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July 2020

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FROM THE EDITOR



Industrial Blower & Vacuum Systems

Our thanks go to Kevin Kalk, from DEKKER Vacuum Technologies, for sending us an excellent overview of vacuum applications and solutions in the woodworking industry. Pod System and Nesting CNC Router vacuum requirements are reviewed as well as the challenges they pose to different vacuum pump technologies.

Our own Mike Grennier received the opportunity to profile an energy-saving aeration blower upgrade project realized at the Madison Utilities' wastewater treatment plant in Alabama. Serving the approximately 55,000 residents in the Madison area, this is a Class B solids 8.25 MGD (million gallons per day) activated sludge plant with an average daily flow of 6.5 MGD and a peak capacity of 24 MGD.

Aeration Blower Systems

Tom Jenkins, from JenTech Inc., and our own Mike Grennier had the opportunity to interview Brent Herring, Manager of the Wastewater Treatment Division at KC Water in Kansas City, Missouri. He is responsible for a 320 square-mile service area including 2,800 miles of sewer lines!

If equipment breaks down, the projected annual energy savings can disappear in a matter of hours! Proper lubrication, of rotating equipment, is a fundamentally important cornerstone to reliability. Brendan Pankratz, from Tuthill, provides us with an excellent review of this topic titled, "Positive Displacement Blower and Vacuum Booster Lubricants."

Best Practices EXPO & Conference Announcements

Please consider reserving portions of September 22-23, 2020 for the Best Practices 2020 ONLINE EVENT! Free for all to register at www.cabpexpo.com, this is a great opportunity for maintenance teams, specifying engineers and sales engineers to receive training (and PDH hours)! We will offer LIVE Online Forums and Keynotes, plus hours of pre-recorded sessions.

We have announced the postponement of the Best Practices 2020 Expo & Conference to November 2-4, 2021. It will be held at the same venue – the Schaumburg Convention Center located in Chicago's convenient outskirts near O'Hare International Airport.

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

ROD SMITH

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Register at www.cabpexpo.com

AGENDA AT A GLANCE

Tuesday, September 22nd

- 11:00AM Live Keynote Presentations
- 12:00PM First Wave of Pre-Recorded Sessions
- 2:00PM Live Discussion Forum
- 3:00PM Second Wave of Pre-Recorded Sessions

Wednesday, September 23rd

- 11:00AM Live Keynote Presentations
- 12:00PM Third Wave of Pre-Recorded Sessions

Note: All times listed are U.S. Eastern Standard Time

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BLOWER & VACUUM SYSTEM TECHNOLOGY NEWS

Pfeiffer Vacuum Introduces New HiScroll Vacuum Pumps

The HiScroll models from Pfeiffer Vacuum's new range of scroll pumps are oil-free, hermetically sealed vacuum pumps with high nominal pumping speeds of 6 to 20 m³/h. The new pumps are characterized by their compact design and quiet, low-vibration operation (<47 dB[A], and <42 dB[A] in stand-by mode).

Excellent water vapor tolerance thanks to the two-stage gas ballast. As a result, condensation in the vacuum pump is avoided. With these features, the pumps are ideal for use in many applications in analytics, biomedicine, pharmaceuticals and research and development. They are used in mass spectrometry, electron microscopy, surface analysis, accelerators and laboratory applications, but also in the semiconductor industry, coating processes and gas recovery.

The HiScroll's active temperature control ensures optimal cooling and guarantees the lowest noise level. Jürgen Keller, Pfeiffer Vacuum Market Manager for Analytics said, "We are proud of the fact that our new scroll pumps have the lowest noise emissions in their class. These dry pumps can also be easily connected to other Pfeiffer Vacuum products, such as turbopumps, or operated by higher-level controls via the RS-485 or ProfiNet interface. We drive sustainable solutions and help to reduce the environmental impact and carbon footprint with our new engine concept."

An intelligent interface makes it possible to define specific pressure ranges or a rotation speed setting mode, so that the pump can be optimally adapted to suit the application. This minimizes wear in the



Pfeiffer Vacuum scroll pumps from the HiScroll range.

pump resulting in longer to service time intervals. The proven quality of Pfeiffer Vacuum products with first-class, durable components also ensure a long service life as well as lower operating costs. The pumps are easy to maintain, which not only reduces the time to service but also ensures the highest level of reliability. The integrated safety valve and the self-regulating operation of the pump guarantee safe and reliable use. The powerful motor is up to 15% more efficient than conventional drives. This ensures outstanding performance while keeping temperatures low, which in turn simplifies the cooling of systems and plants.

About Pfeiffer Vacuum

Pfeiffer Vacuum is one of the world's leading providers of vacuum solutions. In addition to a full range of hybrid and magnetically levitated turbopumps, the product portfolio comprises backing pumps, leak detectors, measurement and analysis devices, components as well as vacuum chambers and systems. Ever since the invention of the turbopump by Pfeiffer Vacuum, the company has stood for innovative solutions and high-tech products that are used in the Analytics, Industry, Research & Development, Coating and Semiconductor markets. Founded in 1890, Pfeiffer Vacuum is active throughout the world today. The company employs a workforce of some 3,200 people and has more than 20 sales and service companies as well as 10 manufacturing sites worldwide. For more information, please visit www.pfeiffer-vacuum.com.

Inovair Releases New IM-20 Centrifugal Blower

Inovair released the IM-20, a compact and efficient geared centrifugal blower. The blower was developed for the 20-125 HP market, with size and efficiency in mind. The low profile, vertical inlet, and small footprint make it ideal for replacing less efficient blower technologies. The architecture allows it to fit through a standard 36-inch man door and be placed on most existing blower pads without modification. The vertical discharge and low profile simplify installation by allowing it to be set in the same location as a previous blower thus reducing the amount of piping.

The blower utilizes the same proven reliable and efficient gearbox as the industry leading IM-30. The industry leading energy savings seen from the 2200 gearhead in the IM-30 have been duplicated in real world applications with it. At a WWTP in the Midwest the plant was able to replace (3) 125 HP multistage blowers with (3) 75 HP IM20s and



Inovair IM-20 Centrifugal Blower.

have seen a 45% reduction in power consumption. It is ideal for any wastewater application.

Additionally, The IM-20 utilizes the latest Inovair control system, which was developed in-house using years of experience in the MWWT industry. The control system is manufactured in our UL-rated panel shop and includes features such as automatic temperature and pressure compensation for use in a variety of wastewater applications. These controls can be coupled with our innovative Master Control Panel to provide sensor (DO, ORP, etc.) feedback control at a very cost-effective price.

About Inovair

Inovair is the industrial products division of Accessible Technologies, Inc. The company was founded in 1994 to expand the application of high efficiency geared centrifugal blower technology within forced induction, aerospace, municipal and industrial applications. Inovair has been the worldwide leader for high performance compressors utilized in aircraft ground support equipment since 1998, is a leader in compact high efficiency blower packages for wastewater treatment, and also supplies blowers and compressors for a broad range of industrial applications. Highly efficient blower design, durable transmission design and space utilization are just a few hallmarks of the Inovair line of geared centrifugal blowers and compressors. All Inovair activities, including engineering, manufacturing and service, are performed in the USA. For more information, visit www.inovair.com.

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BLOWER & VACUUM SYSTEM TECHNOLOGY NEWS

Quincy's QSV Variable Speed Rotary Screw Series

Quincy's QSV line of variable speed oil-sealed rotary screw vacuum pumps are ideal for a wide range of applications in canning, glass bottle/container production, food packaging, pipeline drying, and many other medical/ industrial applications.

This series delivers up to 3000 ACFM at a vacuum level of 29.9" HgV with each pump capable of turning down to about 10% speed while maintaining deep vacuum. The pump's VSD and set-point control allow delivery of the lowest possible flow to match the required vacuum demand, thereby optimizing process efficiency. Ultra-high oil retention rate at all operating pressures leads to reduced environmental impact. The system's Airlogic II Controller and optional ICONS solution provide a state-of-the-art monitoring system for your vacuum pump, allowing you to proactively plan maintenance intervention. The equipped sound attenuation canopy results in roughly half the noise level of comparable technologies.

About Quincy

Quincy Compressor is a leading designer and manufacturer of reciprocating and rotary screw



Quincy's QSV series is the perfect solution to replace multiple point-of-use vacuum pumps with one centralized vacuum system.

air compressors, vacuum pumps and a full line of air treatment components. In business since 1920, Quincy has built its reputation on quality and rugged reliability, building tough air compressors for the most demanding applications. The Quincy brand is synonymous with quality, delivering “Performance You Demand. Reliability You Trust.” For more information, visit www.quincycompressor.com.

Gardner Denver Launches Oxygen Rated Claw Vacuum Pumps

Gardner Denver continues to innovate and optimize our Elmo Rietschle VLR vacuum claw products to reach new markets and applications. We are pleased to announce the release of our new oxygen rated vacuum claw pump series designed for applications with oxygen rich gas streams. The VLR-OXY option brings dry claw performance to your oxygen-rich application. Available as an option on the VLR301, VLR401, and VLR501, these pumps are ideal for waste anesthesia gas recovery and other niche applications where process gas may be composed of up to 60% v/v O₂. The special preparation of these pumps involves thorough and exacting cleaning of all internal components to ensure that the process gas stream will never contact residual combustible materials within the compression chamber of the vacuum pump.

Oil-free vacuum allows for clean performance without the hassle and expense of regular process oil changes. This is especially relevant in the realm of high-oxygen processes, where the use of incredibly expensive fluorinated oils is mandated. With the Elmo Rietschle VLR-OXY line of vacuum pumps, your maintenance costs will be reduced to an occasional change of gearbox lubricant.

About Gardner Denver

Gardner Denver is a leading global provider of mission-critical flow control and compression equipment and associated aftermarket parts, consumables, and services, which it sells



Gardner Denver Elmo Rietschle VLR-OXY vacuum claw pump.

across multiple attractive end-markets within the industrial, energy and medical industries. Its broad and complete range of compressor, pump, vacuum and blower products and services, along with its application expertise and over 155 years of engineering heritage, allows Gardner Denver to provide differentiated product and service offerings for its customers' specific uses. Gardner Denver supports its customers through its global geographic footprint of 40 key manufacturing facilities, more than 30 complementary service and repair centers across six continents, and approximately 6,500 employees world-wide. For more news and information on Gardner Denver, please visit www.gardnerdenver.com.

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BLOWER & VACUUM SYSTEM TECHNOLOGY NEWS

Edwards Launches New Compact Dry Vacuum Pump

Edwards launched the new nXRi high performance compact dry pump, with lower input power and zero maintenance, bringing real performance improvements and cost benefits across a range of applications. Initial variants will provide pumping speeds of either 60 or 90 m³h⁻¹, four times more pumping speed than a similar sized dry pump.

Designed with size in mind, the compact footprint and height allow the Edwards nXRi dry pump to fit easily under a benchtop saving valuable space in the laboratory; and at under 30kg offers a highly mobile vacuum pump for changing workflows and environments. The pump is maintenance free for up to five years, with no tip-seal or oil change, for maximum uptime and reduced maintenance costs.

The nXRi's 40% smaller footprint, compared to alternative dry pumps, assures seamless integration into analytical instruments and vacuum systems for a ready to go vacuum solution, perfect for mass spectrometry, electron microscopy and leak detection.

R&D and industrial customers will enjoy the design flexibility, oil-free and low maintenance features.

"Performance is at the core of our new nXRi dry pump," said Dave Goodwin, Product Manager, Scientific Vacuum, Edwards. "nXRi delivers four times more pumping speed than similar sized dry pumps, and with low ultimate pressure and high reliability customers are assured a consistent and stable vacuum for years to come."

About Edwards

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



Edwards new nXRi high performance compact dry pump.

In 2019, Edwards was celebrating its 100-year birthday. The founder, FD Edwards, began by importing vacuum equipment from a small office in South London. 100 years later Edwards has over 6,000 employees worldwide engaged in the research, design, manufacture and support of high technology vacuum and exhaust management equipment. Edwards has state-of-the-art manufacturing and technology facilities in Europe, Asia and the Americas. For further information about Edwards products please visit www.edwardsvacuum.com.

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JAN 23 **Compressed Air Leak Management Best Practices**
Presenter Ron Marshall, Chief Auditor, Marshall Compressed Air Consulting
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FEB 20 **Verifying Blower System Energy with ASME PTC 13**
Presenter Tom Jenkins, P.E., President, JenTech Inc.
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MAR 19 **Designing Piping Systems for Low Pressure Drop**
Presenter Tom Taranto, Owner, Data Power Services
March 19, 2020 – 2:00PM EST
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APR 16 **How to Correctly Size Vacuum Pumps**
Presenter Chris Gordon, President & CEO, Blackhawk Equipment
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MAY 21 **Air Compressor Master Controls to Prevent Control Gap**
Presenter Tim Dugan, P.E., President and Principal Engineer,
Compression Engineering Corporation
May 21, 2020 – 2:00PM EST
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JUN 18 **VSD Air Compressor Installation Guidelines**
Presenter Loran Circle, Senior Consultant, Compressed Air System Training & Consulting
June 18, 2020 – 2:00PM EST
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JUL 20 **Where Does Blower Air Go? Process Fundamentals**
Presenter Tom Jenkins, P.E., President, JenTech Inc.
July 20, 2020 – 2:00PM EST
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AUG 20 **Calculating Storage for Demand Events**
Presenter Tom Taranto, Owner, Data Power Services
August 20, 2020 – 2:00PM EST
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OCT 15 **Vacuum System Efficiency Projects**
Presenter Chris Gordon, President & CEO, Blackhawk Equipment
October 15, 2020 – 2:00PM EST
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NOV 12 **Measuring KPI's: kW, Flow, Pressure, Dewpoint**
Presenter Tim Dugan, P.E., President and Principal Engineer,
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November 12, 2020 – 2:00PM EST
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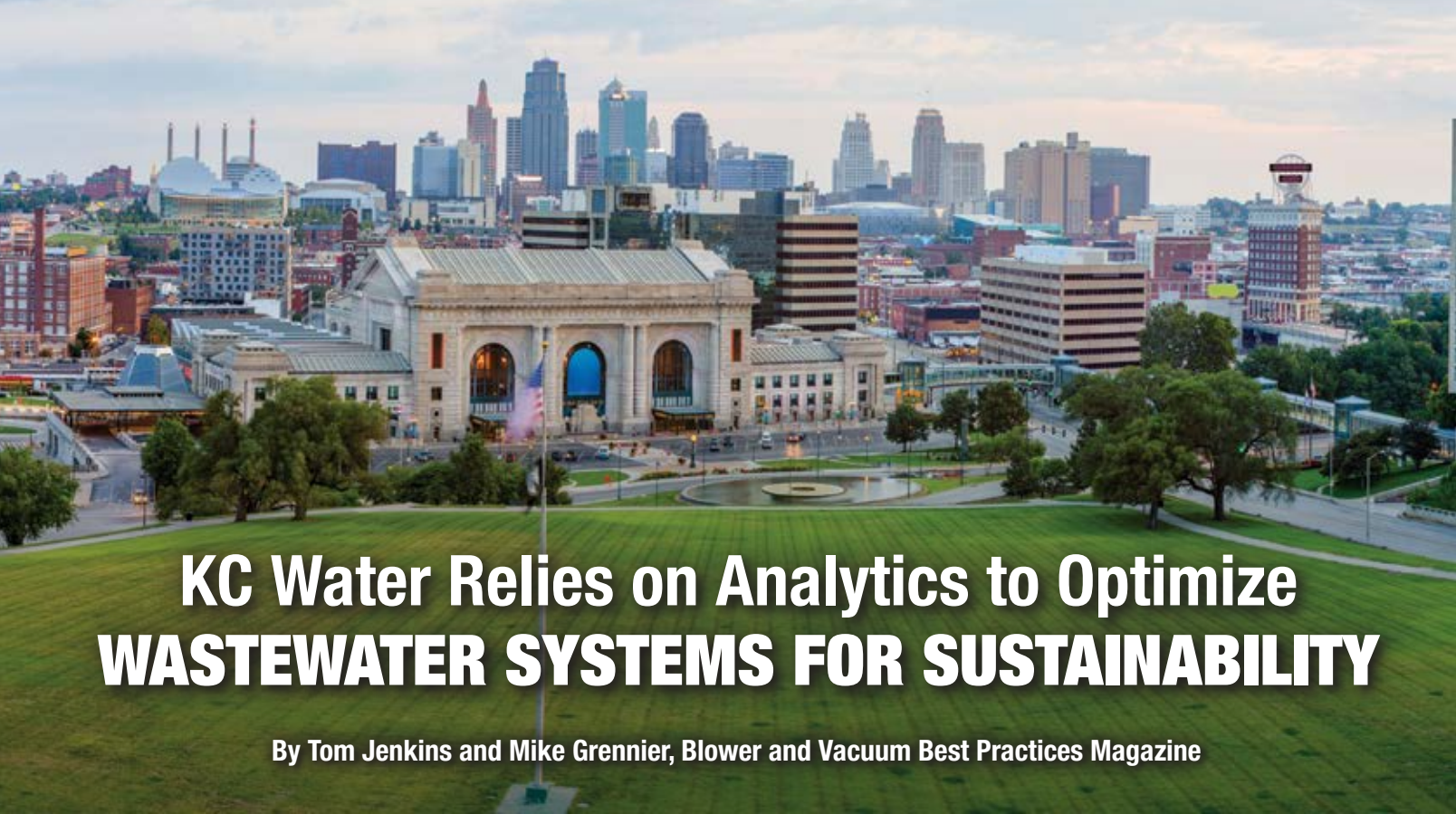
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AERATION BLOWER SYSTEMS



KC Water Relies on Analytics to Optimize WASTEWATER SYSTEMS FOR SUSTAINABILITY

By Tom Jenkins and Mike Grennier, Blower and Vacuum Best Practices Magazine

▶ Water resource recovery facilities represent a major market for aeration blowers. Blower and Vacuum Best Practices Magazine interviewed Brent Herring, manager of the Wastewater Treatment Division at KC Water in Kansas City, Missouri, to get an owner's perspective on the industry.

Good morning! Please describe KC Water.

We are a municipally owned water, wastewater, and stormwater utility with three separate

rate bases. I oversee the systems that have to do with wastewater, while other divisions handle water treatment and distribution and stormwater management. Our 320-square-mile service area includes 2,800 miles of sewer lines and 2,800 miles of water lines.

KC Water encompasses six wastewater plants and 43 flood and sanitary stations. There are 15 flood stations along the Missouri River that keep Kansas City dry. Then we have 1,350 acres of land for biosolids application.

Industrial pre-treatment is the responsibility of the Regulatory Compliance Division. We all work closely together.

What has been your attention lately, given the need to continuously upgrade a utility of this size?

We've spent a lot of money upgrading infrastructure. We spend a lot of money on pipes in the ground in terms of addressing combined sewer overflow. Our issue wasn't so much capacity at plants as it is the way you



“I think the only way we get quickly to cleaner water is to optimize how we use the technology we are buying.”

— Brent Herring, Manager of the Wastewater Treatment Division, KC Water

move flow across 320 square miles, twenty four hours a day, seven days a week.

We've done many, many projects. At any one time in my division, we have 100-125 projects under way in construction or design. Our projects range from small to large both in terms of complexity and cost, ranging from pump station upgrades to a \$150 million thermal hydrolysis biosolids facility design-build project.

How do you decide what's best for all involved given so many projects?

We often use the Quadruple Bottom Line (QBL) approach, which is a takeoff of

the Triple Bottom Line concept. We weigh investments decisions on four criteria: environmental, community, operations, and economic impacts.

We apply QBL when it looks like there is no super clear alternative to a particular solution, or when it looks like there might be diverging issues among these four areas. We don't use it all the time because there are times when the most environmentally friendly project is also the most cost-effective. What I really like about QBL is the ability to maximize resources and minimize the burden on ratepayers and the environment.



Brent Herring, Manager of the Wastewater Treatment Division, KC Water, Kansas City, Missouri.

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KC WATER RELIES ON ANALYTICS TO OPTIMIZE WASTEWATER SYSTEMS FOR SUSTAINABILITY

It sounds as though QBL is a balanced approach to decision-making.

That's exactly what it is. Our goal is to have a holistic decision-making framework that is responsive to the needs of ratepayers and our rate structure, while also giving us the ability to weigh the environmental benefits and take into account system and facility operability and short- and long-term costs. At the end of the day, we blend those together in a logical and consistent manner.

We're also very committed to Envision (<https://sustainableinfrastructure.org/envision/>), which is a decision-making framework created by the Institute for Sustainable Infrastructure. Envision helps us to continue to create a sustainable and resilient utility.

Does KC Water rely heavily on aeration blowers to maintain treatment?

Three plants serving the north portion of our service area use aeration blowers. Two have turbo blowers and one has multistage blowers.

The other three plants don't use blowers since we use bio towers (trickling filters). The multistage blowers are in a plant that is fairly old. The turbos have been running for seven to 10 years. We don't have any issues with those blowers in that application.

Aren't blowers usually the biggest single energy use for most municipalities?

Not only that, but wastewater treatment and water treatment facilities are second only to schools in terms of capital investment. These operations are usually either the biggest or the second biggest capital investment for most municipalities. Our focus with blowers and most processing equipment is on reducing energy consumption while ensuring operability. We need to be looking for the renewable, the reuse portion, the green portion of wastewater treatment.

Do you use separate buildings for your aeration blowers?

We've always put blowers in buildings because a building was already there, not because that was the best place to put it relative to where you're going to put the air. I'd much rather have blowers next to the aeration tank. We want to minimize that delivery system, subsequent losses, or any other issues, whether it's accumulation or condensation or any other issue. Also, it takes a lot of energy to push that air. It's only 10 feet away, but 10 feet is 10 feet over the lifetime of the facility.

What is your approach to blower sizing?

I come from a time when you probably needed three blowers – two at maximum flow, and one as a spare for backup. Well, maybe we need to look at different options. Maybe we need to have them sized in sort of a Mama Bear/Papa Bear/Baby Bear arrangement. Blowers



A turbo blower in use at the Fishing River Wastewater Treatment Plant in Kansas City, Missouri.

are mission critical, and they are a significant part of our operation due to energy costs and regulatory compliance. They are one component that can cause a problem with permit compliance.

In wastewater treatment plants today, we need to optimize our ability to treat flow more efficiently for objectives that were never envisioned in the original Clean Water Act, such as managing nutrients. The industry – the blower industry, the profession, the required treatment, water quality objectives, our understanding of treatment technologies in wastewater – has come a long way. We’re on a curve to optimize wastewater treatment, but it is not a simple equation.

Are newer technologies, such as remote monitoring, a big part of your efficiency efforts?

Years ago, we didn’t have the ability to monitor remotely like we do today. The cost of doing these large-scale SCADA systems has dropped exponentially over time. As a profession, we have not told the good story about technology investment benefits like we are able to with metrics and analytics today.

That’s important, because we don’t work in a profession that’s easy to explain. Sometimes, the story is not easily told in 10-second sound bites. Analytics enables us to quantify performance at a very high level, which we hope enables our internal stakeholders and ratepayers to be more comfortable

with investing in technologies that improve efficiencies.

How do you use analytics with blowers, for example?

A good example is blower timing. Where you have demand charges for electricity, can we shift treatment operations to lower-cost, evening-time periods? It goes to wastewater diurnal variations. In a service area as large as Kansas City, the diurnal variation is not as significant as it might be elsewhere. But we can still optimize our strategy in terms of the incoming flow and organic loading.

The blower system doesn’t operate as a thing in and of itself. Everything else responds and relates to it. It needs to be an integrated

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KC WATER RELIES ON ANALYTICS TO OPTIMIZE WASTEWATER SYSTEMS FOR SUSTAINABILITY



Shown are the main blowers used at the Rocky Branch Wastewater Treatment Plant in Kansas City, Missouri.

system within all of the facility's components. As it relates to blowers and any piece of instrumentation that has controls, one needs to really give some serious thought to how many signals you bring back to the SCADA system; and how to optimize the control strategy to enable more effective human interaction with operations and maintenance staff.

Anytime we can use technology like blowers and controls to optimize how treatment occurs is significant. I think the only way we get quickly to cleaner water is to optimize how we use the technology we are buying.

Are Inputs/Outputs (I/O) a major consideration for optimization?

Yes. If it costs \$100,000 to have 500,000 I/O points, but you've got a number of additional systems, how much money can one invest? There might have as many as 15 points on a single blower that should be monitored, and maybe you've got four blowers in a system.

Don't forget the physical need to wire that stuff so you can troubleshoot it. This isn't rocket science, but one needs to know and understand how all the pieces come together and how they relate to each other in their operation, troubleshooting, and maintenance.

Is it correct to say your operations staff remains a big part of optimization?

Right, and budget pressures continually cause us to consider how we deploy resources. They have over the years. No one wants to hear that. Yet technology enables our ability not only to staff appropriately but also to increase people's skill sets and equip them to be critical thinkers and troubleshooters.

You know, years ago, if you had a problem with a pump, it was pretty simple to diagnose.

Same with a blower. It worked or it didn't. Nowadays, you can't figure out if it's the blower or the controls because everything is so integrated. Today's workforce needs to be able to understand the sophistication of controls. It makes it even more important for operators to be comfortable with technology. Job security is not just about fixing things. Job security should be based on the fact that I can operate things.

Describe the changes you've seen in treatment plant operators in recent years.

A majority of the folks coming in are millennials. In my view, the old command-and-control management structures no longer work; in other words, doing something just because I tell you to go do it. One can do that, but that approach is not likely to get the needed collaboration and cooperation. Millennials are accustomed to constant feedback. So how do I meet the need they have for that? How do we integrate that with other generational needs and norms?

Today, we need to build an organization that is continually responsive to the human elements; incorporates thoughtful technology implementation; and meets the needs of our customers cost-effectively and enables our team members to be the best water professionals they can be.

Thank you for these insights. BP

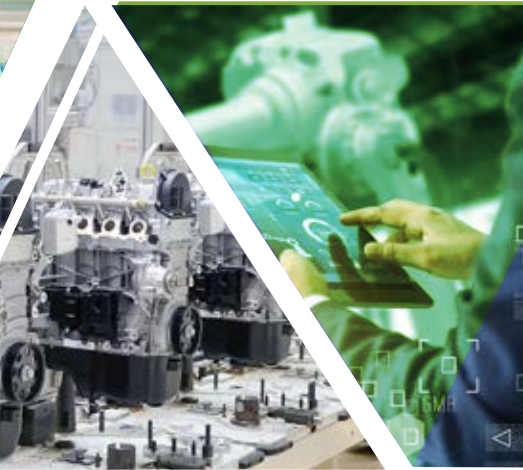
For more information, please contact Brent Herring at Brent.Herring@kcmo.org; or visit <https://kcwater.us/>.

All photos courtesy of KC Water.

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INDUSTRIAL BLOWER & VACUUM SYSTEMS

VERSATILE VACUUM TECHNOLOGY is a Force Behind Industrial Woodworking

By Kevin Kalk, DEKKER Vacuum Technologies

► There's a lot of vacuum going on in the woodworking industry. From treatment to routing to handling, vacuum systems help meet the demands for higher speed performance, greater precision, faster production and better quality. Vacuum technology enhances the skills and talents of operators.

With a variety of well-established system designs to choose from, each offering various combinations of advantages, woodworking

facilities of all sizes and production capabilities can precisely target their vacuum requirements to deliver maximum output. Here's an overview of the most significant woodworking vacuum applications.

Pod System CNC Routers

"Small but powerful" is the operative phrase for pod-system vacuum. The individual pods on the grid are small and don't cover a lot of area. One system may have as few as four pods

to as many as 24 pods, and they are adjustable. This gives the system flexibility in several ways, such as being able to machine on the sides and bottom of a piece. Since there is very little air that needs to be removed, a deeper vacuum is required for the additional holding force.

A small lubricated rotary vane vacuum pump is the most common type used for a pod system. It has sufficient flow and a consistent, deep vacuum for maximum holding power. They are



**“The specific requirements of the application
will determine the ideal vacuum system.”**

— Kevin Kalk, DEKKER Vacuum Technologies

usually air-cooled. The lubricated rotary vane has a simple mechanical design and is simple to install and has the additional benefits of being low-noise, low-maintenance pumps.

Nesting CNC Routers

When you associate vacuum with woodworking, the ubiquitous nesting CNC routers are usually first to come to mind. As opposed to pod systems, nested systems have a larger area to cover, so a much larger capacity vacuum system is needed.

Hold-down force depends on the type of router tools, force generated by the depth of cut, feeding speed and other variables. Generally, the average hold-down force on a single piece should be around 2,000 pounds. Because there is a continual leak of air through the fiber board, a table with a fiber board of four by eight feet usually uses a vacuum system that can deliver a minimum of 300 ACFM with as much depth of vacuum as possible. Generally, a vacuum level between 18 to 24 inches mercury (Hg) is considered “the sweet spot.”

Vacuum Pump Options and Considerations

A common solution for nesting routers is the oil-sealed liquid ring vacuum pump (LRVP). Less common are the lubricated rotary screw vacuum pump and dry (oil-free) rotary vane pump.

The lubricated rotary screw makes the grade for its high vacuum and energy efficiency. Rather than rotating vanes, the design incorporates two parallel screw rotors rotating in opposite directions. Because they never contact each other, there is virtually no wear, and are thus low maintenance. They run very quietly and are considered eco-friendly.



A lubricated rotary vane pump is a common solution for pod-system vacuum since it provides sufficient flow and a consistent, deep vacuum to provide maximum holding power.

The dry rotary vane uses more energy but offers a wide performance range and deep vacuum. Like the rotary screw, there is no internal metal-to-metal contact (in this case, of the vanes), so they are durable and require little maintenance. Generally, the initial cost of dry pumps is greater and they require more expensive maintenance.

The challenge with using these two types of vacuum pumps in woodworking operations is the usual suspect – sawdust. Ingestion can break vacuum pump types such as the lubricated rotary screw and dry rotary vane, unless the utmost care is taken to maintain the complete functionality of the inlet filter.

Carryover of wood dust into the vacuum pump and possible rupture of the filter element can increase pressure loss, resulting in a reduction of pump capacity and vacuum level. If the vacuum level is 24" Hg vacuum and there is a pressure drop of 2" Hg vacuum, the pump capacity loss is 33%. If the pressure drop is 3" Hg vacuum, the pump capacity loss is 50%! Because of the heavy dust load, the pressure drop can increase rapidly. It's highly recommended to install a two-stage inlet filtration system to protect the pump.

Oil-sealed Liquid Ring Vacuum Pumps Stand Up to Woodworking Rigors

Using LRVPs is often a good choice for nested parts routers given the combined advantages offered. There is a wide range of product lines with ACFM capacities ranging from under one hundred into the thousands. High-efficiency, single-stage liquid ring vacuum pumps are capable of deep vacuum levels up to 29" HgV, with maximum efficiency throughout the vacuum range.

The LRVP is easily incorporated into the woodworking environment. With its self-contained circulating system, the pump is basically “plug and play.” But the most significant advantage of the oil-sealed liquid ring vacuum pump is its steady performance in a sawdust-heavy work environment.

Woodworking may be the most difficult application for vacuum pumps. With a nested parts router, cutting and drilling puts the vacuum system right in the middle of a sawdust storm. The design of the LRVP allows it to handle soft solids and entrained liquids or vapors without compromising the pumps' mechanical integrity or efficiency. This is because there is no metal-to-metal contact between the rotating parts and the casing, eliminating the need for internal lubrication. With noise levels in the 68 to 80 dBA range,



Oil-sealed liquid ring vacuum pumps, such as the DEKKER VmaxPLUS model, deliver efficient and reliable performance in sawdust environments.

VERSATILE VACUUM TECHNOLOGY IS A FORCE BEHIND INDUSTRIAL WOODWORKING

“quiet running” is frequently mentioned by end users as one of the most popular features of the pump.

Rugged liquid ring pump systems are also known to provide years of trouble-free operation and don't need to be rebuilt or replaced on a regular basis. The pump has only one moving part, and no metal-to-metal contact means the pump is wear-free. Grease-lubricated bearings are located external to the pumping chamber, negating the damaging effect contaminated lubricants can have on the bearings. The pump runs at a low operating temperature. Also, because oil is used instead of water for the seal liquid, the corrosion and scale buildup associated with water is completely eliminated. Preventive maintenance can be enhanced through “adders” that help safeguard the system, including an inlet filter, vacuum relief valve, spin-on oil filter and exhaust trip leg.

Advantages of Variable Frequency Drives

A significant benefit of the various pump types is their adaptability to variable frequency drives (VFDs), which allow motors to adjust speed to match actual load. VFDs offer two advantages.

The first is reduced energy consumption (50% turndown on power) when the pump is not in use. Second, VFDs help eliminate part slippage. As leakage increases from cutting, the vacuum



An oil-sealed liquid ring pump with variable frequency drive control ensures the motor speed adjusts to match actual load.

pump speeds up to maintain constant pressure, eliminating slippage and scrap. The pump may also have a longer operating life when not running at maximum output at all times.

Matching the Pump Technology to the Application

The specific requirements of the application will determine the ideal vacuum system. Consulting a woodworking vacuum distributor or manufacturer is recommended. Applications include preservation/impregnation, as well lamination/pressing and material handling.

Wood preservation extends the service life of timber products through the pressure impregnation of chemicals into wood to provide long-term resistance to fungi, bacteria, insects and more. The three most common pressure processes used – the full-cell (Bethel), modified full-cell, and

empty-cell process (Rueping process or Lowry process) – all contain sequences in which vacuum and pressure are applied. The pressures used in treatments vary from about 50 to 250 pounds per square inch, depending on the species. Pressures commonly range from about 125 to 175 psi.

Preservation is a chemical-oriented process. According to the U.S. EPA, there are two general classes of wood preservatives: oils, such as creosote, pentachlorophenol, copper naphthenate and oxine copper; and waterborne salts, including chromated copper arsenate, copper zinc arsenate, copper azoles and borates. The versatile oil-lubricated rotary vane vacuum pump system is an excellent choice for the preservation process, particularly for its capability to handle entrained liquids and vapors from the chemicals.

In lamination/pressing applications, atmospheric pressure is a powerful source when used with adhesives to bond together layers of wood or wood material. The lubricated rotary vane and the oil-sealed liquid ring vacuum system are appropriate technologies for this application.

Another application in virtually every operation is material handling. However you want to handle, lift, maneuver, transport, load and unload wood products, vacuum helps get the job done. Vacuum lifters, frames and grippers



“The many advantages of versatile, powerful vacuum technology can be summed up in one word: control.”

— Kevin Kalk, DEKKER Vacuum Technologies

with the capability to hold up to thousands of pounds are able to manipulate products while protecting them from damage, reducing labor time and enhancing safety.

From small or large work pieces, pieces with gaps, finished pieces and delicate veneers and more, the variety of material handling situations are met with a variety of vacuum types. An oil-sealed liquid ring system and both the dry and lubricated rotary vane vacuum pumps are well-adapted to handling, as is the variant of the oil-sealed LRVP, the water-sealed liquid ring. Water is the most used service liquid sealant.

In Control with Vacuum

The many advantages of versatile, powerful vacuum technology can be summed up in one word: control. The liquid ring, rotary vane and rotary screw vacuum pumps and systems, and the use of variable frequency drive, give woodworkers the surehanded, reliable control of the woodworking processes they need to ensure optimized production. **BP**

About the Author

Kevin Kalk is Vice President of Sales and Marketing, DEKKER Vacuum Technologies. Kalk has been with DEKKER for over three years and

helped in product design and implementation, including products developed specifically with the woodworking industry in mind.

About DEKKER Vacuum Technologies

Established in 1998, DEKKER Vacuum Technologies is an industry leader in the manufacture and distribution of liquid ring vacuum pumps and compressors, rotary piston and rotary vane vacuum pumps and systems. For additional information, contact DEKKER at <https://www.dekkervacuum.com/>.

All photos courtesy of DEKKER Vacuum Technologies.

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AERATION BLOWER SYSTEMS

Madison Utilities Wastewater Treatment PLANT BLOWER UPGRADE SAVES ENERGY

By Mike Grennier, Blower & Vacuum Best Practices Magazine

Madison Utilities' willingness to invest in strategies and the latest technologies is a key factor in the success of its wastewater treatment plant in Madison, Alabama.

▶ Aside from expertise in wastewater treatment plant management, there's a reason why the Madison Utilities wastewater treatment plant in Alabama has a long track record of maintaining compliance, while also keeping water treatment rates low: It's willing to invest in strategies and technologies that keep it ahead of the operational curve.

One need look no further than the treatment plant's digester project upgrade to see the value of the plant's forward-thinking approach at work. The upgrade involved the replacement of five Positive Displacement (PD) blowers with four, high-speed Inovair integrally geared blowers for aerating the digesters. With fewer – and smaller –

blowers the plant saves tens of thousands of dollars in energy costs per year. The blowers also offer flexibility to cost-effectively adapt to the need for increased water treatment in the future.

For Madison Utilities Wastewater Manager Mark Bland, the ability to do more with less is about adapting to change for the benefit of ratepayers.

"It really helps to have a team that's willing to accept change," Bland said. "That's the hard part because you're putting trust in the technology. But the better plant operators are the ones who are willing to change."



"If we're good stewards of the money we're granted to operate the plant and we invest in the right technologies and do things efficiently and effectively the ratepayers benefit."

— Mark Bland, Wastewater Manager, Madison Utilities

Rapid Growth Drives Upgrade Projects

Located in Madison, Alabama, and originally built in 2002, the Madison Utilities wastewater treatment plant is a Class B solids 8.25 Million Gallons per Day (MGD) activated sludge plant with an average daily flow of 6.5 MGD and a peak capacity of 24 MGD. The plant serves approximately 55,000 residents.

Throughout the years the plant launched several upgrade projects in response to a rapidly growing population driven by a bustling economy supported by major companies in the information technology, aerospace, and automotive industries, among others.

The main systems found at the plant today include the headworks operation with a vortex grit removal system, three primary carousel-type aeration basins and three secondary clarifiers for primary treatment; a Return Activated Sludge (RAS)/Waste Activated Sludge (WAS) pump station; six aerobic digesters for processing WAS; and a dewatering facility with a centrifuge for drying the Class B solids for use as fertilizer. The plant also uses both peracetic acid and ultraviolet disinfection techniques as part of its wastewater treatment process.

In 2018, Madison Utilities increased aerobic digester capacity at the plant by adding two digester tanks to four existing tanks to keep pace with increased wastewater treatment needs. The project also included the addition of the new blowers and fine-bubble diffusers to its aerobic digesters in place of coarse bubble diffusers, as well as Dissolved Oxygen (DO) probes and airflow meters for increased monitoring and measurement.

“It gets to be a bit of a numbers balancing game,” Bland said, regarding the plant’s goals for efficiently processing WAS and thickening sludge for application as a Class B solid. “Our goal is to process the sludge as energy-efficiently as possible, while at the same time, reducing the amount we pay for solids removal.”

Electrical and Sludge Removal Costs Add Up

Each day, the Madison Utilities treatment plant’s aerobic digesters process approximately 80,000 gallons of Waste Activated Sludge (WAS), which is generated by the biological treatment process.

Within the digesters, activated sludge is continuously aerated by aeration blowers and fine-bubble diffusers and mixed with the wastewater until desired Biological Oxygen Demand (BOD) levels are reached. At the end

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MADISON UTILITIES WASTEWATER TREATMENT PLANT BLOWER UPGRADE SAVES ENERGY

of each cycle, aeration is stopped to allow the sludge to settle to the bottom of the digester tank floor. The process leaves clear water at the top of the tank, which is then decanted and pumped back to the headworks for further processing. Sludge is pumped to the dewatering facility to produce Class B solids, which meet the required Specific Oxygen Update Rate (SOUR) before being trucked off site.

Before the digester upgrade project, the plant's digester were equipped with five, fixed-speed 125 horsepower (hp) PD blowers. Of the five blowers, the plant dedicated one blower to each digester tank with the fifth blower serving as a standby unit. During normal conditions, the plant operated two blowers at near capacity in combination with the course bubble diffusers

to provide aeration to all four digester tanks. It also operated the third and fourth blowers occasionally during the hot summer months to meet increased demand for aeration.

When planning the digester upgrade project, Bland worked closely with Krebs Engineering, Inc. (<https://krebseing.com/>) to carefully vet blowers options. Krebs Engineering, based in Birmingham, Alabama, served as the consulting engineering firm for the digester upgrade project. Energy savings were pegged as key to success – within reason.

“The biggest expense for our treatment plant is electricity, followed by sludge disposal. The less amount of electricity we put into something the more money we save as long

those efforts don't make our sludge disposal rate go up,” said Bland.

Tackling Varying Discharge Pressures

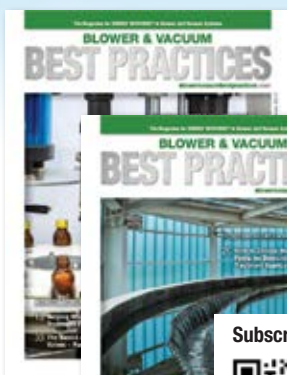
When evaluating blower technologies for the project, Krebs Engineering examined a range of criteria to determine the technology best suited to the needs of the plant today, and well into the future.

Among the key considerations was the changing water levels of the digester tanks and the ability of the blowers to operate at varied discharge pressures as a result. On any given day, the water level within each digester tank typically varies from four to eighteen feet as batches of WAS are processed. The new blowers needed to readily and efficiently

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adapt to wide swings in discharge pressures, said Caleb Leach, PE, Senior Project Engineer, Krebs Engineering.

Blowers equipped with Variable Speed Drives (VSDs) were also clearly an important option versus fixed speed units, said Leach.

“The fixed speed PD blowers could effectively handle low, or high water levels,” Leach said. “However, they were sending the same amount of air whether it was needed or not, which of course, wasn’t as energy efficient as it could be with VFD blowers since the plant can speed them up or down based on water levels and the thickness of the sludge. We also wanted to avoid blowers that enter a surge condition and blow off excess air.”

Krebs Engineering evaluated blower technologies based on capital costs and performed a 20-year-present-worth analysis, which accounts for routine maintenance, as well as costs associated with overhauls if and when needed, and the cost to increase blower capacity to meet future processing needs. The evaluation also included a wire-to-air analysis of various blower technologies based on the total electric power consumption required to produce a specified flow and pressure.

Leach also factored in the Madison Utilities’ approach to wastewater management, noting its willingness to adopt advanced technologies to achieve efficiencies, whether it’s peracetic acid for disinfection or newer blower technologies for aeration.

“Madison Utilities is one of the first wastewater treatment plants in Alabama to use peracetic acid disinfection,” he said. “In my view, they’re one of the more progressive treatment plants in terms of both new technology and how they manage the plant.”



By upgrading its aerobic digesters with high-speed, integrally geared blowers, Madison Utilities’ wastewater treatment plant saves tens of thousands of dollars per year in energy costs – and gains flexibility in meeting future water treatment needs.

New Aeration Blowers Deliver Flexibility and More

Madison Utilities opted to replace its PD blowers at the treatment plant with four high-speed, integrally geared VFD IM-30 centrifugal blowers from Inovair (<https://inovair.com/>), Lenexa, Kansas.

The IM-30 blowers, which incorporate a proven gearbox and non-contact oil film bearings to reliably operate at speeds of 31,000 to 38,000 rpm, were engineered and packaged as two stacked configurations and installed adjacent to the digesters. Each package features two separate blowers stacked vertically in a single weatherproof enclosure. One stack of blowers is engineered with two 100-hp blowers, each of which is rated to deliver 575 to 1,750 scfm. The second stack features one 100-hp blower rated to deliver 575 to 1,750 scfm and a second 50-hp blower rated to provide 500

to 900 scfm. Combined, the blowers are designed to deliver 500 to 6,150 scfm at discharge pressures from 3.0 to 8.9 psig.

The installation of the four smaller, high-speed blowers – in place of five larger PD blowers – satisfies the need for cost-effective aeration under all load conditions, as well as increased processing needs for years to come. They also provide the standby capacity in keeping with federal regulations, but no more than necessary.

During average daily conditions, the plant typically operates one, 100-hp blower continuously at near capacity to provide the appropriate level of airflow needed for all six digesters. During low load conditions, however, it can turn off the 100-hp blower and operate the 50-hp unit to satisfy aeration needs.

MADISON UTILITIES WASTEWATER TREATMENT PLANT BLOWER UPGRADE SAVES ENERGY



Shown is a high-speed, integrally-gearred, VFD centrifugal blower at Madison Utilities' wastewater treatment plant.

The plant's SCADA system automatically controls the blowers based on airflow needed as determined by digester load conditions and DO levels. The use of VSD blowers in place of fixed-speed units is particularly advantageous, Bland said.

"For example, the SCADA system monitors DO levels and when it sees they're high, it will tell the blower to slow down since it's basically burning energy for no reason," he said.

Bland said he also appreciates the 12:1 turndown ratio of all four blowers combined since the blower system offers a high level of flexibility to provide minimal airflow during the lowest demand times without over-aerating and wasting energy, while at the same time, satisfying the need for maximum aeration when required.

"The turndown capability of the blowers is very important to me since it means we don't have

to worry about over-aerating. Why would I put more energy into it to accomplish the same job? Using technology to save energy costs is something we work to achieve in every area of the plant."

While the blowers contribute to energy efficiency on daily basis, Bland said another advantage of the fully enclosed, stacked configuration was the ability to install the machines in a single compact footprint without the need for additional infrastructure costs normally associated with larger blowers located in a traditional blower room. Additionally, he said the plant only needs to update the impeller of the 50-hp blower to significantly increase blower aeration capacity when needed later.

"We don't want to be wasteful," Bland said. "I really like having the flexibility built into the system so I can upgrade to the 50-hp blower to a 100-hp blower without adding a lot of cost or having to undergo a costly shutdown."

Annual Savings of \$50,000 Anticipated

Bland said the decision to replace aging PD blowers with new integrally geared blowers supports Madison Utilities progressive approach to wastewater management.

"I like to tell people, 'We dropped one complete blower, reduced overall connected blower horsepower, and yet we've increased our aerobic digestion capacity.' I think that says a lot about our current setup," he said.

The new aeration blowers have met the treatment plant's expectations for overall performance since their first day of operation. This year, Bland expects to see positive financial results based on a full analysis of cost savings. Based on results to date, he expects the plant to save approximately \$50,000 or more per year in energy costs.

When viewing the big picture, Bland said he's proud of his team's willingness to continue to adapt to changes in technology and wastewater treatment operating strategies.

"Things are always changing," Bland said. "Doing things the way there always done is not always acceptable. If we're good stewards of the money we're granted to operate the plant and we invest in the right technologies and do things efficiently and effectively the ratepayers benefit." **BP**

All photos courtesy of Madison Utilities.

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INDUSTRIAL BLOWER & VACUUM SYSTEMS

Positive Displacement Blower and VACUUM BOOSTER LUBRICANTS

By Brendan Pankratz, Tuthill

► You have your equipment, everything is set up and ready to run, but what about your lubricants? Too often, lubricants receive little attention with respect to their use in rotating equipment. Even the most reliable cars in the world will encounter problems on a short commute if the wrong transmission fluid is used during a flush. The same is true with your Positive Displacement (PD) blower or vacuum

booster that operates around the clock. In our experience, approximately 80% of all bearing and gear failures are the result of improper lubrication.

PD rotary lobe blower and vacuum booster oil should be considered as important as any of the machine's other primary components. It is absolutely essential for smooth, efficient

machine operation, and the correct oil will easily pay for itself in savings and convenience.

In this two-part article series, we review the purpose of blower and vacuum booster lubrication. We also discuss oil specifications, exploring what they mean and offering insights for selecting the most beneficial oil.



“PD rotary blower and vacuum booster oil functions as a lubricant, protectant, sealant, and coolant.”

— Brendan Pankratz, Tuthill

More to Lubricant than Meets the Eye

For now and the foreseeable future, bearings, gears and oil lubrication are at the heart of rotating equipment. But is correct oil specification really that critical? Isn't oil just a lubricant? It turns out, there's much more to the story.

Of course, the most evident function of oil is to provide lubrication at the interfaces between sliding surfaces. By introducing a thin film between moving components, such as meshing gear teeth, contact is minimized or even eliminated, and the coefficient of kinetic friction is dramatically reduced. This results in less component wear, less frictional heating, and longer asset life.

Where there is oxygen, corrosion is likely to be found. Oftentimes, copper and iron surfaces act as catalysts for corrosion at temperatures

above 200°F, accelerating the corrosion process further. The key is to prevent oxygen and water from contacting corrosion-prone components with a film of oil containing the right barrier-forming additives. When oil is specified incorrectly, components may not be protected properly during or between operation cycles, exposing components to corrosive damage.

Cooling is another crucial function of oil. Most of the heat generated by a positive displacement rotary lobe blower is the result of gas compression as it exits the discharge into a high-pressure region. Some of this heat is carried away with the gas as it is pumped, while some of it is transferred into the blower housing, ports, and end plates via conduction. Since oil can transport heat five to 10 times more effectively than air, the blower oil sumps are able to move just a small amount



Shown is an example of gear failure from improper lubrication.

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POSITIVE DISPLACEMENT BLOWER AND VACUUM BOOSTER LUBRICANTS

of this heat from the end plate to the inside surfaces of the oil covers, and eventually into the ambient air by free convection using the oil as a transportation mechanism. Most importantly, the oil transfers the heat away from dynamic contacting parts, protecting them from thermal damage.

In applications where lip or mechanical face seals are used, oil also serves both as a lubricant and sealant between rotating and stationary parts of the seal. As the oil is drawn into the space between the seal rotor and stator by a combination of the capillary action and drag, it augments the seal's ability to do its job without blistering or cracking. Without proper lubrication, seals quickly fail due to

the extreme temperature that develops where the rotor and stator meet.

Eliminate the Mystery of Specifications

More than any other item, operators and end-users inquire most about the International Standards Organization (ISO) viscosity grade of the oil they should be using to service their blowers and vacuum boosters.

In many cases, no consideration is given to any of the hundreds of other physical or chemical properties and designations of an oil. Imagine the scenario where you call every automobile dealership in town in search of the cheapest, new vehicle with candy apple

red paint. Paint color matters, but is the paint or the price really the most important thing about a vehicle? What about the number of seats, the power under the hood, the safety features, or the reliability ratings? Shopping for a vehicle based on paint and price is like shopping for oil based on ISO viscosity grade and price.

ISO viscosity grade is important but it is a single line on a new car window sticker. It would be essential to read and understand the entirety of the window sticker so you don't end up purchasing a candy apple red compact car when you needed a heavy-duty pickup truck. It's why it's beneficial for decision-makers to possess knowledge of the following important,



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POSITIVE DISPLACEMENT BLOWER AND VACUUM BOOSTER LUBRICANTS

but less understood, specifications and properties of lubricating oils:

- API Group Base Oils
- Viscosity
- Viscosity Index
- Additive Formulation

API Group Base Oils

The foundation of any oil is the base stock from which it is derived. The quality of a base stock is a measure of purity and uniformity.

For example, a base stock with some long hydrocarbon chains and some short hydrocarbon chains is considered to be less pure than one almost entirely comprised of long ones. The presence of impurities such as aromatics, sulfur, and nitrogen compounds often compromises the oil's physical and chemical properties and leads to a low quality, underperforming lubricant.

It's why some lubricants are formulated from superior quality, full synthetic polyalphaolefin (PAO) stock. This makes their primary constituent an American Petroleum Institute (API) Group IV base stock, differentiating it categorically from the mineral oils in API Groups I through III, which are refined directly from crude oil.

Additionally, some lubricants made from full synthetic PAO stock are synthesized in an ethylene oligomerization process to produce ultra-high purity oligomers with minimal branching. The result is a lubricant that exhibits excellent oxidative stability, an extremely low pour point, and a very flat viscosity curve. For the equipment operator, this means excellent resistance to breakdown at high temperatures, exceptional flow at low temperatures, and more consistent lubrication across the entire spectrum of operating temperatures. (See Table 1).

Viscosity

Two viscosity values are often used to convey the thickness of a fluid: absolute, or dynamic, viscosity and kinematic viscosity. Absolute viscosity is related to the measure of the force required to move an object through the fluid and is solely a function of the fluid's internal friction. Kinematic viscosity is related to the resistance of the fluid to flow under its own weight.

Since weight is directly proportional to density, the kinematic viscosity is dependent on both internal friction and fluid density. This can best be illustrated by comparing both types of viscosity for water and mercury at a given temperature. Interestingly, the absolute viscosity of water is only 64% of that for mercury, but the kinematic viscosity of water is 870% of that for mercury. This means that it takes around two thirds the force to move an object through water when compared to

API BASE STOCKS										
	Derivatives	Methods	Saturates (%)		Sulfur (%)		Viscosity Index	Oxidation Stability	Volatility	Low Temp. Attributes
Group I	Mineral (crude oil)	Solvent refining	<90	and/or	>0.03	and	80 to 120	Good	Fair	Fair
Group II	Mineral (crude oil)	"Hydroprocessing Catalytic dewaxing"	≥90	and	≤0.03		80 to 120	Good	Good	Good
Group III	Mineral (crude oil)	"Hydroprocessing Catalytic dewaxing"	≥90	and	≤0.03		≥120	Very good	Very good	Very good
Group IV	Polyalphaolefins (PAOs)	Oligomerization	-		-		125 to 200	Excellent	Excellent	Excellent
Group V	Naphthenic crude, esters, polyglycols, silicones, polybutenes, alkylated aromatics	Varies	-		-		Wide range	Excellent	Excellent	Excellent

Table 1: API base stock group comparisons.

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mercury, but mercury will flow 8.7 times faster under its own weight.

Because of the simplicity of measurement, the kinematic viscosity at 40°C (KV 40) is almost always used to compare lubricating oils. This value, in units of centiStokes (cSt), is placed into one of the viscosity ranges determined by the International Organization for Standardization in ISO 3448. Each of these viscosity ranges is designated as a Viscosity Grade or ISO VG.

Viscosity Index

Personal experience tells us maple syrup flows significantly better at room temperature than straight out of the refrigerator. This is due to viscosity's dependence on temperature. Some oils fall into the range of 100 to 320 ISO VG, for instance, but the ISO VG is, quite literally, a single data point on the curve relating kinematic viscosity to temperature.

Unless a given PD blower always operates at 40°C, this number is somewhat meaningless without consideration of the rest of the temperature-viscosity curve.

For example, if the oil in a particular blower generally operates at 100°C, then another fluid property, namely the Viscosity Index (VI), should receive attention. This value is a characterization of the amount of dependence the viscosity has on changing temperature. A higher VI is usually desirable since this means the oil will maintain its thickness better at temperatures above 40°C and will better resist thickening at temperatures below 40°C. Some full synthetic oils exhibit extremely high VIs, positioning them above all mineral oils, blends, and synthetic blends. For the operator or owner, this makes colder startups and higher running temperatures possible without sacrificing protection for critical internal components (See Figure 1).

Additives Formulation

The formulation and preparation of a lubricant additive package is similar to baking. A good baker would not add the butter to a pie crust after it was baked and expect the result to be successful. Introducing additives after the lubricant is already in use is less effective than using a lubricant that is correctly formulated from the beginning. Similarly, a good baker would never triple the amount of butter in the pie crust in an attempt to guarantee it will not stick to the pie tin. The ratio and timing of the ingredients in a good recipe is a delicate balance between flavor, chemistry, and physics. The same concepts apply to lubricant formulation.

For example, surface-active additives such as rust inhibitors and anti-wear additives, must compete for space on the metal surfaces in the oil sumps. In some cases, one type of additive may work to deactivate another type. At some point, adding more of one additive or the other will become a detriment to the performance of the oil and equipment rather than an enhancement. The goal of a highly engineered additive package is to find the optimal balance of the correct additives which target the precise needs of a given application. Some oils are formulated specifically for a particular brand of equipment in order to achieve this balance and substitutions should not be used.

The Right Decision Pays Dividends

PD rotary blower and vacuum booster oil functions as a lubricant, protectant, sealant, and coolant. Given that some oil specifications are misunderstood or misapplied, while others are often overlooked completely, it's important for all specifications to be taken into consideration when determining appropriate

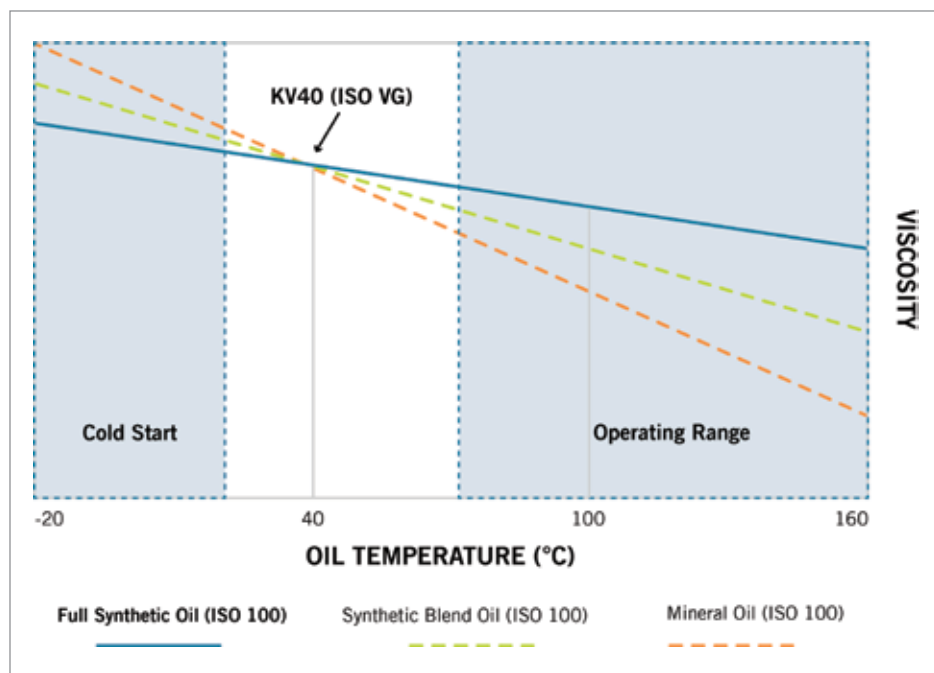


Figure 1: Shown is a comparison of oils with different viscosity properties (full synthetic, synthetic blend, and mineral oil).

oil usage. Making the right decision will not only provide protection but also contribute optimal equipment performance and longevity.

The next article in this series will discuss critical lubricated components and how can you most effectively protect them. It will also look at oil temperatures, oil delivery methods, and what to know about useful oil life and how to maximize it. **BP**

About the Author

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BLOWER & VACUUM SYSTEM INDUSTRY NEWS

Short-Term Delivery of Medical Gas Equipment and 36 Vacuum Pumps for Emergency Hospital Trailers in the US

As hospital capacities are being expanded to face the increasing number of COVID-19 patients, the demand for medical air compressors, vacuum systems, and medical gas pipeline is increasing as well. As a medical gas equipment manufacturer, Powerex is part of a critical infrastructure industry designated by the Department of Homeland Security; since Busch Vacuum Solutions is a key supply partner for Powerex, they are deemed critical infrastructure as well.

Medical air compressors and vacuum systems are required to operate ventilators, which are being used to treat patients suffering from COVID-19. To prepare for the spike in severe COVID-19 cases, both federal and state emergency management organizations have deployed mobile ICU trailers with ventilators, delivering greatly needed capacity to the areas hardest hit by the pandemic. One of the largest mobile ICU trailer projects has tasked Powerex to supply them all the medical gas equipment in an accelerated timeframe.

Thanks to their long-standing relationship, Powerex was able to rely on Busch Vacuum Solutions to provide 36 R5 rotary vane vacuum pumps required for the ICU units. Busch was able to meet the shortened timeline, allowing Powerex to build and ship the units on schedule, and contributing to the alleviation of the pandemic.

While the Powerex factory ramped up production of medical air and vacuum systems, the Busch team in the US stepped up to help rush through the ordering, production, and shipping process of these critical vacuum units.

These units will be built into trailers that will be deployed to multiple locations throughout the country. And with hundreds of thousands of infected people, these vacuum units for hospitals are urgently needed in the US.

“The healthcare industry has been a key focus for Busch for many years and we are proud to be a major solutions provider to our partner equipment manufacturers like Powerex. We are committed to supporting our medical customers through these fast-moving and challenging times,” said Turgay Ozan, President of Busch USA.

“Powerex recognizes that timing is critical in this pandemic, and our team has stepped up to the challenge of manufacturing urgently-needed medical gas equipment in a short timeframe. We are grateful for our

key supply partners like Busch USA and their willingness to rise to the challenge as well,” said Chris Trusock, Business Unit Manager of Powerex Medical.

About Busch Vacuum Solutions

Busch Vacuum Solutions is one of the largest manufacturers of vacuum pumps, blowers, and compressors in the world. Our product range consists of solutions for vacuum and low overpressure technology in all industry sectors. For more information, visit www.buschusa.com.

About Powerex

Powerex is headquartered in the Cincinnati, OH area and is a leading manufacturer of NFPA 99 medical gas source equipment and medical gas pipeline. For more information, visit www.powerexinc.com.



Powerex received 36 Busch R5 rotary vane vacuum pumps to support their rapid build-out of the medical vacuum systems in the ICU trailers.

Lone Star Acquires Dynamic Specialties Inc.

Lone Star Blower acquired Dynamic Specialties Inc. Founded in 2001, Dynamic Specialties is a control, instrument and electrical power systems integrator building control panels and custom fabricated systems.

“Dynamics offers great synergies for Lone Star as we no longer have to outsource control panel design, panel manufacturing or system integration of our blower products and this allows us greater custom packaging solutions. We also bring programming and software options to Dynamics projects with our experienced controls engineering staff. This is a perfect fit and a game changer!” said Andrew Balberg, President of Lone Star blower.

Kent Anderson, President/Founder of Dynamic Specialties said, “Previously as a vendor of Lone Star and working closely with the people there we saw a cultural fit of passionate driven people but also the infrastructure and resources to grow and expand our markets rapidly. Together we are much stronger.”

Dynamics has already moved into Lone Star facilities and with both companies’ combined carry certifications such as ISO 9001, UL508A, ULC, CSA, CE, ATEX, and ASME Section 9. Dynamics will continue to market under that brand but operations are combined into Lone Star.

About Lone Star Blower

Lone Star is manufacturer and service company

for blower and blower control systems with locations around the world. Products include the GL-Series single stage geared turbo blowers (100 to 6,000 HP), DT-Series of gearless “high speed” turbo blowers (20 to 500 HP) and the LS-Series multistage turbo blowers (20 to 3,500 HP). Combined with CS-Series controls, Lone Star can offer a total solution well beyond just the blower. Lone Star also supports many other brand blowers with Lone Star manufactured parts and service that are a step above the OEM offerings.

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.

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BLOWER & VACUUM SYSTEM INDUSTRY NEWS

SUTO Vacuum Flow Meter Helps Locate Pipeline Leaks

An electronic equipment manufacturer was looking for a vacuum measuring device. This device is required to measure the vacuum gas flow rate of products to ensure compliance to the industry standard, and to measure the pressure and flow rate of the vacuum to help achieve energy saving purposes.

This manufacturer had used vacuum pressure measuring devices, but not any vacuum flow measuring devices. They learned that the S418-V can measure not only the vacuum flow in real time but also the vacuity (vacuum pressure) and measure them at the same time, which fills the gap of products in the industry. In addition, the key features such as easy-to-install, high accuracy, integrated data logger, and free analysis software caught the manufacturer's eyes as well. The manufacturer decided to choose the S418-V.

The manufacturer selected the appropriate type from the four available tube sizes (DN8, DN15, DN20, DN25) of the S418-V. The straight section design made the installation quite easy. Through measuring the actual vacuum flow and absolute pressure of the product, engineers found that the vacuum flow used by the system equipment was much larger than expected. They then exported the measurement data out of the integrated data logger, and made analysis using the graphical analysis module provided in the free S4A analysis software. The analysis implied a potential problem linked to leaks. Following this clue, engineers inspected the production line in detail, and located the leaking connectors. After replacing the connectors, the problem was solved.

Satisfied with the functions and performance of S418-V and its perfect system-level solution, the manufacturer started to deploy S418-V across its vacuum system for measurement.

About SUTO iTEC

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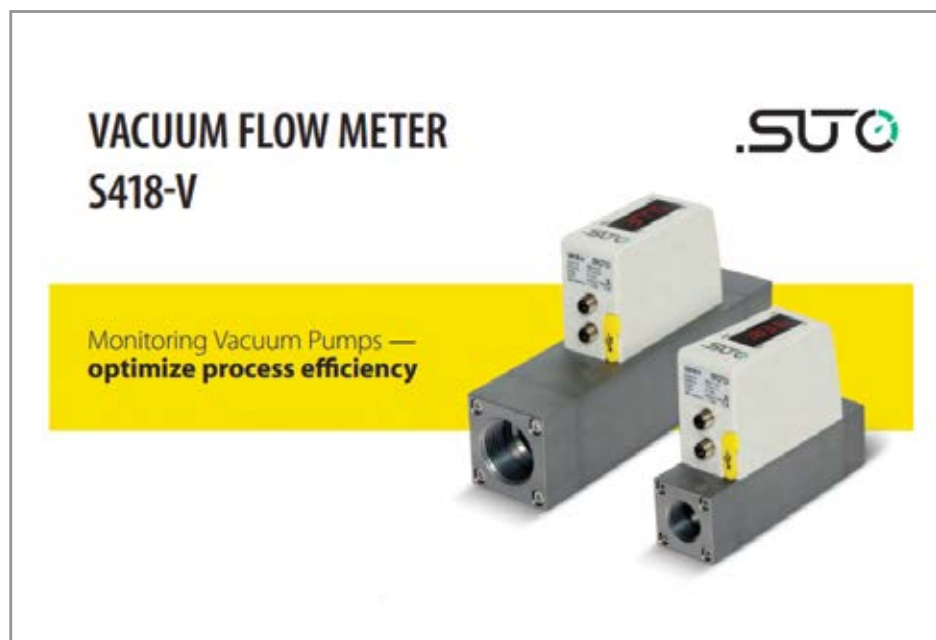
Sulzer Takes a Spin Through the Circular Economy

An innovative compressor design proves industrial equipment can deliver high performance, low through-life costs and a smaller environmental footprint. Sulzer's HST turbocompressor shows how a forward-thinking attitude to design, manufacturing and through-life support enables products to meet the goals of the circular economy.

As organizations seek to reduce the environmental impact of their operations, the concept of the circular economy is attracting growing interest in many sectors. At their heart, circular economy principles seek to break the link between the creation of economic value and the wasteful consumption of natural resources.

Products designed according to circular principles aim to use resources for as long as possible, extracting maximum value from them. Once a product reaches the end of its service life, as many parts and materials as possible are recovered and re-processed, leaving the smallest possible waste footprint.

One product showing how the circular economy can operate in practice is Sulzer's HST turbocompressor range, an innovative,



SUTO S418-V Vacuum Flow Meter.

high-performance machine with a 24-year track record in demanding industrial applications.

HST turbocompressors are commonly used in wastewater treatment facilities, perhaps the original example of efficient resource-reuse. In these applications, the compressors aerate treatment tanks, optimizing the performance of the biological organisms that are used to break down solid contaminants.

The environmental efficiency of the HST turbocompressor goes far beyond its end application. It starts with the basic design of the machine. Conventional compressors are extremely complex items of equipment, with elaborate gearboxes and multiple seals, bearings and other parts which generate friction and, ultimately, wear out.

The HST, by contrast, uses a simple design. Its rotor is driven directly by an electric motor, with no intermediate gearing. The rotor itself spins on magnetic bearings, which means there is no metal-to-metal contact of moving parts, minimal friction and almost no mechanical wear.

Its simplicity and lack of wearing parts helps the HST compressor to achieve a very long service life. The design was first introduced in 1996, and many early units are still in continuous operation today.



HST™ turbocompressors being manufactured in the Sulzer factory in Kotka, Finland.

Furthermore, since the design operates without oil lubrication it needs little regular maintenance and generates no waste lubricants requiring treatment and safe disposal. In fact, the only consumable products in the machine are two filters installed at the air intake and air outlet. Plenty of the original HST units still working today have never required a major overhaul.

High speed turbocompressors, as their name suggests, spin very quickly. The motor in the smallest units rotates at around 50'000 rpm.

Even the largest units run at 20'000 rpm. That high operating speed means the motor is around half the size of a motor of equivalent power running a slower, conventional compressor. Furthermore, a smaller motor needs fewer raw materials and less energy to manufacture.

High speed and low friction also translate into high operating efficiency. In tests against conventional alternatives, HST turbocompressors have consistently demonstrated lower energy consumption



“Products designed according to circular principles aim to use resources for as long as possible, extracting maximum value from them.”

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"The need to control the rate of oxygen added to the aeration system has become particularly acute with the increasing application of nutrient control."

— Henryk Melcer, Senior Process Engineer/VP, Brown and Caldwell,
(feature article in April 2019 Issue)

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"As part of our ongoing focus on sustainability, we were excited to partner with Atlas Copco to pioneer the first waterless vacuum pump in the craft beer industry. We are now saving 5,000 gallons of water per day and \$35,000 per year."

— Julia Person, Sustainability Manager, Craft Brew Alliance,
(feature article in April 2019 Issue)

"Many rental air compressors, designed to deliver 1,600 cfm of compressed air at 90-150 psig, are used in 50 psig applications like pneumatic conveying, fermentation and fluid catalytic cracking."

— Matthew Piedmonte, Director, Aerzen Rental
(feature article in April 2019 Issue)

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BLOWER & VACUUM SYSTEM INDUSTRY NEWS

for the same output. For owners, this means significant operating cost savings over the life of a machine as well as lower carbon emissions.

Mechanical wear isn't the only reason components fail in hardworking machines, and one thing that can limit the life of industrial products is their control electronics. Control systems are very reliable, but the rapid pace of evolution in electronic systems means that they can become obsolete quite quickly. Finding replacement components for a ten- or twenty-year-old machine may be almost impossible.

In the case of the HST, however, the machine's modular design helps to keep obsolescence at bay. Sulzer service engineers can quickly and easily replace control electronics with the latest generation of high-efficiency variable frequency drives (VFDs).

Older parts removed from machines are returned to Sulzer for inspection. Control systems that are still functional are refurbished and held in stock to provide a source of replacement components for the population of compressors still running with their original control systems. Parts that are beyond repair are dismantled for recycling.

This circular principle is also applied to complete HST turbocompressors. If a customer wants to replace an existing unit with a newer version, or one of a different output, Sulzer offers a buy-back program for the old machine. Compressors that come back from customer sites are dismantled and, after inspection and refurbishment, their components can also be used as spare parts for other older machines.

If certain parts of a recovered HST are unsuitable for reconditioning and reuse, most are easy to recycle. The main components of the machine: the volute, impeller, rotor and frame are made of aluminum, while the base and enclosure are steel. In addition, the compressor's manner of operation means that these parts remain clean and uncontaminated in use, increasing their value as a feedstock for recycling.

The circular economy offers significant potential benefits for equipment users, manufacturers and the environment. Realizing those benefits doesn't need to be difficult, but it does require attention to the full value chain, including equipment design, operation, in-service support and end-of-life. Over almost a quarter of a century, the Sulzer HST turbocompressor range has shown just what is possible when manufacturers and end-users take a long-term perspective on asset performance, efficiency and sustainability.

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