaft. This prevents any potential loss of power coming from a belt drive. Combining the permanent magnet motor with an integrated frequency converter also permits high efficiency even when operating at lower speeds. The innovative design is very compact and uses 30% less space than most rotary screw packages equipped with frequency converters. The range has three models; 50, 75 and 100 horsepower providing pressures up to 15 psig and capacity up to 1,500 cfm. The ROBOX screw compressor is controlled by the Smart Process Control tool. It analyses and applies the oxygen data received from the process and adjusts the operating parameters to optimize energy savings without interrupting the process.

Eurus Blower is led by industry-veteran, Tom Hodanovac. Their MB series bi-lobed blower standard package comes with a common base/discharge silencer and a spring supported motor mount tension base, allowing for automatic V-Belt tensioning. The flow ranges of this product line are from 27 to 3189 cfm and pressures up to 15 psig or vacuums up to 15" HgG. The Company prides itself on durability and units are covered with a 24 month factory warranty from date of shipment.

Conclusion

The 2017 WEFTEC Technical Exhibition and Conference will be held September 30th to October 4th at the McCormick Convention Center in Chicago. For more information on the 2017 WEFTEC, visit www.weftec.org BP

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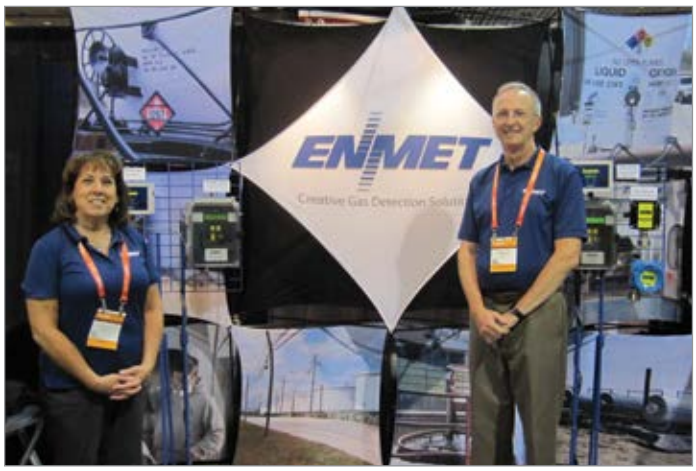
Tim Hilgart and Becky Gibson at the Howden Roots booth

Amber Roberts next to the Siemens Turblex single-stage integrally-geared centrifugal blower.



Norman Davis and Nancy Aulisa presented their Wet Well Monitor to measure methane, oxygen and hydrogen sulfide in hazardous wastewater environments, at the ENMET booth.

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

Aerzen USA Celebrates a Groundbreaking Event

Aerzen USA has been on a growth path over the past several years and is in need to expand the Coatesville, PA operation. The company has developed expansion plans and new building designs and celebrated the start of a new chapter in the company's history. A groundbreaking event took place to kick-off the building expansion.

New building expansion features include additions to the office and seating areas with a new conference room and lunch room. Additional manufacturing and warehouse space will be part of the addition to accommodate the company's expanding product range. The tentative completion and move-in time frame is in the summer of 2017.

For more information, visit www.aerzenusa.com.

Aerzen USA celebrated a groundbreaking event to kick-off the building expansion.

Atlas Copco Completes Leybold Vacuum Acquisition

Effective as of September 1, 2016, Atlas Copco AB (Stockholm, Sweden) owns the former Oerlikon Leybold Vacuum GmbH, renamed Leybold GmbH. Founded in 1873, Atlas Copco is a global player with more than 43,000 employees in over 180 countries. Leybold becomes part of the Vacuum Solutions Division, belonging to the Compressor Technique Business Area, with approximately 6,500 employees represented in over 35 countries.

With this acquisition, Atlas Copco trusts the strengths of the vacuum specialists at Leybold, founded in 1850, who will keep their traditional and well-known brand in the market. "The technological know-how and the innovative spirit of Leybold will complement our vacuum portfolio and strengthen our market presence, contributing to our customers' success," says Geert Follens, President of the Atlas Copco Vacuum Solutions Division.

Leybold, headquartered in Cologne, Germany, and has a 166-year long history, develops and delivers vacuum pumps, systems, standardized and customized vacuum solutions and services for various industries. As a leading supplier of vacuum technology, Leybold offers sustainable solutions for industrial processes such as secondary metallurgy and a range of coating technologies. With a high application expertise in the fields of analytical instruments, display production as well as in research and development, Leybold ranks among the world's top providers and has always been a part of well-known, globally active companies.

With rough, medium, high and ultra-high vacuum pumps, vacuum systems, vacuum gauges, leak detectors, components and valves, as well as consulting and engineering of turnkey vacuum solutions, Leybold provides a very broad portfolio for general and specific customer applications. "We will continue to support our customers

in the future with our vacuum expertise. Our enhanced product portfolio, sustainable after-sales services and proximity to our customer will distinguish us as a reliable business partner", says Steffen Saur, Chief Marketing Officer, responsible for the global sales and service activities of Leybold. "Additionally, by combining Atlas Copco's and Leybold's strengths in industrial dry pumps and scientific turbo pumps, it will provide a technology platform for superior next generation products."

As a pioneer of vacuum technology, Leybold will continue to focus on performance and growth in the industrial, research and development, and analytical market sectors.

About Atlas Copco

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

About Leybold

Leybold is a part of the Vacuum Solution Division within 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 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

Busch to Open New Service Center in Austin, Texas

Busch, LLC is a leading manufacturer and retailer of vacuum pumps, compressors and blowers with a reputation for reliable high-performing vacuum products. The global, family-owned company is continuing to solidify its future here in the U.S. with a new 44,000 sq. ft. building in Austin, Texas. The new facility will offer single piece flow re-manufacturing with four flow line capabilities, processing 16 modules per day from disassembly to testing. It also has the potential to serve as a distribution hub for pumps and parts.

Some upgraded features of the building include additional space, a training center, a fully exhausted disassembly area and visual production planning by way of large screens in each area tracking actual movements in the flow lines. Additionally, the new facility offers climate controls for the production area and state-of-the-art process measurement capability of all hard parts. A visitor walkway will allow visitors to view the production area without entering it, and customers will be able to track their repairs via the web in real time.

Additionally, the entire workflow of the building is in line with the seven steps of flow line production:

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

1 Purge and de-systemize
2 Disassembly/hot wash
3 Blast
4 Presentation
5 Assembly
6 Frame assembly
7 Testing.

Busch is opening a new 44,000 square foot Service Center in Austin Texas.

While exciting days are ahead as the Busch Family continues building for the future, excellence awaits our customers as we continue to strive to provide the highest standard of products and services!

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

Bimba Announces Acquisition of Vaccon Company

Bimba, an industry-leading innovator of pneumatic, hydraulic and electric motion solutions, today announced the acquisition of Vaccon Company, Inc., a leading innovator in vacuum technology that includes vacuum pumps, vacuum cups, end-of-arm tools, and accessories.

Pat Ormsby, President of Bimba, says, "This acquisition reflects Bimba's dedication to technology expansion and growth. The addition of Vaccon's vacuum technology to our distribution channel increases Bimba's strategic value in our targeted industries, including packaging, automotive, factory automation, and material handling."

Founded in 1972 by Dick Ferri with headquarters in Medway, Massachusetts, Vaccon will continue to operate from its present location under the current management led by Ellen Ferri. "We are excited to be joining Bimba," she says. "With the help of Bimba's channel partners and financial strength, Vaccon will be able to expands its offerings of products and technology."

Vaccon products are esteemed for their rugged yet simple "straight-through" single-stage venturi design, which allows particles, dust and other contaminants to pass through the pump without clogging or malfunction. Just as Bimba's products "make things move," Vaccon's "picks things up" in hundreds of applications from assembly to waste & spill clean-ups.

About Bimba

Bimba is a forward-thinking innovator providing industry-leading pneumatic, hydraulic, and electric motion solutions that are easy-to-use, reliable and ready for all engineering solutions. Including its brands TRD, Mead, MFD, Pneumadyne, Acro and Vaccon, Bimba markets an extensive line of industry-leading products including pneumatic, hydraulic, and electric actuators; valves; fittings; air preparation and a variety of safety and production solutions. In addition to its broad line of standard catalog products, the company's business develops many custom and semi-custom products designed for specific customers and applications. These products, used in machinery and automation, are sold to original equipment manufacturers and end-users throughout the world in an expanding variety of industries.

For more information, visit http://www.bimba.com.

Owens Corning Recognized as a ENERGY STAR® Partner of the Year-Energy Management

Owens Corning develops, manufactures, and markets insulation, roofing, and fiberglass composites. Many of the company's products and systems save energy and improve comfort in commercial and residential buildings.

Owens Corning is receiving ENERGY STAR® Partner of the Year recognition for its vigorous energy management program. Key 2015 accomplishments include:

- Achieving an average reduction in energy intensity of more than 3 percent per year for the past five years.
- Completing 77 energy projects for a savings of $7.8 million in 2015.
- Expanding its use of clean power by implementing three renewable energy projects, including a 2.4 megawatt solar canopy and two wind power supply agreements for new installed capacity.
- Allotting and sustaining a dedicated capital funding pool specifically for energy projects.
- Building a strong company energy team with energy leaders at plants and several

Certified Energy Managers (CEM) throughout the organization.

- Implementing a system for sharing best energy management practices across the company, ENERGY STAR Partner Share, to help develop new ideas and to learn from ENERGY STAR industrial partners.

For more information, visit www.owenscorning.com or www.energystar.gov.

Lone Star Blower and GL-Turbo Announce Opening of GL-Turbo Houston Facility

Lone Star Blower, Inc and GL-Turbo (GLT) announce the opening of GL- Turbo Houston as a USA Manufacturing facility. This joint venture will manufacture the core units of the GL Series integrally geared turbo blowers with variable inlet and discharge guide vanes. As an ISO 9001 and 14001 manufacturing plant this is expected to create 20 to 30 jobs in the next couple of years.

James Jin, owner of GLT, stated, "GL Turbo originated in Boston, MA and designed our GL Series blower with a design team from Massachusetts Institute of Technology (MIT) in 2006. Our GL Series core components are made in the USA and since Lone Star already packages, services and tests these units, having a manufacturing center in Houston will assist us with quicker lead times and a more local presence to serve the Americas and beyond. This fits into our *Think Globally and Produce Locally* market strategy to rapidly gain market share."

"Our partnership with GL-Turbo has grown to bring complete manufacturing to Houston. The core components such as gears, shaft and impeller are already made in the USA, so the final assembly was a natural evolution," said Andrew Balberg, President, and CEO of Lone Star. Balberg continued, "We now offer complete performance testing in our Houston facility up to 3,000 hp for all blower technologies according to any published world standard. This is a market first."

Matt Howard, Vice President of Operations at Lone Star, added. "Offering the fastest lead time is also part of our customer first commitment and this manufacturing line will fit in well with our existing multistage centrifugal turbo LS Series product manufacturing line."

About Lone Star Blower

Lone Star is a manufacturer, master distributor, packager, and service company for blower and blower control systems located in Houston, Texas. Products include single stage turbo blowers (both gear driven with variable inlet and discharge guide vane and gearless driven with a permanent magnet motor), vertically split multistage centrifugal turbo blowers, and related blower control systems. Lone Star also services many other blower brands. Industries served include water and wastewater, power, petro-chemical, oil and gas mining, and many others using compressed air or gas, in pressure or vacuum applications.

For more information, visit www.lonestarblower.com Email: info@lonestarblower.com or call +1 832-532-3112.

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