The Magazine for ENERGY EFFICIENCY in Compressed Air, Pneumatics, Blower and Vacuum Systems

COMPRESSED AIR BEST PRACTICES

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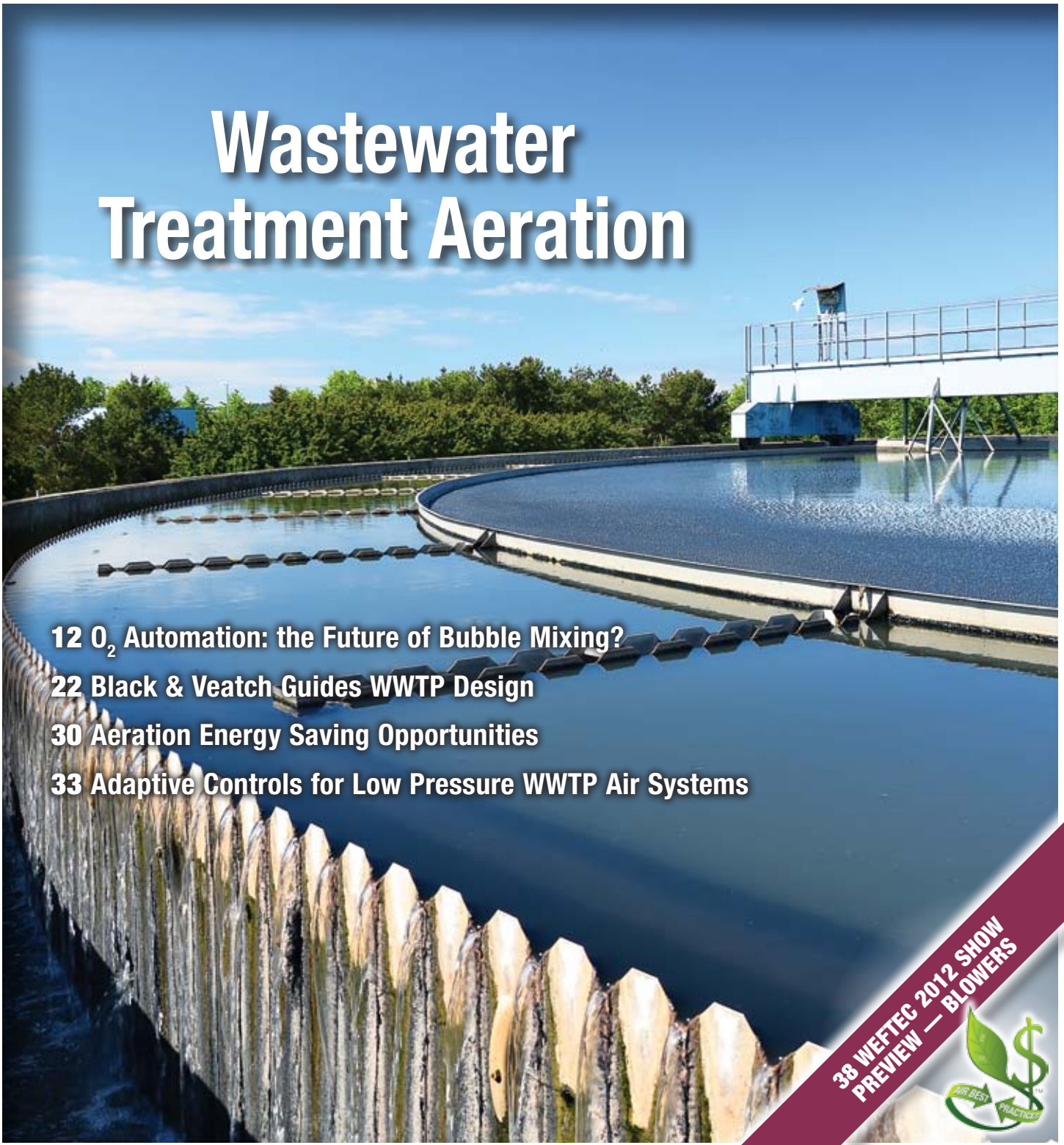
September 2012



Wastewater Treatment Aeration

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FROM THE EDITOR | Wastewater Treatment Aeration

The aeration process, in wastewater treatment plants (WWTP's), represents 65% of the energy usage. This normally accounts for 20% of a municipalities' total energy bill. Most experts agree that this represents a significant area of opportunity for municipalities to save energy as virtually all systems do not have an efficient oxygen transfer system or a blower system able to match kW consumption with demand under 50% loads.

"Bubble mixing" is the layman's term for an important process in managing the effectiveness of oxygen transfer as it relates to maintaining the appropriate levels of dissolved oxygen (DO) in a mixing tank. Please read our page 12 article, "O_2 Automation: The Future of Bubble Mixing?", to learn about a new technology aiming to reduce the "demand-side" requirements of an aeration system.

Julie Gass P.E., from Black & Veatch, is a mechanical engineer who designs new wastewater treatment plants and retrofits on existing plants. Please read the interview I did with her, on page 22, to get her expert view on the past and future for blower technologies in aeration systems.

The Consortium for Energy Efficiency (CEE) provides us with their first column titled "Aeration Energy Offers Opportunities to Save." CEE members manage significant energy efficiency incentive programs in the U.S. and Canada.

How are the three cycles (DO, NH4 and NO3) controlled in each basin? Have adaptive controllers and system splitting options been considered? Are VFD controlled blowers installed and if so, do they have a control scheme allowing them to provide energy efficiency? These questions are explored on page 33, in an insightful and challenging article titled, "Adaptive Control for Low Pressure Wastewater Treatment Air Systems", provided by Kaeser Compressors on behalf of the Compressed Air Challenge®.

Last but not least, on page 38, you will find our WEFTEC 2012 Show Preview article. We are proud to be a "Supporting Publication" and are greatly looking forward to the Exhibition and Conference taking place in New Orleans from September 29 to October 3.

We thank the authors above for sharing their knowledge and thank you for your support and for investing in ***Compressed Air Best Practices®***. BP

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COMPRESSED AIR, PNEUMATICS, VACUUM & BLOWER INDUSTRY NEWS

Private Equity Partnership to Purchase Sullair Corporation

Sullair Corporation announced that United Technologies reached an agreement with the private equity firms of The Carlyle Group and BC Partners for the purchase of Hamilton Sundstrand Corporation's Industrial businesses, including Sullair Corporation. BC Partners and Carlyle have formed a limited partnership and will jointly oversee management of Sullair. This transaction is expected to close in the fourth quarter, upon completion of all required approvals.

About the Private Equity Partnership

The Carlyle Group is a 25-year-old investment firm that boasts an array of sophisticated investors, ranging from public and private pension funds to unions and corporations. BC Partners is a 26-year-old worldwide private equity firm that specializes in buyouts and acquisition financing.

A Message from the President

According to Henry F. Brooks, President of Sullair Corporation, "The partnership between Carlyle and BC Partners provides a unique growth opportunity for Sullair. They recognize that our business is a performance leader in our markets with great employees, great products, and vested channel partners. Additional investment in Sullair will enhance our capabilities to compete on a global scale."

Mr. Brooks concluded by saying, "As president of Sullair Corporation, I could not be more pleased with this outcome. Sullair has a history of great performance, and I feel that with the combined BC Partners/Carlyle Group ownership, the future for Sullair is indeed the brightest in my memory." www.sullair.com

BOGE Announces New Factory

Compressed air specialist BOGE announced plans to increase its turnover by about 40% over the next three years. Since the Bielefeld-Jöllenbeck headquarters cannot accommodate this level of growth, an additional German production facility will be established in Großenhain/Saxony. "We realised that the extension of our production area was inevitable. We therefore started investigating various production locations — whereby Germany was never in doubt as the host country. Saxony appeared particularly attractive to us", says Wolf D. Meier-Scheuven, BOGE partner and Managing Director, about the decision for the new location. Managing Director Thorsten Meier adds to this: "Saxony is at the centre of Europe. This new production location positions us closer to customers in eastern Germany and in all of Eastern Europe. In this way, we will further develop our market position in those regions."

In the first construction phase ending 2013, a 5,000 m² production hall will be erected on the 30,000 m² Großenhain site. Provisional planning projects an investment of about 12.5 million Euro for the first construction phase. At least 25 new workplaces will be created in this phase. The plan is to extend the new location within the coming years, step by step. "A total investment of more than 20 million Euro is planned in Großenhain in the longer-term, generating in excess of 60 jobs", states Meier.

Ten million Euro were last invested in Bielefeld in 2009, for extension of the assembly and

logistics area. This new investment does not threaten the Bielefeld location. There is no plan to relocate existing production facilities. "The decision for Saxony in fact also further secures the Bielefeld location. The framework conditions at the new location will assist in maintaining our cost structure on a healthy level", explains Meier.

The establishment in Großenhain was supported by Wirtschaftsförderung Sachsen GmbH. The Saxony Minister for Economic Affairs, Sven Morlok, expresses satisfaction: "We are proud of having gained a highly innovative company, boasting a tradition such as BOGE has, for Saxony. Especially companies such as these are important to Saxony as a business location — and we are actively promoting this: The Free State of Saxony offers attractive framework conditions and the necessary support."

Großenhain in the district of Meißen is located in the immediate vicinity of the regional capital, Dresden. Apart from a bustling city centre with a modern infrastructure, Großenhain also offers attractive industrial sites in rural surroundings and has optimal road and rail connections. This major district town benefits from its proximity to commercial hubs such as Berlin, Leipzig and Prague. The Dresden growth region, in addition to its technical colleges producing the necessary specialists such as engineers, can also offer a good mix of industrial firms and service providers. This high market potential offers excellent conditions for entrepreneurial success.

More information: www.boge.de or www.boge.com/us

BOGE
COMPRESSED AIR SYSTEMS

COMPRESSED AIR, PNEUMATICS, VACUUM & BLOWER INDUSTRY NEWS

Kaeser Opens Two New Factory-Direct Facilities

Kaeser Compressors, Inc. opened two new factory-direct facilities. The new branch offices are responsible for supporting Kaeser's industrial and commercial customers in Wisconsin and Minnesota.

Both branches supply and support the company's entire product offering. Bringing experience as Kaeser's National Service Manager, Matt McCorkle accepted the role of manager to the new locations, and his team of factory-trained sales and service professionals offer a full range of services, including:

- Scheduled preventive maintenance
- Air system and equipment design and installation
- Equipment repair services and parts
- Air system audits for energy reduction and process improvement
- New equipment sales

"Compressed air is important in so many applications — everything from manufacturing processes to painting at small body shops," said McCorkle. "We established our new facilities to ensure the customers in the region who need highly reliable compressed air and blower equipment have the opportunity to call on local Kaeser representation. We are confident area businesses will quickly understand why Kaeser has a reputation for quality and service."

The new Kaeser facility in Wisconsin is located in Menomonee Falls, and serves customers in the Milwaukee metropolitan area, the Fox River Valley, Green Bay, plus Madison and the surrounding Southern Wisconsin region. The new Kaeser facility in Minnesota is located in Eden Prairie, and serves customers in the Twin Cities metropolitan area, Outstate Minnesota and Western Wisconsin.

For more information about the facilities or to discuss air system needs, call 855-523-7373 (KAESER3) or visit www.KaeserNews.com/MN&WI.

Pneumatech Shows Off New Houston Manufacturing Facility to Distributors. Reveals Plan to Increase Opportunities Worldwide

Pneumatech, a world leader in compressed air-gas system engineering, welcomed distributors to Houston on July 12-13 to tour its new manufacturing facility in Houston and learn about the company's far-ranging expansion strategy.

The distributors, who traveled from North and Central America and Asia, heard about prospects for new Pneumatech products to be introduced in 2012, including a filter product line that can deliver greater energy savings for users.

"We have a golden opportunity to work together with our distributors to grow our mutual businesses in new and exciting directions," said Ellen Steck, President, Pneumatech. "We are expanding our sales and customer service teams, we have a new, state-of-the-art production facility in Houston, and we're introducing new products and reaching new markets around the world. We also want to let our distributors know we have their backs when they go to customers with our products, giving them the world-class support they and their customers expect from Pneumatech."

The event featured presentations by Horst Wasel, President, Atlas Copco Quality Air division, and Joseph A. Fresch, Vice President-North America, Pneumatech. Wasel shared plans to expand distribution of Pneumatech products into Latin and South America,

Australia and South Korea in the next year, followed by expansion into markets in Europe and Africa. Pneumatech is also pursuing new opportunities in industries such as oil and gas, medical, marine and rental.

"We plan to make the Pneumatech brand stronger worldwide," Wasel said. "We want to position Pneumatech as a premium air-gas brand by providing the support for product innovation and customer service that it deserves."

Attendees also toured the new 96,000 square-foot manufacturing and assembly facility in the World Houston International Business Center, where many of Pneumatech's advanced air-gas treatment products are now produced. Products include refrigerated dryers, regenerative dryers, landfill and biogas dryers, nitrogen generators, drains, after-coolers, filters, water chillers and closed loop coolers.

"We're striving to make Pneumatech the market leader for air-gas treatment products and custom-engineered solutions around the world," Steck said. "Pneumatech has a solid history of bringing industry advances and end-user benefits, and we're working hard to really leverage these key characteristics that created our success and make the most of these strengths as we move forward for the future."

For more information visit www.pneumatech.com.

To read more ***Industry News*** articles, visit www.airbestpractices.com

"There are times when size does matter."

Heiko Kerkhoff, Assembly, BOGE

"But it's the efficiency that counts."

Gavin Monn, International Sales Director, BOGE

The 200 kW **SLF 271** model is designed such as to ensure that the maximum volume flow automatically adapts to the pressure. To invent an even more intelligent control of the coupling between pressure and speed is almostimpossible. This compressor is infinitely adjustable from 8 to 13 bar and engineered for optimum FAD at any pressure. This saves energy and provides companies with high compressed air demand with efficient **air to work**.

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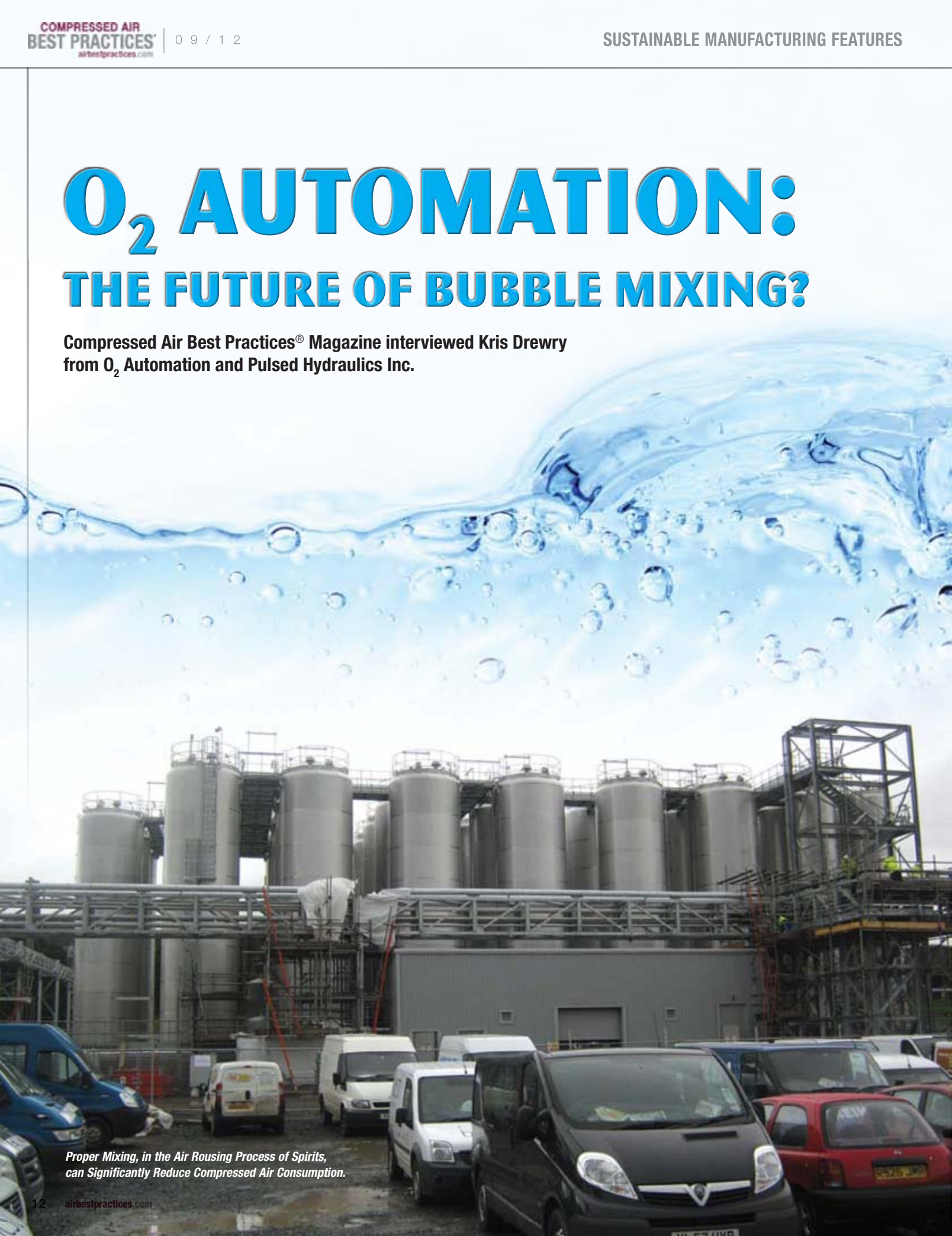
To learn more about BOGE, the SLF product range, or our other products phone **770-874-1570** or visit **www.boge.com/us**

O_2 AUTOMATION:
THE FUTURE OF BUBBLE MIXING?

Compressed Air Best Practices® Magazine interviewed Kris Drewry from O_2 Automation and Pulsed Hydraulics Inc.



Proper Mixing, in the Air Rousing Process of Spirits, can Significantly Reduce Compressed Air Consumption.

Good morning. Please describe your background in bubble mixing.

Good morning. I got involved with bubble mixing technologies, in industrial applications, over twenty years ago.

The unique application engineering challenges (and opportunities) presented by bubble mixing interested my partner, Richard Koopmans and me, enough to form Pulsed Hydraulics Inc. (PHI) in 2004. Our goal was, and continues to be, to take our Pulsed Hydraulics (bubble mixing) technology to industries, like the wastewater industry, because it reduces energy and maintenance costs in existing mixing and aeration systems.

What kind of industrial applications does PHI work on?

We can mix just about anything with our technology, but stay away from mixing sand because it does not like to be suspended. Our target market is wastewater, as the process has multiple locations that require mixing. We have installed dozens of systems in lift stations to keep them from building up grease and odors. Using a large air bubble to mix means, for all practical purposes, zero oxygen transfer. Therefore, we are installed in anoxic zones, grease tanks, EQ basins, sludge tanks, and aeration basins which we see as our largest market.

We have industrial accounts where we mix chemicals and acids. Our favorite is blending wine and spirits using compressed nitrogen. The old way to blend was to use "air rousing." This was done by installing rows of perforated pipes in the bottom of the tank and attaching an air pipe to this grid. Since the typical mixing cycle was 45 minutes, copious amounts of air and energy were used. This process resulted in air stripping alcohol from the product. Installing the PHi big bubble mixers cut the mixing process to five minutes without stripping the alcohol and reduced energy costs associated with the compressed air production by 90%.

O_2 AUTOMATION: THE FUTURE OF BUBBLE MIXING?

The O_2 Automation Patented Bubble System.

Our "non-shear" mixing process works as follows. There is an electro-pneumatic air valve controlling air output. A one-inch through-put pipe goes to the bottom of the tank and into a stainless steel plate that squashes the air to form a wider bubble. This pulse of air is released at 45 psi for ½ a second. About 4 cubic feet of air goes through the valve and creates the bubble. The bubble rises through the spirits at a rate of 4 feet per second and lifts material to the top of the tank. Currents go to the side of tank and then materials fall to the bottom of tank creating a circular motion. There is no shear to damage the scotch.

How did PHI get started with wastewater treatment plants (WWTP's)?

We were asked, years ago, to run a test at a site in New York City where nitrates had to be removed from the wastewater. We agreed to run a nine-month test on the site. We said we could use aeration for this process on an anoxic station. To do this, an anoxic basin (with zero oxygen) was made part of the process so that the nitrates would get consumed by the microorganisms. We ran the test for nine months to cover summer, fall, and winter temperatures. The test conclusion results were successful. Due to this test and some other experiences, we decided to launch a new company called O_2 Automation to focus our core technologies on wastewater treatment plants.

Please describe O_2 Automation.

O_2 Automation was organized in 2011 to develop and market a patented process that reduces power consumption at municipal and industrial wastewater treatment plants (WWTP). The Company is a joint venture owned jointly by PHI and Steve Holt. Mr. Holt is the President of WWaterteech, Inc. and is the Manager of O_2 Automation. He has brought over thirty years of experience in the WWTP market and aeration application knowledge to our team.

"Installing the PHI big bubble mixers cut the mixing process to five minutes without stripping the alcohol and reduced energy costs associated with the compressed air production by 90%."

— Kris Drewry, O_2 Automation and Pulsed Hydraulics Inc.

O_2 AUTOMATION: THE FUTURE OF BUBBLE MIXING?

Cridersville, Ohio Test Site.

Testing of the O_2 Automation Technology

Cridersville, Ohio

The O_2 Automation test entailed adding two bubble forming plates to mix the 15x30x15 foot swing basin. The basin's TSS measurements with the diffusers operating were different by 20% where the bottom measurement read 20% higher than the top measurement (2' from top and 2' from bottom) The DO reading was .60 mg/l. The O_2 Automation mixer was turned on and after 10 minutes of operations the measurements where retaken. The TSS difference between the top to bottom readings where now only 1% and the DO measured 1.30 mg/l the mixer was turned off and the TSS and DO readings returned to their starting points.

Soongsil University Testing of O_2 Automation

Dr. Seongho Hong of Soongsil University was awarded a government grant to evaluate O_2 Automation technology. His study is focused on energy savings and process improvement.

Dr. Hong installed the big bubble mixing system into a basin that is 78'x14'x14' in size. The control basin is of the same size and runs in parallel with the test basin sharing the same loading. Each basin has its own turbo blower to allow matched air flows and precise energy measurements. The test basin has four bubble forming plates installed using a bridge to allow installation without draining the basin.

The total power required for the O_2 Automation mixing system is 4 hp to mix the test basin. The installation time to install the four bridges was less than five hours with the total time to install the pulsed air piping, the control unit and the compressor was less than 2 days.

The testing period is set for six months, where multiple parameters will be measured between the test basin and the control basin. Dr. Hong did share the startup numbers with us after the first week of operation.

- TSS in control basin has a difference of 15% top to bottom

Fine bubble aeration provides good oxygen transfer but does not provide effective mixing. When the TSS has a 15% to 20% difference between top and bottom we know that nutrients as well as the oxygen is not equally distributed in the basin thus the basin is not processing to its design capacity. The increase in DO is due to the mixing physics of the big bubble, as it creates a top to bottom current flow. The downward currents keep the small bubbles in the liquid longer thus they have time to transfer more oxygen. In fact the mixer uses less than 10% of the power the aeration blowers use to transfer oxygen therefore they provide a net energy savings while enhancing the performance of the aeration basin.

- TSS in test basin has a difference of <1% top to bottom
- The test basin has 15% more MLSS than the control basin (maybe settled waste being mixed into the flow)
- The test basin DO is 7.5 mg/l. The control basin DO is 5.5 mg/l. The test basin has 20% less air flow to the diffusers than the control basin
- BOD removal is 25% higher in test basin then in the control basin

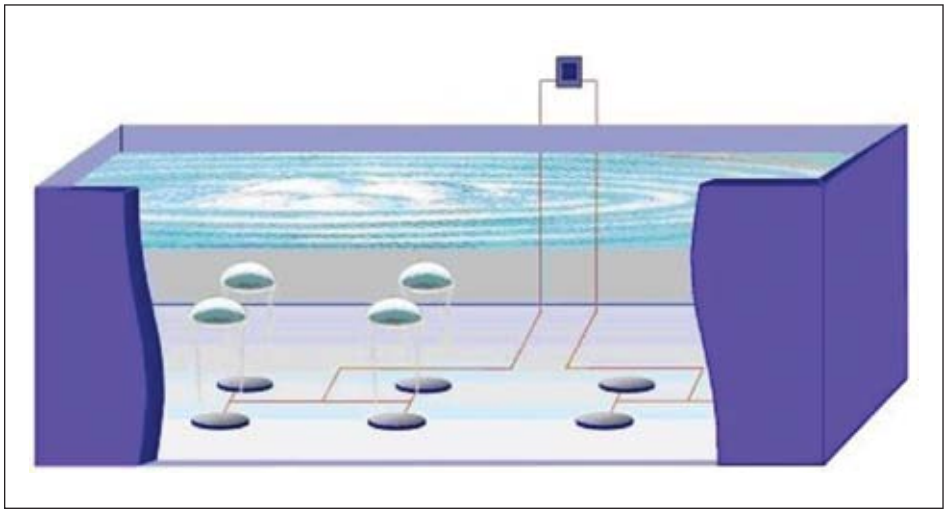
The first look at Dr. Hongs' numbers shows they are following the measurements taken at Cridersville, Ohio.

O_2 Automation has licensed two PHI patents that enhance the aeration process and reduce the energy needed while meeting the EPA discharge standards. We are now well underway with four significant "concept validation" tests that will provide us the scientific data the market requires to validate our new process.

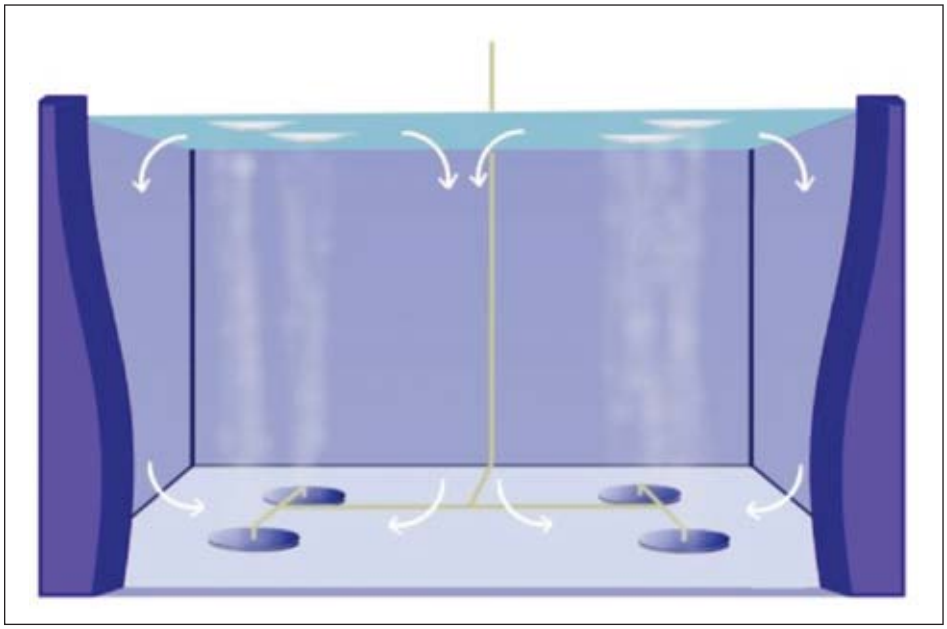
Describe your mixing process please.

The O_2 Automation mixing technology Hydro-Pulses compressed air through 8" stainless steel bubble-forming plates on the bottom of the tank. The bubbles are sequenced into the liquid at a rate of one every 20 seconds. These beachball-size (1 meter diameter) bubble masses fight their way to the surface. As they rise, they drag tank contents with them. When the bubble-masses break the surface and exit to the atmosphere, the tank contents roll horizontally until they meet a tank wall, or meet a wave of contents coming from another bubble-mass, which forms a virtual wall. The contents move down the structural or virtual wall until they hit the tank bottom, where they move sideways, sweeping up settling solids in their path. *When installed in an aeration basin, the downward currents force the small bubbles to stay in the solution longer and increase the oxygen transfer efficiency by 15% to 50% depending on the diffuser design and location.*

O_2 AUTOMATION: THE FUTURE OF BUBBLE MIXING?



Step 1: Bubble Masses Rise to the Surface.



Step 2: The downdraft flow zones impede the rise of aeration bubbles-increasing their efficiency.

The O_2 Automation mixing system is not like diffuser or coarse-air mixers, where air is fed continuously. Instead, each Hydro-Pulsed bubble-mass is allowed to reach the surface, and the contents allowed to move of their own momentum for a predetermined length of time. This allows O_2 Automation to use the minimum amount of energy necessary to keep solids in suspension.

The patented system also decouples the mixing function from the fine bubble diffusers and uses only 10% of the horsepower to mix the same volume of wastewater. This decoupling allows the blowers to be adjusted to provide the required air for creating DO levels needed for the biological process.

How are the appropriate dissolved oxygen (DO) levels more efficiently managed by your process?

The curve on page 20 shows dissolved oxygen (DO) readings in parts per million (ppm) for a typical aeration basin. The red line reflects the DO required to keep the biological process active. Any additional oxygen above the red line will not be used by the organisms to break down biological waste. For each aeration basin that operates 24/7, thousands of dollars can be saved by reducing the oxygen level. The area above the red line shows energy not needed for the process. The WWTP is designed to provide

"New bubble mixing technologies will reduce the energy consumption and maintenance of the current systems that are sized for peak demand loads infrequently seen."

— Kris Drewry, O_2 Automation and Pulsed Hydraulics Inc.

the oxygen required for peak loading. Loading decreases after the peak inflow and the DO rises above the biological requirements. The constant air flow line shows the required air used for mixing. With the current design there is a limited turn down range as the WWTP must keep the diffusers operating continuously to mix the basin. O_2 Automation's technology is to keep the process functioning at an optimal level while reducing power consumption.

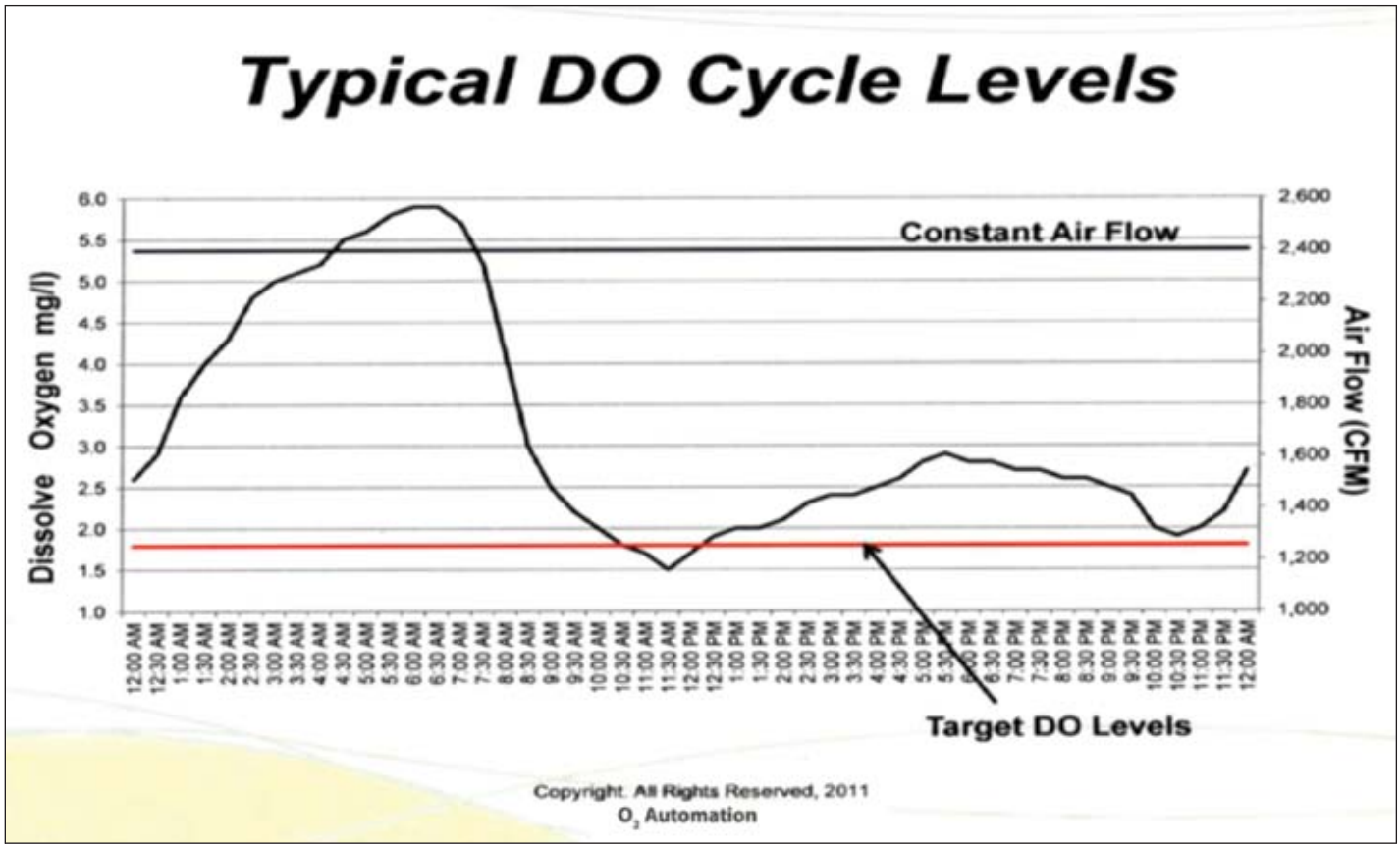
Why is it important to de-couple mixing from aeration?

Most existing wastewater treatment plants (WWTP) use a bank of blowers connected to a ductwork system with multiple paths. The blowers alone have a limited turn down capability and the ductwork that feeds the plant's basins must be balanced and provide the required air to the heaviest loaded basin. When this is done, each of the basins (whether needed or not) will receive the same volume of air. To recover this energy and allow blowers to be turned off and/or turned down without affecting the required air pressure, O_2 Automation will install Festo (see www.festo.com) flow valves. These valves have a weir flow design allowing the valves to precisely control the air flow and pressure to the multiple banks of diffusers. Using the Festo valves will allow O_2 Automation to maximize the energy savings for these older designs.

A typical 100 foot basin will use around 4 horsepower worth of compressed air with our mixing technology. We are using 50 psi going into 4 one-inch pipes. Each plate fires once a minute on fifteen second intervals. Each pulse uses 4 cfm every 15 seconds. A typical plant would use 50-60 hp of blowers to aerate this basin. You could only turn it down to 30 horsepower because you start to lose your mixing (TSS). Now the process is affected. Material falls below the diffusers and starts accumulating.

To keep the total suspended solids (TSS) at specification, as measured by milligrams of solids per liter of water, they must remain within a 1% differential between the bottom 1 meter and the top 1 meter of the tank. Specifications typically call for a 10% differential when combined with aeration —

O_2 AUTOMATION: THE FUTURE OF BUBBLE MIXING?



by separating out the mixing — our process can do a 1% differential. An improvement in TSS differential is a significant benefit to de-coupling mixing from aeration.

Our mixers mix independently and thereby allow for greater turn-down of the blowers that are now focusing on aeration. To understand this better, look at the typical DO Cycle (Dissolved Oxygen) at a WWTP. You will use 4 hp. When there is little demand, you can turn off the blowers.

A Typical 24-Hour DO Cycle

1. The 6 AM morning flush. Air flow goes up to meet rising DO demand
2. DO demand remains constant with spikes during the lunch hour and break times. Most municipalities have the same demand curves.
3. DO levels go up significantly after 11 pm and stay there until the morning flush — as there is almost no demand for oxygen — yet the blowers continue to aerate.

The original vision was that our O_2 Automation technology would run at night to provide the mixing required for very low energy costs and be off during the day when the aeration system could do the mixing. This would save the client on blower kW at night when only mixing was required. What we found in the testing is that we do more than just mix — we increase the rate of DO (due to the down draft slowing the rise of the bubbles) and we thereby increase aeration efficiency — and reduce blower kW requirements. Blowers are now able to run at partial loads during the peak daytime hours. We believe that down the road, we will see the use of more smaller blowers and air compressors in the WWTP.

Conclusion

The aeration process in wastewater treatment plants is a recognized area of opportunity. New bubble mixing technologies will reduce the energy consumption, maintenance, of the current systems that are sized for peak demand loads infrequently seen. BP

For more information please contact Kris Drewry at Pulsed Hydraulics Inc, email: kris@phiwater.com, www.phiwater.com

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Black & Veatch Provides Guidance to WWTP Design

By Rod Smith, Compressed Air Best Practices® Magazine

Compressed Air Best Practices® Magazine interviewed Ms. Julie Gass P.E., Lead Process Mechanical Engineer, from Black & Veatch on trends in the wastewater treatment industry especially pertaining to new technology aeration blowers and energy efficiency.

Good afternoon. Please describe Black & Veatch.

Good afternoon. Black & Veatch (www.bv.com) is an employee-owned, global leader in building Critical Human Infrastructure™ in Energy, Water, Telecommunications and Government Services. Since 1915, we have helped our clients improve the lives of people in over 100 countries through consulting, engineering, construction, operations and program management. Our revenues in 2011 were US$2.6 billion. Black & Veatch service offerings include:

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- Engineering design
- Management consulting
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- Asset management
- Environmental consulting
- Security design and consulting

Julie Gass P.E., Lead Process Mechanical Engineer, Black & Veatch.

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The practice of classifying water into different categories can create division about water value and contribute to communication challenges, but for purposes of this discussion, we'll focus on six types of services provided by Black & Veatch:

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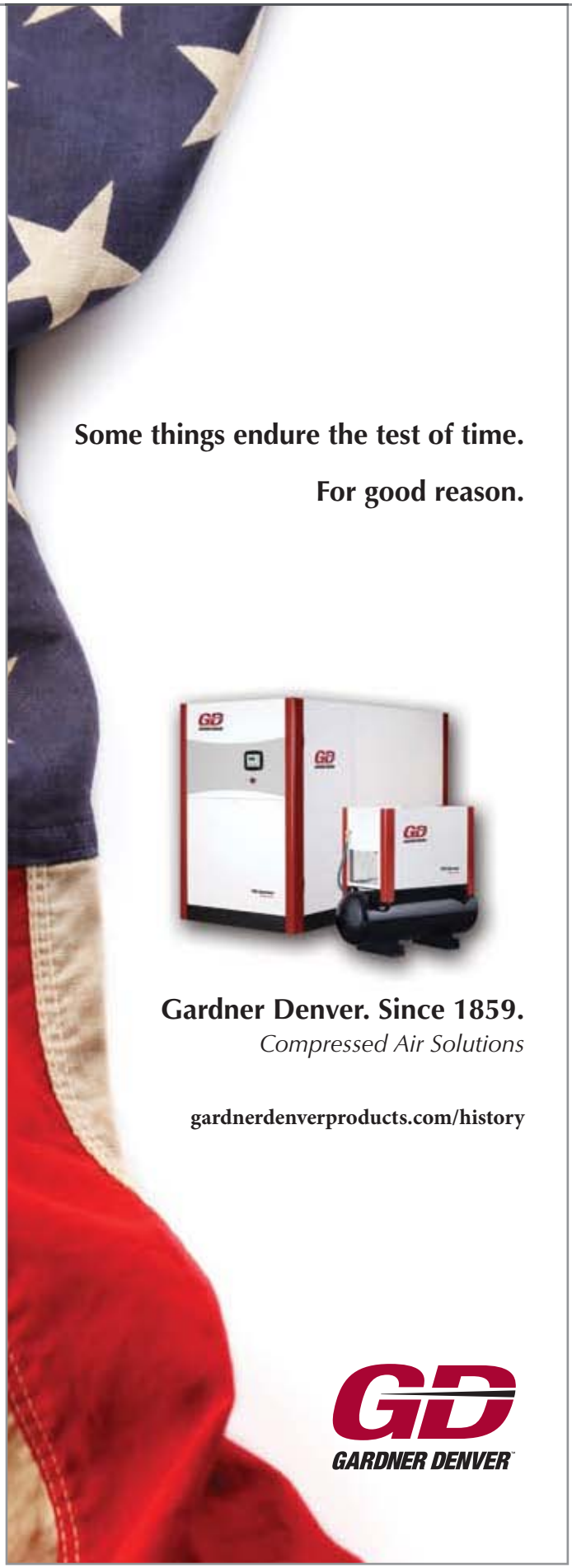
3. **Program & Construction Management:** We offer many services in a comprehensive approach to the field of Program and Construction Management (PMCM). It's an approach that includes managing entire systems, improving project delivery and managing construction.

4. **Sustainable Water & Energy Solutions:** Studies are predicting a significant increase in water usage leading to a shortfall in supply in many geographies and regions of the world. At the same time, utilities juggle the competing challenges of limited resources and greater needs. This is often complicated by the impact of aging infrastructure. The issue of power consumption at wastewater plants is closely tied with one of the main topics of this article, aeration blowers, since they



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are such a large power consumer. The new technology blowers and efforts to write a performance test code to verify performance are key to sustainable solutions.

5. **Water Resources:** We deliver solutions that preserve and protect watersheds, manage storm drainage and flood control, and provide sustainable water supplies.

6. **Water & Wastewater Treatment:** Black & Veatch knows how to solve water problems. We have expertise in drinking water supply, treatment and distribution. Our capabilities include:

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   - Ozone systems
   - Ultraviolet disinfection
   - Dissolved air flotation
   - Desalination

What is your role at Black & Veatch?

I work in the Water & Wastewater Treatment division. I am a Mechanical Engineer and my role is to design new wastewater treatment plans and to design retrofits on existing plants. I am on-site, as we speak, at a wastewater treatment plant retrofit start-up. We designed this plant for our client.

So you decide what blowers and air compressor systems are used in a wastewater treatment plant?

Yes and it's funny because depending upon who you talk to, the terms "blower" and "air compressor" can have different meanings. Some people call a blower an air compressor. I define a blower as something producing 3-25 psig pressure. Below that pressure range, I call it a fan. Above 25 psig, I call the machine an air compressor. Blowers, producing air in the 5-15 psig range, are what we typically use for the aeration process in wastewater treatment plants.

A Dry Screw Blower. (Courtesy Atlas Copco)

Air compressors are used for instrument air (operating pneumatic valves and instruments) and also for service air (air tools and other uses). Air compressors also supply our airburst systems. Airburst systems use compressed air at 125 to 150 psig to clean the screens used to protect fish from being drawn into intake pumps. The airburst system provides a large burst of air to clear debris from the screens. It usually takes us about an hour to fill the compressed air receivers used for the air burst .

What blower technologies have traditionally been used for aeration?

Over the past five to seven years, there has been a big revolution in blower technologies available for aeration. In the past, the two most common technologies were rotary positive displacement (PD blowers) and multistage centrifugal blowers, running at 3600 rpm with multiple impellers on the shaft (depending upon pressure requirements). These multistage units have low maintenance costs but there can be some efficiency losses due to the circuitous air flow path.

A third traditional technology has been the single stage centrifugal blower. These units have a gear box with integral gears. The impeller is overhung on the outside of the bearings (not between them). The advantage here is in efficiency in comparison with the multistage or pd units. Of course the capital cost of single stage centrifugal units are higher than the other technologies. They also use Inlet Guide Vanes and Variable Diffuser Vanes with a control algorithm that further improve efficiencies at partial loads.

Gearless Turbo Blowers installed at the Fond du Lac plant. (Courtesy ABS USA)

What trends do you observe with blowers in wastewater treatment plants?

The aeration process, at a wastewater treatment plant, can account for forty to 70% of the over-all plant electrical energy consumption.

A major design challenge we have at wastewater treatment plants is that we have to design systems that will meet peak load requirements that occur perhaps one day out of each year. The rest of the time, the plant is functioning at partial loads. So a key design question we ask is "What is the efficiency of this blower when the machine is turned down?"

What blower designs help you with this "part load" challenge common to wastewater treatment plants?

First, and this is the big one, the market has been impacted by the introduction of new gearless, high-speed turbo blowers. They are single-stage machines operating at 20,000 to 40,000 rpm — without multiple impellers and gearboxes. They have non-contact bearings (magnetic or air bearings) that eliminate the need for a lubrication system. Most deploy a variable frequency drive. These units also come in skid packages incorporating cooling systems and VFD's seemingly providing a lot of advantages. One significant advantage is that for the first time, there is a more efficient technology available for small and medium-sized wastewater treatment plants which is the gearless turbo technology. The single stage integrally geared units have been available for many years and offer good efficiency for the larger plants but were often not well suited for small to medium size plants. We see a trend towards using banks of smaller units to allow smaller plants to install horsepower ranges better suited to their varying load profiles.

Second, the positive displacement blower manufacturers are coming out with new designs, like the rotary dry screw blower, that is optimized for the pressure ratio needed for wastewater aeration and offers improved efficiency in comparison with traditional positive displacement blowers. These are also packaged machines and they often incorporate Variable Frequency Drives that help match kW consumption with partial load conditions.

What are some of the challenges you face?

Utilities have recognized the energy saving potential in the aeration systems of wastewater treatment plants and offer significant energy rebates or other incentives to clients for installing more efficient equipment which is often higher in capital costs. They require documentation to substantiate the kW reduction claims of the blowers and this has led us towards trying to verify the numbers we are seeing claimed in the marketing literature of some of the high-speed turbo blowers.

The high-speed turbo blowers are delivering significant benefits and energy savings. Many of the initial claims (four or five years ago),

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however, did turn out to be outlandish and unrealistic. In some cases, it was due to the accessory items installed in the total package. We are working now, with the code organizations and manufacturers, to get more reliable energy consumption numbers that are "apples-to-apples" and more realistic.

What kind of work are you doing with ASME and ISO on test codes?

Consulting engineers, plants and utilities are asking how do the blower manufacturers prove their energy efficiency claims? There are many subsystems on these aeration packages and it's hard to conduct an "apples to apples" measurement and comparison without a standard. The old standards were designed to measure input power to the blower shaft which is impractical for many of the new units since the impeller is attached to an extended motor shaft. The package components also contribute to total power consumption. For example, some plants require harmonic filters and some don't. Some blowers have

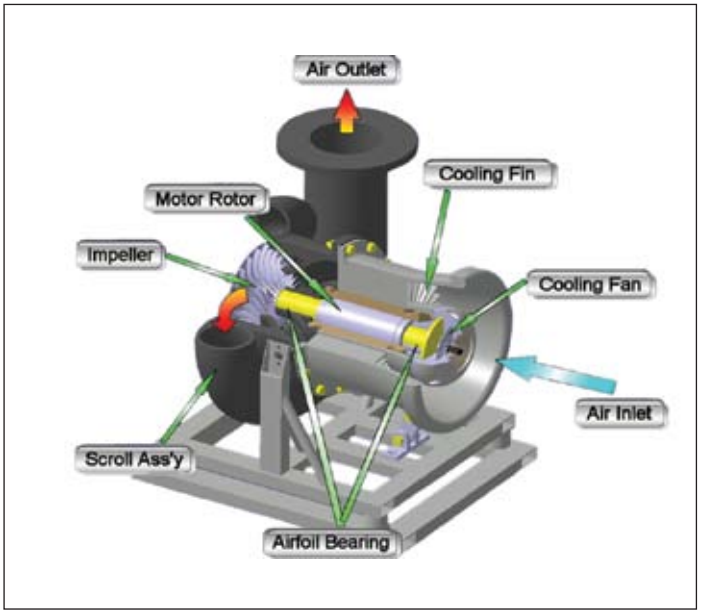

Illustration of a High-Speed Turbo Blower Core (Courtesy APG-Neuros)

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different cooling systems than others and each cooling system has a different power requirement. What and where should one measure kW consumption? The client wants to know what the total kW energy cost is so the input power to the blower shaft is no longer sufficient.

Consulting engineers and blower manufacturers were aware that something needed to be done but the Consortium for Energy Efficiency (CEE) served as a catalyst to start code committees to revise existing test codes. Engineers and manufacturers have combined their expertise to start two initiatives on test codes. I am currently involved with two separate initiatives. ISO /CAGI and ASME. ISO and CAGI have a joint initiative that will first revise the ISO 5389 standard for centrifugal machines followed by a planned revision to ISO 1217 for positive displacement machines. The revisions will provide guidance formeasuring total package input kW on both machine types. We will capture wire power going into the packages — not shaft power going into the blower. ASME is also writing a brand new code, PTC13, with the same goal, but will cover all packaged technologies in one standard. We hope to see these test standards finalized and become available over the next year or two.

What does the future hold?

The Consortium for Energy Efficiency (CEE) has a strong representation from the utility companies who will continue to offer energy reduction incentive programs. They strongly support this work being done by the blower industry in support of test codes. We all want to talk about total power used vs. air flow and pressure coming out of the package. Verifying the efficiency claims will benefit all parties as we continue to strive for more efficient systems.

We expect to see aeration systems able to turn down to 50% of rated flow in most wastewater treatment plants without a significant increase in operating horsepower.

What about aeration control systems?

For years, dissolved oxygen (DO) control systems have been used and most-open valve control systems have been discussed. However, the systems sometimes did not work well when implemented. The goal is to not waste the pressure built at the blowers by excessive throttling of the basin valves. Most municipal WWTP jobs are still competitively bid. A control system integrator often implements the control descriptions written by the engineer but the low bidder may not have experienced with wastewater aeration. We have found significant advantages to pre-qualifying integrators to ensure the integrator is experienced and to giving the successful blower vendor single-source responsibility with the integrator as a sub.

DO sensor technology is also becoming more reliable and less prone to fouling than in the past. The DO sensor provides an indication as to whether the system is meeting the DO setpoint. A flow meter and modulating valve are used in conjunction to control the air flow to each basin zone. Typically, butterfly valves are used but, for the first time different types of control valves are being considered for some applications. Feed forward control systems measuring other wastewater parameters are also being considered. The whole system needs to be scrutinized. BP

Thank you for your insights.

For more information visit Black & Veatch at www.bv.com or contact Rod Smith at Compressed Air Best Practices® Magazine, email: rod@airbestpractices.com, www.airbestpractices.com

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"We expect to see aeration systems able to turn down to 50% of rated flow in most wastewater treatment plants without a significant increase in operating horsepower."

— Julie Gass P.E., Lead Process Mechanical Engineer, Black & Veatch

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Aeration Energy Offers

By Jess Burgess, Consortium for Energy Efficiency

Aeration systems at wastewater treatment facilities present significant, cost-effective energy savings opportunities. Aeration — the introduction of air into the wastewater stream to support anaerobic bacteria and mixing — is a key function at the majority of wastewater treatment facilities in North America. Aeration accounts for 25-60% of total energy consumption at wastewater treatment facilities, and a significant piece of operating budgets sector-wide.

The aeration system may also be a rich source of cost-effective energy savings. Savings opportunities range from large and capital-intense to operational and low-cost. The two short case studies below illustrate each type of opportunity. Regardless of scale, state and local energy efficiency programs have resources to support aeration system improvements — and other cost-effective upgrades — that save energy at wastewater facilities. To learn more about efficiency program resources for water and wastewater facilities in your area contact your electricity and gas providers.

More For Less

In 2008, Snohomish Public Utility District, an energy efficiency program administrator in northeast Washington, assisted a wastewater treatment facility that needed additional aeration system capacity, and was interested in energy efficiency. The facility serves a community of about 20,000, with an average daily flow of approximately half a million gallons. At the time of the project, the facility used parallel 85 horsepower brush rotors to mix and aerate the wastewater in the aeration basins.

CEE SM
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Engineers from the efficiency program helped the wastewater facility to analyze three upgrade scenarios for treatment capacity, energy performance, and maintenance costs, and to compare the initial and lifecycle costs of all three systems. The scenarios considered included (1) adding a third brush rotor, (2) replacing the existing brush rotors with a positive displacement blower, controls, and fine-bubble diffusers in the aeration basin, and (3) replacing the brush rotors with a high-speed, gearless "turbo" blower with integrated dissolved oxygen controls, and fine-bubble diffusers.

The first option — adding a third brush rotor — had the lowest initial cost, but was ruled out because of high energy and maintenance costs, which would have resulted in a higher total cost compared to options two and three. The wastewater facility ultimately selected option three, the high-speed blower and fine-bubble diffusers — which had the lowest annual energy and maintenance costs.

High-speed blowers can offer significant efficiency improvements, compared to mechanical aerators, or positive displacement and multi-stage centrifugal blowers. They achieve this through the use of highly-efficient permanent magnet motors and a frictionless magnetic or airfoil bearing design that improves the unit's mechanical efficiency. The blower installed at the Washington wastewater facility also included integrated dissolved oxygen sensors and a variable speed drive that modulated the speed of the blower to maintain a specified oxygen concentration in the wastewater stream. The fine-bubble diffusers, installed in the bottom of the aeration basin, provided an additional efficiency improvement, by more evenly distributing air throughout the basin, and increasing the overall oxygen transfer efficiency, compared to mechanical mixing.

Opportunities to Save

The completed project met the wastewater facility's need for expanded aeration capacity, while at the same time reducing aeration system energy consumption by 61%, and saving the facility $16,000 per year in energy costs, and an additional $500 in reduced maintenance. The energy efficiency program provided a $39,000 project incentive, to offset the higher initial cost of the high efficiency equipment.

Tiny Bubbles

Wastewater treatment systems use biological processes to remove pollutants. The majority of these biological processes require oxygen, which is provided through a system of air compressors, distribution pipes, valves and diffusers. Over time the diffusers become fouled, reducing oxygen transfer efficiency, and increasing the amount of air needed to support the process.

Aeration energy is the largest non-labor operations cost for most wastewater treatment plants. The aeration oxygen is added simply in the form of bubbles to waste water to help keep the bacteria alive that's cleaning the water. The smaller the bubble, the better the system.

At the Metropolitan Wastewater Treatment Plant in St. Paul, Minnesota, energy benchmarks indicated significant diffuser fouling had occurred. Xcel Energy, the electrical utility for the plant, funded a study to evaluate various cleaning techniques and the impact on diffuser performance. As a result of the study, a combination of chemical and high-pressure cleaning methods were recommended and employed to effectively return the diffusers to like-new condition.

The solution made for smaller profile bubbles that allowed for optimized oxygen transfer. That efficient transfer translates to a reduced airflow requirement. In other words, the blowers producing the bubbles don't have to work as hard. In addition, the clean diffusers feature a lower pressure drop, which further reduces the blower power required.

The diffuser cleaning project reduced the required airflow by 48,000 scfm, resulting in 11 million kilowatt hours of energy savings, or approximately 22% of aeration energy use. In-house staff completed the cleaning to further reduce costs and the project paid for itself in energy savings in only three months.

Conclusion

The brief case studies above demonstrate that aeration systems within wastewater treatment plants can be a rich source of cost-effective energy savings, and that energy efficiency programs administered by local utilities can help identify, quantify and implement these energy-saving projects. The authors encourage water and wastewater facility managers to contact their electricity and natural gas providers to inquire about available efficiency program resources for water and wastewater facilities in your area. BP

CEE is a consortium of efficiency program administrators from across the U.S. and Canada who work together on common approaches to advancing efficiency for the public good. For more information visit www.cee1.org. CEE would like to thank the following people and organizations for their assistance in preparing this article.

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ADAPTIVE CONTROL FOR LOW PRESSURE WASTEWATER TREATMENT AIR SYSTEMS

By Roy Stuhlman, Kaeser Compressors Consultant and an instructor for the Compressed Air Challenge and Stephen Horne, Kaeser Compressors, for the Compressed Air Challenge®

In recent years, there have been many changes in wastewater treatment. Most modern processes control three cycles: DO, NH4, and NO3, and all of the processes require high volumes of air. Undeniably, the low pressure air system uses more electrical power than the rest of the wastewater treatment plant combined. The blower packages in these systems can be equipped with low noise enclosures, fixed speed or variable speed drives, and can include all the instrumentation needed for self-protection. The latest designs are classified as end-products which are "plug-and-play." In addition, manual process control is being replaced by automated process control. These sophisticated system controllers match the blower capacity to the process demand by delivering the required flow in real-time for optimized, efficient operation. This is accomplished by measuring data from the process as well as data from the machines connected to the process. New blower technologies also include gearless, high speed turbines and oil-free, rotary screw blowers. All of these advancements can help to improve low pressure air system efficiency when controlled efficiently.

When modern wastewater treatment facilities are designed and built, they are dedicated to serve a defined region and are many times substantially oversized to handle the future growth of the community they serve. This growth however, depending on the local economy, could take years to reach maximum capacity. The specified "worst case" site conditions may only occur a few days a year, but the plant must pay the higher electrical cost every other day.

It is common for new system designs to include variable frequency drives on all of the blowers. While variable frequency drives (VFDs) offer great flexibility, they have a high investment cost and their own efficiency drawbacks. The most efficient low pressure air systems are a combination of fixed speed units and VFD controlled units that work in conjunction with the wastewater treatment process controls. VFDs are perfectly suited for applications where the air flow is variable. However, in applications where there is a broad range of airflows, a method of system splitting can be applied. In system splitting, the low pressure air system can be controlled more efficiently by cycling fixed speed machines to cover the large portion of the demand and using VFD machines to provide the trim load. This is a result of the losses in the VFDs, the blowers, and the drop off in motor efficiencies at partial loading / speeds which are not found in fixed speed machines.

The second part of the system is an intelligent controller which can analyze the system / process requirements in real-time. A controller that combines the requirements of the process with available capacity in the most efficient way is known as *adaptive system control.* The wastewater treatment process controller communicates the process requirement to the adaptive low pressure air system controller which provides the air that is needed by selecting the most efficient combination of units to match the current demand. When the input power of this selected combination

ADAPTIVE CONTROL FOR LOW PRESSURE WASTEWATER TREATMENT AIR SYSTEMS

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KNOW PRESSURE COMPRESSED AIR CHALLENGE

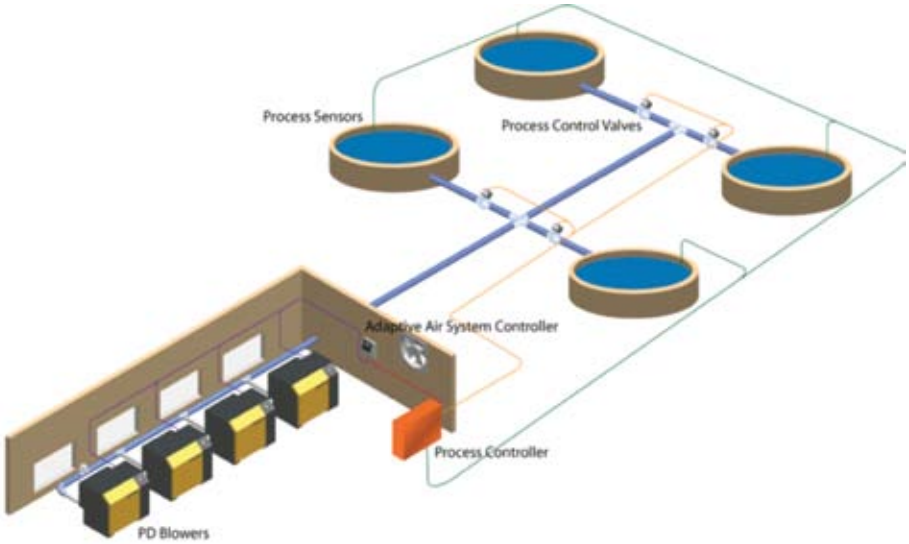
Roy has been in the compressed air industry for over 40 years, and worked the past 30 years for Kaeser Compressors, Inc. in Fredericksburg, VA, the US subsidiary of KAESER KOMPRESSOREN GmbH. Roy spent the majority of his years in the field guiding customers and sales associates in the proper selection of compressed air equipment and efficient system design. In 1984, he became Kaeser's National Sales manager and in 1998, he became Kaeser's Vice-President of Sales with responsibilities for Kaeser's distribution network and factory sales representatives. In addition, Roy aided in the development of Kaeser's extensive training program, acting as both instructor and mentor to students and other instructors. Roy is a KFaCT (Kaeser Factory Certified Training) Master System Specialist as well as a certified Compressed Air Challenge Level 1 Instructor. Roy retired from Kaeser in 2011, but continues his work as an instructor and consultant with Kaeser.

of units is compared to the input power of the multiple VFD solution, the efficiency gains can be seen. Adaptive control combined with system splitting is an attractive alternative because it offers reduced initial investment cost, lower cost of redundancy, improved system reliability, and optimized system performance.

A typical "conventional" system will include two or more identically sized units with identical variable frequency drives. In this arrangement, several units are running in parallel with another unit for redundancy. The simplest control systems are often setup to share the demand and the blowers operate at the same speed resulting in an accumulation of inefficiencies at lower demands. In comparison, a split system is setup with three or more units. One or two units will include variable frequency drive and the balance of the air blowers are fixed speed machines with reduced current starting and auto-dual control. The initial investment cost is reduced by limiting the number of variable frequency drives needed.

In system splitting, auto-dual control on fixed speed positive displacement blowers allows the unit to be placed into an idle condition where ambient air is passed through the blower at no pressure (which requires very little power). The unit can remain in this idle condition for a defined period of time before shutting down, allowing the adaptive controller to observe the system's response and reload if needed. This ability to load and unload as well as start and stop the motors offers quick response times while consuming minimal energy (especially when compared to blowing off air at pressure). The variable speed machine(s) are configured with Proportional Integral Derivative (PID) loops which enable the units to hunt for a speed that matches the systems demand in real-time. The VFD machine should be no larger than required to reduce investment cost while covering the gaps in supply that will occur when fixed speed machines are placed into idle. It is more efficient to turn blowers off than to turn blowers down.

The performance advantages depend on the size of units selected and effectiveness of the

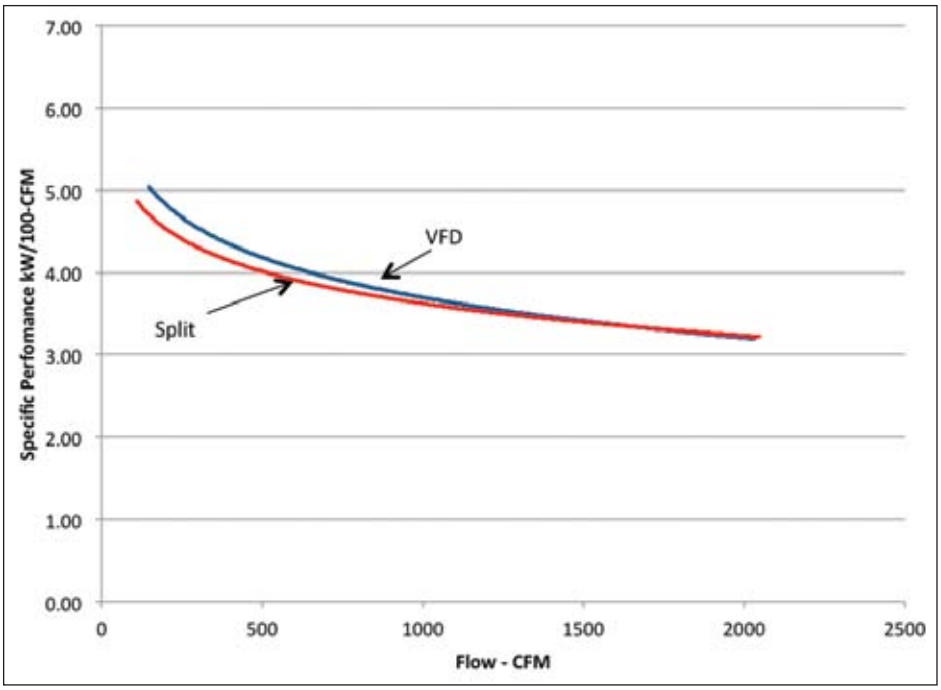


Low Pressure Air System for Watertreatment Facility

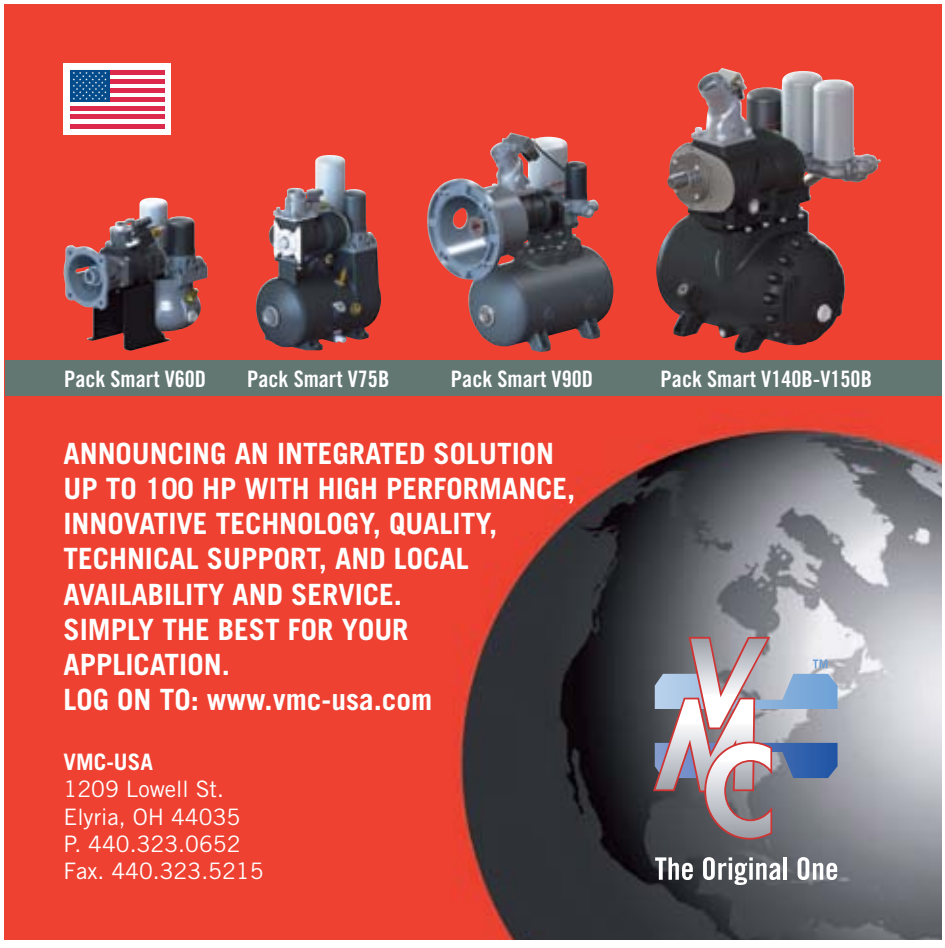
control scheme. The goal when sizing units is to utilize the minimum number of fixed speed machines to provide the base load while staying within the turndown range of the VFD unit to trim the transient system variations. The fixed speed units, setup to operate at their best efficiency point, provide the best wire-to-air efficiency when considering all of the losses in power transmission. The VFD unit can be set to follow the variations in demand to optimize system performance, by matching system demand.

The efficiency gains can be seen by examining each unit's specific power and the combination of these units over the entire operating range of the system. Specific power is a ratio of total input power (kW at the input to the unit's control system) over the produced flow rate (cfm). In low pressure air systems this can be given as kW/100 cfm. It is very important to consider the input kW to the control panel to include all losses and power consumers to run the equipment, not just the estimated power at the motor at a given design point or the efficiency of the airend. On VFD driven machines, input kW will vary over the entire operating range of the machine. At constant pressure, the efficiencies will drop at the lower end of the operating range; not only because of the lower airend efficiencies, but because of the losses in the motor and drives.

As an example let's review a 2,000 cfm system at 7.0 psig (assuming standard conditions). A typical specification may require three like-sized VFD positive displacement blower packages. For the conventional (VFD) setup, the units are to be sized for at least 667 cfm at 7.0 psig which results in a 30 hp positive displacement blower. The combined average specific power of three units in operation will be 4.26 kW/100 cfm over the entire operating



Graph 1.



ADAPTIVE CONTROL FOR LOW PRESSURE WASTEWATER TREATMENT AIR SYSTEMS

CAC® Qualified Instructor Profile

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KNOW PRESSURE COMPRESSED AIR CHALLENGE®

Stephen Horne is the US Product Manager for Kaeser's Omega Blower line, and has over 10 years of experience with the design and function of blower systems in wastewater aeration applications. Stephen has also served as Kaeser's in-house engineer for machine modifications and system design. He is a primary blower product and application instructor in Kaeser's Factory Certified Training program. Stephen holds a Bachelor's degree in Mechanical Engineering from Virginia Polytechnical Institute and State University.

range of the system. Average specific power is identified by looking at the specific power of the system at data points across the entire operating range of the system.

The split system concept would utilize one 30 hp VFD driven positive displacement blower package, two 20 hp positive displacement mid-load fixed speed machines, and one 40 hp positive displacement base-load fixed speed machine. The average specific performance of this system over the entire operating range is 3.68 kW/100 cfm.

Graph 1 shows a comparison of the specific power of the two systems with the constant pressure and variable flow. At full flow performance, the VFD solution is marginally better. However, at lower flows the adaptive control system shows greater efficiency. If the entire performance envelope is examined and averaged, the adaptive control system is 13% better than the VFD-only solution. Over a 10-year period, this equates to $95,000 in savings (assuming $0.09/kW-hr & inflation).

While this example is somewhat elementary when compared to actual site conditions, the potential for savings is clear. Furthermore, many plants are sized with provision for community growth and for "worst case" conditions. The specified low pressure air system capacity may be much more than what is actually required. With this consideration, the plant may not see full flow conditions for many years to come which will only further increase the operational savings provided by a high efficiency low pressure air system. By substituting fixed speed machines for the base load and trimming with one VFD unit, the overall system reliability is improved. By limiting the accumulative effect of running larger blowers at lower speeds where losses are greatest, system efficiency is improved.

Modern wastewater treatment technology has become very advanced. Most control three cycles — DO, NH4, NO3 — in each basin. Aeration represents the majority of the energy consumption. It is reasonable to investigate the most efficient means to produce and deliver the air. Adaptive controllers and system splitting offer both an advanced option for air delivery and selection method for the equipment that produces this air. While multiplex VFD controlled units offer inherent redundancy and flexibility, it comes at cost when evaluating the system specific power consumption. Even the most efficient blowers may not result in the lowest power if the control system is not efficiently controlled. Combined with lower initial cost, lower cost for redundancy, and greater reliability, an adaptive control scheme is very appropriate for wastewater treatment plants with sophisticated automation.

When evaluating existing blower systems, it is a good idea to contact your blower specialist. Working closely with your blower specialist can determine which control strategy is best for your specific process, and if a system audit is needed. System audits can uncover energy savings opportunities within the system and can pay big dividends.

The Compressed Air Challenge is a voluntary collaboration of industrial users; manufacturers, distributors and their associations; consultants; state research and development agencies; energy efficiency organizations; and utilities. This group has one purpose in mind — helping you enjoy the benefits of improved performance of your compressed air system. The mission of the CAC is to be the leading source of product-neutral compressed air system information and education, enabling end users to take a systems approach leading to improved efficiency and production and increased net profits. For more information, please visit www.compressedairchallenge.org. BP

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weftec® 2012
the water quality event™

SHOW PREVIEW

By Compressed Air Best Practices®

WEFTEC® 2012, presented as "the water quality event", is taking place from September 29 to October 3, 2012 in New Orleans. WEFTEC®, the Water Environment Federation's Annual Technical Exhibition and Conference, is the largest conference of its kind in North America and offers water quality professionals from around the world with the best water quality education and training available today.

Also recognized as the largest annual water quality exhibition in the world, the expansive show floor provides unparalleled access to the most cutting-edge technologies in the field; serves as a forum for domestic and international business opportunities; and promotes invaluable peer-to-peer networking between its more than 18,000 attendees. More than 280,000 square feet of exhibition space had already been booked by more than 700 exhibiting companies for WEFTEC 2012 at the time of publication.

Compressed Air Best Practices® Magazine is proud to be "A Supporting Publication" of WEFTEC®. This industry is a major user of Aeration Blowers, Air Compressors. We will be exhibiting at the show and distributing this issue to show visitors. We hope this article can help show visitors find the blower and compressed air system manufacturers at WEFTEC®.

Table 1. Compressed Air, Pneumatics, Blower and Vacuum Technology Exhibitors at NPE 2012

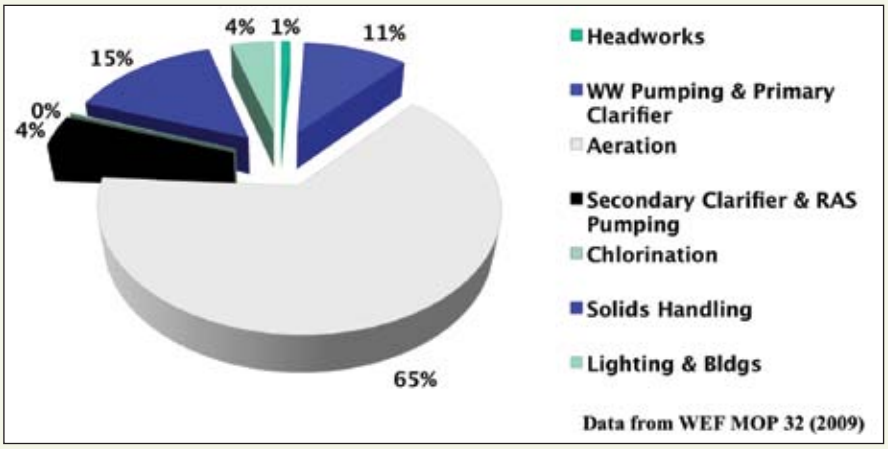
COMPANY	TECHNOLOGY*	BOOTH NUMBER	COMPANY	TECHNOLOGY*	BOOTH NUMBER
Aerzen	B, AC	4743, Hall F	HSI Blowers	B	7129, Hall H
APG-Neuros	B	7829, Hall I	Kaeser Compressors	B, AC	4461, Hall F
Aqua-Aerobic Systems	B	3327, 3345 Hall E	Mapner Gas Compressors	AC	4946, Hall F
Ashbrook Simon-Hartley	B	1915, Hall C	Mapro International	B, AC	3967, Hall E
BKT	B	3135, Hall E	Onyx Valve Company	AC	4701, Hall F
Citel	AC	2659, Hall D	Piller TSC Blower Corp	B, AC	6621, Hall H
Compressed Air Best Practices Magazine	B, AC, P	2659, Hall D	Pollardwater.com	B	1029, Hall B
Continental Blower	B, AC	3535, Hall E	Republic Blower Systems	B	7021, Hall H
Environmental Dynamics International (EDI)	B	3134, Hall E	Robuschi	B, AC	5813, Hall G
EURUS Blower	B, AC	7223, Hall I	Schreiber	B	5931, Hall H
FPZ	B, AC	2762, Hall D	ShinMaywa America	B	6957, Hall H
Gardner Denver	B, AC	5813, Hall G	Siemens Water Technologies	B	4027, Hall F
GE Energy	B	4059, Hall F	Spencer Turbine Company	B	3001, Hall D
Geotech Environmental Equipment	B, AC	6549, Hall H	Stamford Scientific Int'l	B, AC	7329, Hall I
Grundfos	AC	3027, Hall D	Sulzer Pumps/ABS	B	7239, Hall I
Hoffman/Lamson	B	5813, Hall G	United Blower	B	5628, Hall G
Howden Water Technology	B, AC	5247, Hall G	USA BlueBook	B	5955, Hall G

*B – Blowers, AC – Air Compressors

Aeration Blower and Compressed Air System Technology Exhibitors Can Help WWTP's Reduce Energy Costs

We highly recommend that wastewater treatment professionals take the time to review their compressed air and blower aeration systems by visiting one of the exhibitors at WEFTEC®. Pierre Noack, President of Aerzen USA commented, "Water and wastewater processing consume 3% of U.S. electricity and wastewater treatment normally represents 20% of a municipalities' energy bill. Noack continued, "Aeration systems represent sixty-5% of the energy usage at a WWTP."

Below is a sampling of some of the exhibitors that can help WWTP personnel evaluate the energy costs associated with the aeration systems.



Aeration Can Represent 65% of WWTP Energy Use (Graph courtesy of Aerzen USA. Data from WEF MOP 32 (2009))

Aerzen (Booth 4743, Hall F) Aerzen presents a new technology of turbo blowers and stretches their range of products by the segment of continuous flow machines. The new AT Turbo blower Generation 5 is designed specifically for municipal and industrial water treatment plants. This series is available in 11 sizes and with suction volumes of approx. 4.000 m³/h up to 13.200 m³/h, pressure ranges of 400 mbar up to 100 mbar and motor sizes up to 300 kW. www.aerzenusa.com

Booth 4743, Hall F: Aerzen AT Turbo Blower

Booth 4461, Hall F: Kaeser Compressors Com-paK Rotary Blower

Kaeser Compressors (Booth 4461, Hall F)
Wastewater treatment plants across the country have discovered that factory-built blower and compressor packages provide distinct benefits to their operations. Kaeser leads the industry in designing packages that include a complete scope of supply with motors, drives, valves, enclosures, controls, and instrumentation. Our Com-paK rotary blower packages and air compressor packages are engineered to simplify installation while ensuring proper integration, component compatibility, and equipment protection for many years of trouble-free performance.

Equipment on display will be:

- Com-paK Blower Packages
  - BB 52 C (170cfm @ 4.4psig, 10hp)
  - DB 166 C (550cfm @ 4.4 psig, 50hp)
  - CB 111 C (335cfm @ 4.4psig, 25hp)
- Air Compressor Package
  - SM 10 AirCenter™ (42 cfm @125 psig, 10hp)
- Aluminum Air Distribution System
  - SmartPipe (available in 6 sizes, from ½" to 6" diameter)

www.kaeser.com

WEFTEC® 2012 SHOW PREVIEW

FPZ, Inc. **(Booth 2762, Hall D)** FPZ, Inc. offers a full line of high performance regenerative/ side channel blowers with flows up to 1500 scfm and continuous pressure capacities over 10psig. These quiet, all-aluminum direct-drive oilless blowers are virtually maintenance free. We provide factory-direct pricing, a 3 year warranty and most models available from stock at our Wisconsin facility. Email: usa@fpz.com, www.fpz.com

Eurus Blower Inc. **(Booth 7223, Hall I)** Eurus Blower Inc. has manufactured reliable, high quality, economically produced PD blowers and packages for over 40 years. The blowers are available in Bi-lobed and Tri-lobed models providing flows up to 50,000 cfm, pressures up to 23 psig and vacuums to 15" hg. Email: tomh@eurusblower.com, www.eurusblower.com

Booth 2762, Hall D: FPZ Regenerative, Direct-Drive, Oil-less Blower

Booth 5628, Hall G, United Blower, Inc. High-Speed Turbo Blower

United Blower, Inc., **(Booth 5628, Hall G)** United Blower Inc. has provided the USA municipal market with the largest range and designs of top quality blowers for 25 years. UBI is an American company. Our systems are made in the USA. Our latest blower system is a high-speed oil less direct driven turbo blower of vastly superior design (when compared to any other turbo blower on the market today).

Booth 7223, Hall I: Eurus PD Blower

UBI will display the following equipment:

- High speed turbo blower system and cutaway
- Positive displacement (PD) blower system and sound enclosure
- Bare shaft PD blower

www.unitedblower.com

APG-Neuros **(Booth 7829, Hall I)** APG-Neuros offers efficient and affordable Direct Drive high-speed turbo blowers and aeration systems for municipal and industrial customers. With over 520 units installed and more than 130 currently on order, APG-Neuros offers the most proven product supported by a strong engineering and well established service networks spread across North America.

Its Award Winning High Speed Turbo Blowers are considered as the industry reference for high quality thanks to the use of the most advanced and proven air bearing, motor and

Booth 7829, Hall I: APG-Neuros High-Speed Turbo Blower

blower aeration control system technologies. Customer benefits include energy savings of up to 35%, elimination of heat rejection, vibration-free operation, noise reduction, smaller footprint, and lower installation costs

Booth 7239, Hall I: ABS Turbocompressor HST 40

compared to conventional products. APG-Neuros' turbo blowers can attain flow rates of up to 25,000 scfm, up to 15 psig design discharge pressure and can provide up to 76% flow turn-down with its innovative dual core models. www.apg-neuros.com

Sulzer/ABS (Booth 7239, Hall I) When Sulzer launched the premium-efficiency ABS submersible sewage pump XFP, it was only the starting shot of the ABS EFFEX Revolution. In the years since, they've introduced more products that raise the bar for energy savings, efficiency and reliability. Visit the booth to see the latest developments or visit www.ABSEffeX.com

ROBUSCHI (Booth 5813, Hall H) At WEFTEC you will have the chance to admire the latest Robuschi innovation for sewage waste treatment: ROBOX Screw Low Pressure. ROBOX Screw Low Pressure is a compressor unit that combines the ease of operation of a traditional lobe blower — like those used all over the world in waste water treatment plants — with the efficiency and extremely silent operation of the "oil free" RSW screw compressor. Thanks to its flexibility and ability to reach a pressure of 15 psig (1,000 mbar) (the range is up to 36 psig / 2,500 mbar) and a capacity of 6,400 cfm (10,500 m³/h), the compressor unit can adapt to clients' most complex needs. One of the main characteristics is extremely compact layout as well as its peculiar oil-bath lubrication system without the need for a mechanical oil pump. www.robuschiusa.com

To conclude, don't forget to visit the booth of Compressed Air Best Practices® Magazine **(Booth 2659 Hall D)** and to sign up your colleagues in the plastics industry for a FREE subscription to our monthly publication! BP

Booth 5813, Hall H: Robuschi ROBOX Screw Low Pressure

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TECHNOLOGY PICKS

New BOGE C 15 Screw Air Compressors

The BOGE screw compressors of the C series provide the successful answer to the trend towards greater efficiency and more flexible performance. Their advantages, for example the compact, service-friendly construction, the low noise level in operation or the optimal heat recovery ensure the sustained popularity of these compressors. They are particularly suitable for workshops and medium-sized factories which need a constant and reliable supply of compressed air.

The C 15 and C 15 D models with integrated dryer were added to the C series at the beginning of 2012, covering the complete spectrum from 11 to 22 kW. With the C 15 F and the C 15 FD, frequency regulated variants are also available on the market since the second quarter of 2012. Thanks to the variable frequency regulation, these models consume only the energy which is needed for the actual compressed air demand. In addition, the fan for the C 15 F is independent of the frequency regulation of the drive system and thus guarantees an optimal cooling airstream in every operational phase.

The C series offers many optimizations compared to the S series and replaces with immediate effect its models up to the class of 22 kW. For example the screw compressors are equipped with economical electro-motors of the "premium efficiency" class IE 3 which clearly reduce the electrical power consumption of the compressor station and thus improve the running costs. The C 15 models additionally offer a housing concept which allows for integration of a heat recovery system and a dryer. The compressor air end is seated on four rubber feet, reducing vibration and further reducing the noise in operation.

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Tel: +1 770 874-1570
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www.boge.com/us

Sullair Extends VSD Compressor Product Line

Maintaining its tradition of developing revolutionary products and energy efficiency technology, Sullair is pleased to introduce its new line of 230 Volt VSD S-energy® Lubricated Rotary Screw Air Compressors. Designed to meet the growing demand for variable speed drive energy efficiency in a 230V package, this expanded line of compressors now includes Models 1100e, 1500e, 1800e, 1800, 2200, 3000P, 3700 and 4500, all of which are now available with Variable Speed Drive. These models range from 15 to 60 horsepower, with capacities from 46.4 to 222 cfm and pressures ranging from 100 to 175 psig.

As energy costs continue to escalate — frequently representing as much as 82% of the total operating expense of a compressed air system — Sullair consistently responds with new equipment, technology and performance features that address significant fluctuations in air demand. Typical are the energy-saving features provided by Sullair Variable Speed Drive compressors by varying the speed of the drive motor to match rising and falling air demand. When a compressed air system operates at less than 100% load, variable speed drive allows the compressor to consume less electrical power than any other motor control method. By adapting speed to output, Sullair VSD compressors keep working at maximum efficiency. This is one of the most effective ways to minimize energy consumption and conserve costs.

Having the same footprint and performance characteristics as the 460V, the Sullair 230V VSD S-energy® Compressors are designed to help users significantly reduce operating and energy costs over the entire compressor life cycle. Contributing to these energy savings is Sullair's time-tested air-end design with low restriction inlet valve for superior cfm performance, the new low-pressure drop air-fluid separation system to prevent energy loss, and a high efficiency

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centrifugal cooling fan. The Sullair S-energy® compressor package also includes a variety of design features that simplify maintenance, improve reliability and extend service life.

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SKF Separator Filter Dryer System

The SKF Separator Filter Dryer (SFD) system introduces an ideal solution for removing water, contaminants, and oil vapor from compressed air and help realize improved pneumatic equipment performance, reduced need for maintenance, increased uptime, and higher productivity. The compact unit is engineered to dry compressed air for pneumatic applications directly from a compressor's reservoir tank or at a point of use, eliminating the need for most external filters.

This innovative technology can be applied to serve pneumatic applications in a wide range of industries; including cement and concrete, aggregates and mining, food and beverage processing, and others where an uninterrupted supply of clean, dry compressed air is critical.

The three-in-one SFD system incorporates a dual-cartridge design, which channels air flow through one desiccant cartridge, while regeneration occurs in the other. Standard units operate between 100-180 psi and will accommodate flow rates ranging from 20 to 800 cfm. The system can serve in high or low ambient temperatures and performs without the use of a refrigerant, a condensate drain line, or a heat exchanger to clean and maintain.

The SFD system is offered in three models: Micro Logic Timer (MLT), Programmable Logic Control (PLC), and Pneumatically Controlled (PC). All install easily on a wall or directly to a compressor's top plate for plugging into standard 120 VAC. Units can be serviced without disassembling or removing them from their mounting position. Custom solutions can be developed and tailored to specific application requests.

SKF SFD Program Manager
Contact Tom Mahoney
Tel: 847-742-0700
Email: Tom.J.Mahoney@skf.com
www.skfusa.com

Michell's New S8000 Chilled Mirror Hygrometer

Michell's new S8000 RS reference chilled mirror hygrometer has been designed to provide dependable measurements in a range of industrial applications where maximum gas dew-point temperature measurement precision is critical and ease of use is essential. It is the smallest and among the lightest instruments of its type on the market. The S8000 RS is capable of measuring dew points to -90 °C (0.1ppmv) with no need for additional, external cooling equipment. Combined with its ±0.1 °C dew-point accuracy and ±0.05 °C dew-point resolution across its measurement range, this also makes it the most cost-effective and convenient hygrometer in its class.

Chilled mirror hygrometers have excellent precision and repeatability because they base their measurements on the actual formation of condensed water or frost on a mirror surface. This is a primary characteristic of moisture so will not drift over time, as can occur with other methods.

The S8000 RS has a sophisticated new optical system that detects very small changes in moisture condensed on the mirror surface.

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This guarantees high sensitivity and fast response when measuring low-dew points. As with all Michell chilled mirror hygrometers, the S8000 RS is available with UKAS and NIST accreditation.

With a high-contrast LCD touch-screen, the S8000 RS is easy to operate and interrogate. USB or Ethernet connections are supplied as standard to enable remote operation and data logging via a PC or network. Robust overall design and practical features make the S8000 RS reference hygrometer a multi-purpose tool for a wide range of applications in an industrial environment as well as for calibration facilities.

Michell supplies high precision hygrometers and is among the largest dew-point sensors manufacturer globally. Their reference chilled mirror hygrometers, such as the S8000 RS, are constantly in use within their own factory for dew-point sensor manufacturing, and in their calibration facility and service center. Michell's customers benefit from the robustness and 40 years of expertise built into each chilled mirror hygrometer design.

Key applications for the S8000 RS include:

- Reference instrument for calibration laboratory. Compact, light and needing no additional cooling — it is ideal for in-house calibration laboratories
- Verifying the purity of industrial gases. Its fast response and high sensitivity enables quick measurements to be taken
- Ensuring the dryness of controlled industrial environments

Michell Instruments
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web: www.michell.com/us

Rexroth's Omega Module EasyHandling System

Rexroth's Omega Module linear motion system adds even more capability to the EasyHandling modular system

Feed units in machine tools, assembly lines and handling applications often require fast deep plunges into large workspaces. Combined with the increasingly fast cycle times of production machines, this places especially high demands on the axis mechanics in automated processes. Rexroth's new linear motion system, the "Omega Module", addresses this need by featuring a very low traveling mass so that top speeds can be reached. The belt drive is fixed to both ends of the main body and is looped around the drive shaft of the table part in the shape of the Greek letter "Ω", reducing the module's mass considerably compared to ball screw assemblies, thereby making it highly dynamic. By guiding the module's table part over ball rail systems, the module achieves a high degree of rigidity for precise movements.

The Omega Module linear motion system allows for higher dynamics over longer distances in feed units, thanks to the combination of its low traveling mass and fast belt drive. Because the drive is stationary, the linear system can be set up in any position in addition to being used as a vertical axis. A pneumatic clamping element maintains the position at standstill and also clamps hanging loads.

As a single axis system, the Omega Module comes with the necessary mechanical and electrical interfaces to fit with the modular Rexroth EasyHandling system. The system's standard Easy-2-Combine form-fit connection method can speed assembly and reduce up-front engineering time, even in multi-axis systems. In addition, it simplifies the direct attachment of pneumatic grippers and rotary modules, or other end-of-arm tooling.

One of the special features of EasyHandling is that it allows for fast start-up. With the EasyWizard commissioning tool, only a handful of axis-specific data needs to be entered, which helps to reduce start-up time to just a few minutes. As a single-axis system, the Omega Module is ideal for assembly and handling applications or in other automation tasks.

The Omega Module comes in three sizes to handle a variety of performance requirements. With a stationary main body, users can specify custom lengths up to 5,500 mm and choose from main bodies (frames) with widths of 55, 85 or 120 mm. This set-up allows for several carriages with their own drive to be operated independently from each other. Rexroth offers the linear motion system with

TECHNOLOGY PICKS

matching drives, motors and controllers. In the largest size, the mechanics are designed for input torques up to 154Nm. With high acceleration speeds of up to 50m/s² and speeds of up to 5m/s, it opens up the door for reduced cycle times even for longer movements.

To learn more, please visit www.boschrexroth-us.com or email info@boschrexroth-us.com

New Ingersoll Rand 5 hp and 7.5 hp Compressors

Ingersoll Rand is offering a newly improved single-phase control scheme for its 5 and 7.5 versions of the small UP6 5-15c line of air compressors. The UP6 single-phase compressors are versatile compressors, ideal for small manufacturing shops, vehicle services environments, paint booths and general industrial applications up to 28 cfm. With food grade coolant and cleanup equipment, these compressors are also ideal in small food and beverage applications. Ingersoll Rand has added a run-on timer and load/unload and blowdown solenoids to improve the reliability and performance of single-phase units in these applications.

A compressor that does not include an enhanced control scheme can easily be misapplied and fail in an environment where the compressor starts and stops too many times per hour. The Ingersoll Rand enhanced control scheme allows the compressor to operate unloaded with the motor continuing to run for the appropriate length of time, ensuring that the reliability and performance of the system is protected. "Having a compressor start and stop too many times an hour is not good for the machine, and increases the chance for motor capacitor failures," said Matthew Smith, Americas region commercial rotary product manager for Ingersoll Rand. "The enhanced control scheme on the Ingersoll Rand UP6 5 and 7.5 single-phase machines is designed to keep the motor continuously running for at least six minutes. This enables the system to protect itself from damage caused by inadvertent misapplication. It also increases the product's longevity, reliability and performance."

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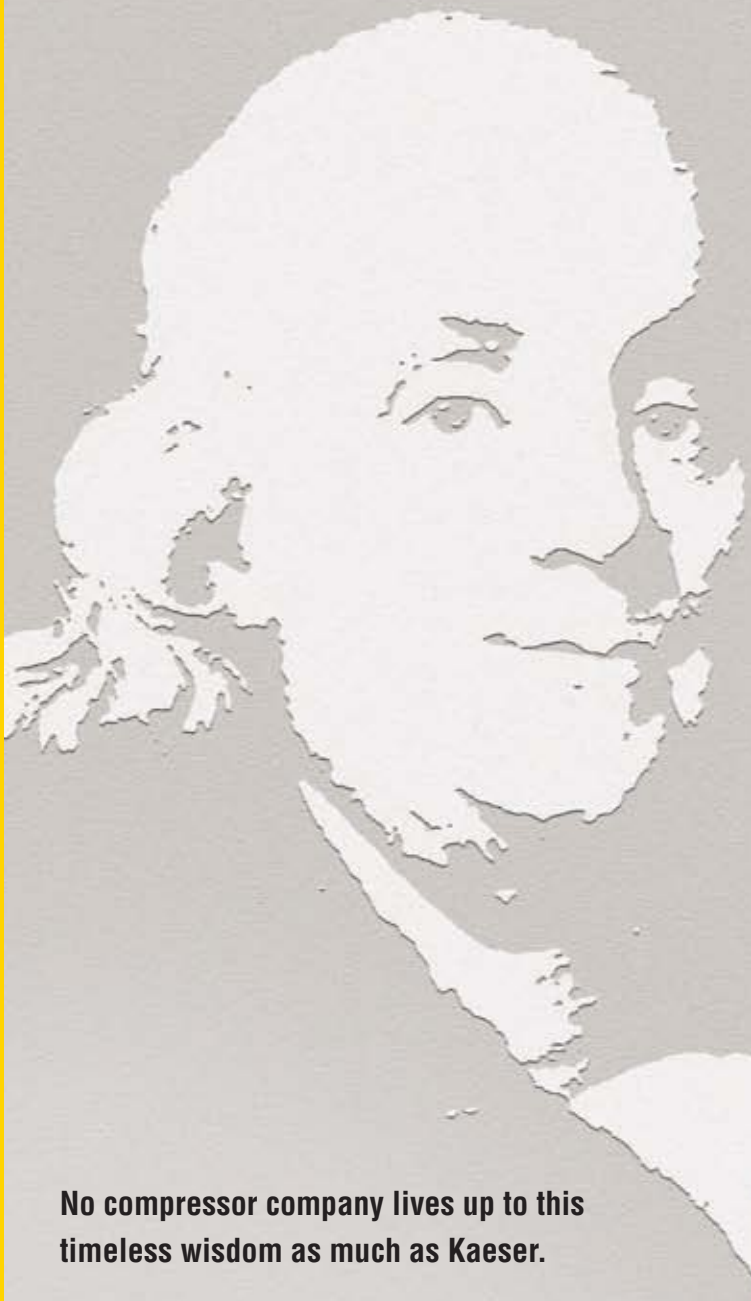

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