The Magazine for ENERGY EFFICIENCY in Blower and Vacuum Systems

BLOWER & VACUUM BEST PRACTICES

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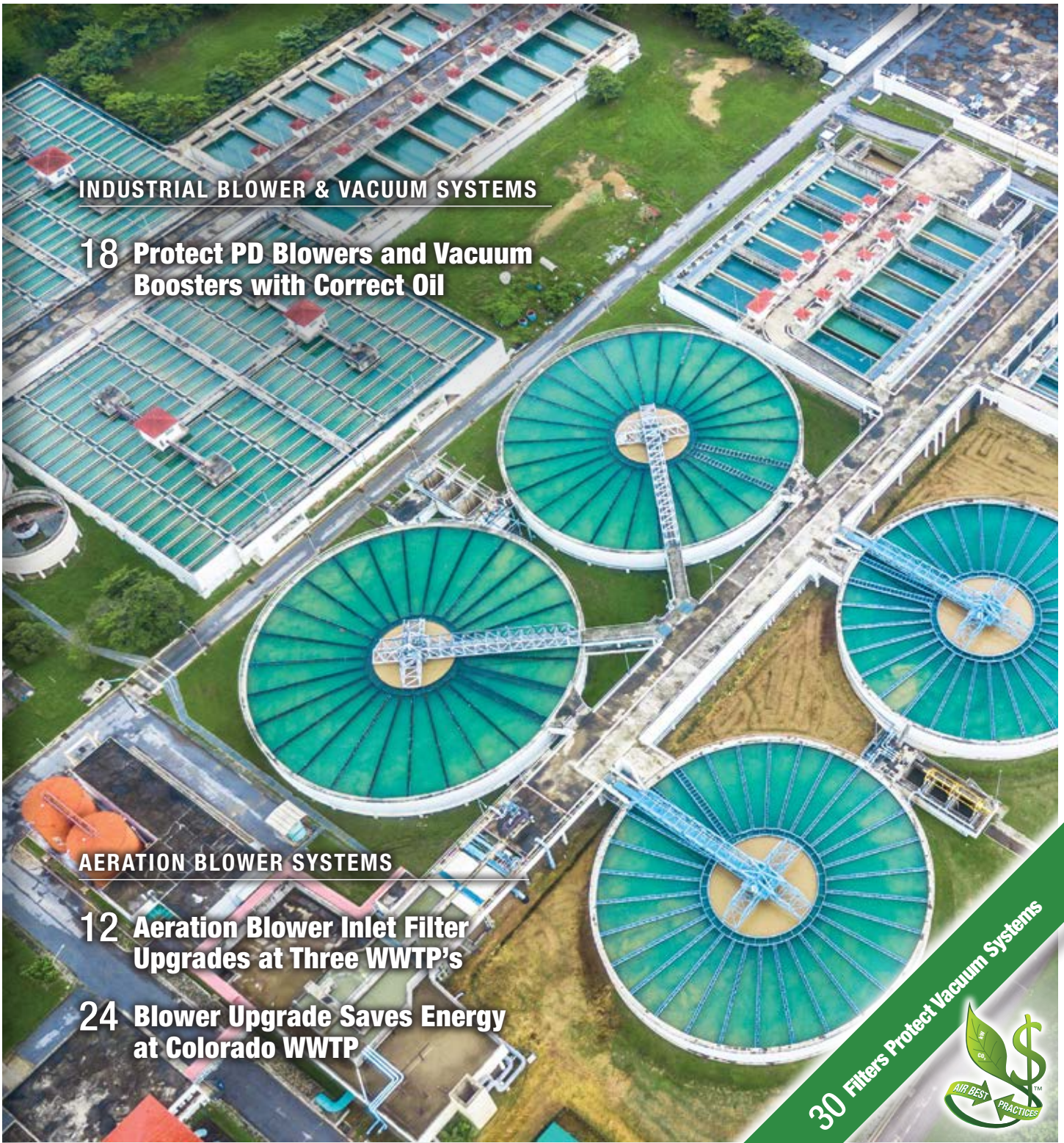
September 2020



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FEATURES

INDUSTRIAL BLOWER & VACUUM SYSTEMS

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COLUMNS

FROM THE EDITOR

Industrial Blower & Vacuum Systems

Bearings, seals and gears are the primary components requiring lubrication in positive displacement blowers and vacuum boosters. Brendan Pankratz, from Tuthill, has sent us a detailed article on how to specify the correct lubricants.

Solberg sends us an educational article discussing both vacuum pump inlet and exhaust filtration. Authors Clint Browning and Mike DeLisi write about how protecting vacuum pumps can increase productivity and help businesses reach their sustainability objectives.

Aeration Blower Systems

Our thanks go to Endustra for providing a very interesting article detailing how three different-sized wastewater treatment plants were able to save energy by upgrading the air intake filters on their aeration blowers. One of the WWTP's profiled is in Eugene, Oregon with an average daily flow of 34 MGD (million gallons per day) and a peak flow of 277 MGD.

Our own Mike Grennier strikes again with an aeration blower upgrade story set in the mountains of Colorado. The Fraser, Colorado WWTP supports the Winter Park ski resort and sees fluctuating flows from 0.5 to 1.5 MGD. New aeration turbocompressors were installed to handle these huge load fluctuations efficiently.

Best Practices 2020 ONLINE EVENT!

Please consider reserving portions of September 23-24, 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.

Track 1: Compressed Air Technology Fundamentals & Maintenance
Track 2: Compressed Air System Energy & Cooling Water Conservation
Track 3: Industrial Blower & Vacuum Fundamentals & System Optimization
Track 4: Aeration Blower Sizing & Specifications
Track 5: Chiller & Cooling Tower Fundamentals & Specifications

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

ROD SMITH
Editor, tel: 412-980-9901, rod@airbestpractices.com

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BLOWER & VACUUM SYSTEM TECHNOLOGY NEWS

Kaeser Redesigns Rotary Screw Vacuum Packages

Kaeser's new redesigned ASV, BSV, and CSV rotary screw vacuum packages offer capacities from 141 to 554 acfm at 99% vacuum. Featuring a completely new cabinet and air flow design, these 10-40 hp units offer exceptionally quiet operation in a compact footprint.

ASV, BSV and CSV models have wide-opening cabinet doors providing easy access to maintenance points. The full enclosure, TEFC motor, and gasketed doors with soundproofing make them a great central vacuum solution in high-dust environments. The new cooling air flow design features a dedicated cabinet fan and topside discharge for better oil cooling. Plus, it can be easily ducted to remove or recover waste heat while further reducing noise.

Kaeser's completely redesigned rotary screw vacuum packages are specifically designed for reliability, efficiency, and easy maintenance for central and dedicated vacuum systems in a wide range of applications.

Vacuum packages now feature premium efficiency IE3 drive motors which use less energy and have lower losses compared with conventional motors. The standard Sigma Control 2 controller provides detailed operating and maintenance status information. Its Ethernet and other communications ports enable remote monitoring with notifications of service interruption and upcoming maintenance reminders. Sensors continuously monitor temperature and pressure as well as oil pressure and level.

"This redesign has integrated superior component layout and service access with excellent airflow characteristics for better cooling, reliability, and noise reduction," said Product Manager Stephen Horne. "This product line has a solid performance history in a wide variety of applications including vacuum and thermoforming in packaging and plastics applications, hold-down for CNC routers (pod and spoiler board), a variety of evacuation/degassing operations, and even medical applications." ASV, BSV and CSV units are easily adapted to NFPA 99C compliant systems for use in hospital installations.

Kaeser redesigned vacuum packages offer reliability and efficiency.

About Kaeser Compressors, Inc.

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

BLOWER & VACUUM SYSTEM TECHNOLOGY NEWS

Sulzer Extends HST 30 Turbocompressor Range

Sulzer has extended its highly popular HST 30 range of turbocompressors with the addition of two new models. The HST 30-58-8 and HST 30-38-2 offer increased flow and pressure respectively for applications in the wastewater industry. Together with a new, larger motor, the HST 30 range offers a cost-effective, efficient, and reliable solution for aeration applications.

There are countless designs for aeration tanks and membrane bioreactors that each have their own requirements in terms of air supply. The size and depth of the tank will often define the specifications for the turbocompressor; traditional, shallower designs can utilize greater airflows while deeper tanks require high pressures of air.

For wastewater treatment plants aiming to upgrade their aeration facilities but retain shallower tanks, the HST 30-58-8 offers improved efficiency at lower pressures up to 75 kPa (10.5 psig) with an extended flow envelope up to 15'000 Nm3/h (9'400 SCFM). This model is also well-suited to the task of scouring membranes in membrane bioreactors (MBRs).

For some sites, both old and new-build, space constraints can mean that aeration tanks are deeper, with a smaller surface area. In these cases, the turbocompressor needs to deliver a higher pressure to ensure an efficient process. For these applications, the HST 30-38-2 offers increased operating pressures up to 130 kPa (18.9 psig); the flow is correspondingly lower at 10'000 Nm3/h (6'500 SCFM).

The HST 30 range has also benefitted from a new 350 kW (450 hp) electric motor which will be fitted to the top-of-the-range models. This offers greater flow rates and peak operating pressures with the HST

The HST 30 range offers a cost-effective, efficient, and reliable solution for aeration applications.

30-46 performance being boosted to 12'400 Nm3/h (7'900 SCFM). As with all of Sulzer's turbocompressors, the entire unit, including the electric motor and electronic controls are all designed and manufactured in-house.

Sulzer has an excellent reputation for reliability in turbocompressor applications, with many units having been in operation for over 20 years. As these, and other units, are considered for refurbishment or upgrading, the HST 30 series offers several benefits in terms of efficiency and performance as well as integration with the latest communications protocols.

About Sulzer

Sulzer is a global leader in fluid engineering. We specialize in pumping, agitation, mixing, separation, and application technologies for fluids of all types. Our customers benefit from our commitment to innovation, performance, and quality and from our responsive network of 180 world-class production facilities and service centers across the globe. Sulzer has been headquartered in Winterthur, Switzerland, since 1834. In 2019, our 16'500 employees delivered revenues of CHF 3.7 billion. Our shares are traded on the SIX Swiss Exchange. For more information, visit www.sulzer.com.

Leybold Expands Turbomolecular Pump Sizes

The vacuum specialist Leybold has expanded its TURBOVAC i/iX series – 90, 250, 350 and 450 – by the sizes 850 i/iX and 950 i/iX to six models. The two new turbomolecular pump variants are characterized by extended, trouble-free operation, longer system life and lower operating costs. They are used in many applications from research and development and analytics to industrial. In other words, especially where a clean and stable high- and ultrahigh vacuum is required – such as in coating, heat treatment, analysis, thin-film research, and helium recovery.

Basically, the new members of the TURBOVAC i/iX family provide significantly improved vacuum performance in a wide range of applications. Especially due to the expansion of the family in the direction of higher pumping speeds and compression values, lower service costs and simple, intuitive operation. In some applications, the integration of the new 850 i/iX and 950 i/iX models will even lead to a significant reduction in the number of pumps and thus in the total life cycle costs.

These options are also useful for another reason: Each vacuum application has different installation conditions. This requires flexible

BLOWER & VACUUM SYSTEM TECHNOLOGY NEWS

installation directions, for example when there is little space for vacuum pumps, as is the case when integrating them into compact, industrial pumping system solutions. Here too, the TURBOVAC i/iX series, with its various models and variants in terms of pumping speeds or compression ratios, is one of the most flexible systems on the market for high-vacuum products and can be mounted in any orientation.

Leybold has expanded its TURBOVAC i/iX series to six models.

Specially to promote sales in the industrial and coating market, EthernetIP, EtherCAT and Profinet Anybus options are now added to the existing Profibus, RS232 and RS485 communication modules. They are all available as IP54 versions. The EthernetIP, EtherCAT and Profinet modules have an integrated web server.

The entire TURBOVAC i/iX series can be controlled and monitored via the TURBO. CONTROL i. The advantage of the controller is that it is equally suitable for integration in high-vacuum applications and compact system solutions. Its application is uncomplicated.

It can be operated intuitively via the display and front keys or via a web server interface. The web server allows all pump parameters to be easily monitored and set via PC or mobile device.

Finally, the maintenance-free and oil-free hybrid bearing concept ensures greater reliability and a longer service life. On the high-vacuum side, the rotor of the turbomolecular pump is guided in a wear-free magnetic bearing, while a ceramic ball bearing lubricated for life is integrated on the backing side, which users can replace themselves on site if necessary.

About Leybold

Leybold is a part of the Atlas Copco's Vacuum Technique business area and offers a broad range of advanced vacuum solutions for use in manufacturing and analytical processes, as well as for research purposes. The core capabilities center on the development of application- and customer-specific systems for the creation of vacuums and extraction of processing gases. Fields of application are secondary metallurgy, heat treatment, automotive industry, coating technologies, solar and thin films such as displays, research & development, analytical instruments, food & packaging, as well as a multitude of other classic industrial processes. For more information: www.atlascopcogroup.com.

Hoffman Introduces NEW High-Speed Turbo Blower for Industrial and Municipal Wastewater Treatment

Hoffman introduced its new high-speed turbo blower for industrial and municipal wastewater treatment. The high-speed turbo blower delivers up to 40% energy savings and increased reliability with low maintenance requirements and comes factory pre-wired and tested in an ergonomically designed sound enclosure for plug-and-play operation.

With several designs ranging from 10 to 700 horsepower, Hoffman has a blower to fit your process needs and serve a wide range of applications. The HOFFMAN REVOLUTIONPLUS

Hoffman new high-speed turbo blower for industrial and municipal wastewater treatment.

sets the standard for new blower design, performance, and efficiency by combing an advanced blower management system with a significantly smaller physical footprint. 70% of aeration equipment lifecycle operating costs are dedicated to energy efficiency; thus, making our top priority to help our customers reduce their carbon footprint and energy consumption while improving operational efficiency.

Furthermore, the high-speed turbo blower consists of several structures and components for optimization. HOFFMAN high-speed turbo blowers have a compression unit equipped with a blowoff valve that releases air to protect the compression unit during start and stop, an inverter that controls the rotating speed of a high-speed motor through the change of frequencies, a PLC control unit that allows a user to actively operate the product depending on the field conditions and an enclosure that fixes all parts and prevents internal noise to the outside.

BLOWER & VACUUM SYSTEM TECHNOLOGY NEWS

For over 150 years, Hoffman & Lamson have been a global leader of engineered solutions and uphold a strong reputation for producing premier quality products efficiently and economically. For additional information on the new high-speed turbo blower, visit our website www.gardnerdenver.com/en-us /hoffmanlamson.com.

About Ingersoll Rand

Ingersoll Rand, driven by an entrepreneurial spirit and ownership mindset, is committed to helping make life better. We provide innovative and mission-critical industrial, energy, medical and specialty vehicle products, and services across 40+ respected brands, including Nash, designed to excel in even the most complex and harsh conditions where downtime is especially costly. Our employees connect to customers for life by delivering proven expertise, productivity, and efficiency improvements. For more information, visit www.IRCO.com.

Vacuum Pumps and Compressors Integrate with Becker AIRLINK

Modern production systems have a huge range of components whose unlimited availability is essential for optimum process control. However, it is not enough to monitor them using only condition monitoring methods and to generate a lot of data. It is better to use the manufacturer's know-how to analyze this data directly in the component and to provide the operator with relevant information via various communication levels. With AIRLINK this is to be achieved for the products of the Gebr. Becker GmbH in Wuppertal.

What is the current operating point of the compressor? What maintenance is required in which period and what spare parts are needed? If this information is available in real time, the total system operating efficiency (OEE) can be increased by optimizing the process sequences as well as condition-oriented maintenance and repair measures. For this purpose, AIRLINK is to permanently record and evaluate the operating states and conditions and make the relevant information permanently available via standardized reports for any platforms and clients, such as mobile devices, ERP systems or platform solutions.

AIRLINK opens the door to digital services in many ways. "Through the simple digital integration of a Becker pump into the machine, the control station, the company network or

AIRLINK provides operating data based on intelligent diagnostics and availability-based maintenance information.

a platform solution, it provides exactly the information our customers need for reliable operation," said Stefan Beierlein, Product Manager at Becker, describing the advantages of the new service.

About Gebr. Becker GmbH

Gebr. Becker GmbH is one of the world's leading manufacturers of efficient vacuum pumps, compressors, and air supply systems. These key components are developed for a variety of applications and industries, such as the packaging industry, additive manufacturing, the printing and paper industry, the wood industry, the electronics industry, or medical technology. With customized solutions and a wide range of services, Becker increases the efficiency of plants, ensures high availability and reduces maintenance costs. The family-owned company, with its headquarters in Wuppertal, is active worldwide with three production sites, 16 subsidiaries and over 50 agencies. Becker, with over 850 employees, stands for quality and is a preferred technology supplier and OEM partner. You will find additional information at www.becker-international.com.

AERATION BLOWER SYSTEMS

Three Different Sized Wastewater Treatment Plants SAVE ENERGY AND MAINTENANCE COSTS with Aeration Blower Inlet Filter Upgrades

By Rob Geyer and Joe DiFederico, Endustra Filter Manufacturers

Energy efficiency and energy consumption are common terms in today's wastewater treatment industry. Along with pumping, running blowers for aeration is the most energy consumptive part of the treatment process.

To reduce aeration energy costs, operators and engineers adopt better maintenance practices, consult with energy-use specialists, and quite commonly upgrade technologies and facilities. Among the most popular means of achieving better energy efficiencies is upgrading to modern or relatively new technologies like high-speed turbo blowers. However, many plants across the country find that upgrading aeration blowers isn't always feasible. New blowers can have price tags in the hundreds-of-thousands, not including the cost of engineering and construction. Often overlooked, however, is a simple means of significantly reducing energy consumption: upgrading blower intake filters.

Optimized intake filters can save thousands of dollars annually in energy savings and may not require construction crews, engineering bids, or grant applications. The benefits can

"Regardless of plant size – small, medium, or large – optimizing intake filters protects equipment and reduces energy consumption."

— Rob Geyer and Joe DiFederico, Endustra Filter Manufacturers

also be realized for treatment plants of all sizes. Described below are examples of three wastewater treatment plants that upgraded filters and came out ahead: a small rural operation with positive displacement (PD) blowers, a suburban plant using multi-stage blowers and a large urban plant that had already upgraded to airfoil bearing high-speed turbo blowers.

Small Plant Saves Thousands in Energy Annually

A wastewater treatment plant in the Midwest serves a population of just over 2,000. The plant uses PD blowers to aerate their activated sludge. While they meet their effluent requirements, they found their blowers were becoming expensive to run.

The installed PD blowers are not variable speed machines: they run at full power until dissolved oxygen (DO) requirements are met and are shut down pending demand. Using a throttle or control system to increase or decrease speed based on DO levels are not options. Near-constant machine operation leads to increased power consumption, and for small rural communities, expensive plant upgrades are not realistic options.

In 2017, the plant discussed blower filter options with Endustra Filter Manufacturers and installed Endustra Tri-Vent® Series intake filters and filter silencers on all nine of its PD blowers. The patented design of the Endustra filter reduces inlet restriction without compromising filter efficiency, allowing the plant's PD blowers to produce the required DO with less runtime. And while all blower intake filters act as silencers to an extent, filter silencers have a reactive chamber designed into the filter for baffling sound. Endustra filters and filter silencers incorporate conical cartridge filter elements with proprietary self-supporting synthetic filter media to protect against particulate ingress without excessive restriction of airflow. The elements can be used interchangeably with intake filters or

THREE DIFFERENT SIZED WASTEWATER TREATMENT PLANTS SAVE ENERGY AND MAINTENANCE COSTS WITH AERATION BLOWER INLET FILTER UPGRADES

intake filter silencers which provide additional noise suppression.

According to plant operators, reaching required DO levels took less time, about 15-25 minutes less per machine. Additionally, less blower runtime led to an approximate power savings of nine dollars per day, adding up to over $3,000 dollars a year, a significant amount of savings for a rural wastewater treatment operation, and more than the total cost of their investment. In addition, the filter elements have only needed to be replaced once, saving on maintenance.

An Endustra Tri-Vent® Series intake filter on a typical PD Blower.

Mid-size Plant Cuts Blower Power Consumption

The Wastewater Department of St. Charles, Illinois, serves approximately 35,000 residents. The department's two treatment plants and eight full-time employees maintain sixteen intermediate pumping stations and can process up to 20 million gallons of wastewater per day.

The single greatest expense of the department's West-side treatment plant was the power required to operate two multi-stage blowers. While not inefficient by design, multi-stage blowers will consume more power than necessary when improperly accessorized.

The general consensus among multi-stage blower engineers is that the most efficient way to regulate blower flow and pressure on multi-stage blowers is with inlet throttling. Multi-stage blower output is regulated via properly balanced throttle settings, and thus multi-stage machines are sensitive to inlet restriction. With excessive inlet air restriction, throttles must be adjusted, and blowers use more horsepower and more electricity. When high restrictions are maintained or final filter restrictions are reached too frequently, blowers more often reach maximum energy consumption for extended periods of time.

The treatment plant knew upgrading blower technology would reduce power consumption, but also realized upgrades require engineering, grant assistance, bond initiatives, and years of planning. In addition, the plant wanted to address maintenance and noise issues related to its existing blower filters.

Chris Rebone, at the time the St. Charles Wastewater Department Assistant manager, encountered challenges with servicing the filters, including issues with safety concerns. Servicing one of the filters required roof access and the other filter, being over 10-feet in the air, required ladders. They also required cleaning or changing almost monthly, and the higher-than-necessary inlet restriction caused excess motor heat, bearing wear, and constant power demands of more than fifty amps. Further, noise levels were elevated to the point that conversation in the blower room was impossible, and blower vibration was knocking the blower valves out of adjustment.

The St. Charles wastewater treatment plant reduced its energy costs and addressed safety and noise concerns by replacing the original blower inlet filter (left) for its multistage blowers with a new inlet filter silencer (right).

In early 2019, Rebone decided to replace existing blower inlet filters silencers on the two multi-stage blowers with Endustra intake filter silencers. After installation, the plant throttled the blower inlet valve to achieve optimal output pressures and power consumption decreased by 19 amps. As a result, it reduced initial blower power demand by 50%.

One filter silencer was mounted directly to the blower inlet, eliminating the need for roof access. The other was, a top-outlet filter-silencer that can be serviced without ladders or tools. Noise in the blower room decreased to levels that allowed conversation even at the filter inlet, and vibrations also decreased enough that the throttle didn't have to be regularly reset. To date, the filter elements have yet to be replaced, filter cleaning has been eliminated, and the filter silencer upgrade paid for itself via power savings in 114 days.

Large Plant Saves Thousands of Dollars Per Year in Maintenance and Energy

The wastewater treatment plant for the City of Eugene, Oregon, has an average daily flow of 34 million gallons per day (MGD) with a peak flow of 277 MGD. Aeration for the plant's secondary treatment process is provided by a number of multi-stage blowers and a recently acquired airfoil bearing high-speed turbo blower originally supplied with washable tuck-in polyester filter pads.

An advantage of high-speed turbo blowers like the one at the City of Eugene treatment plant is the potential for energy efficiency. However, these machines can be sensitive to dust ingress and filtration is crucial. Tight tolerances, high RPMs, exposed electronics, and carefully machined aluminum impellers are what make the blowers efficient yet they also make them sensitive to dust. Without optimized inlet filtration, wear on the machines can be accelerated.

At the City of Eugene's treatment plant, dust ingress on the high-speed turbo blower required vacuuming and scrubbing the blower enclosure. According to Jon Diller, City of Eugene Equipment/Pump Station Maintenance

THREE DIFFERENT SIZED WASTEWATER TREATMENT PLANTS SAVE ENERGY AND MAINTENANCE COSTS WITH AERATION BLOWER INLET FILTER UPGRADES

The City of Eugene installed an Endustra outlet manifold intake filter silencer at its wastewater treatment plant.

Supervisor, plant personnel changed and cleaned the filter pads monthly, and once a quarter, needed to open up the blower enclosure to vacuum and clean the machine interior with a solvent cleaner.

In addition to dust ingress, Diller said the cost of filter pads was mounting. A set of pads cost $1,300 and the plant was spending nearly $10,000 a year on replacements. The pads' inherent lack of dust-holding capacity led to excessive restriction alarms on a monthly basis. Unfortunately, the cost for maintenance eroded the benefit of the anticipated energy savings.

In 2017, the core on the blower failed due to dust ingress and needed to be replaced, which led to the plant installing a 24-inch outlet manifold intake filter silencer from Endustra Filter Manufacturers to better protect the blower. In total, it took the plant less than two days to install the filter and new piping needed for the upgrade.

With the new filter in place since 2019, the city has not needed to clean the blower enclosure and there have been no tripped alarms. Maintenance has also been simplified because changing the filter element does not require ladders, manlifts, or even tools. In addition, the plant experienced unanticipated power savings due to the optimized filter's lower restriction. Based on the positive results of the high-speed turbo blower filter upgrade, the plant began the process of upgrading filters on its remaining blowers.

Scalable and Cost-Effective Solution

Regardless of plant size – small, medium, or large – optimizing intake filters protects equipment and reduces energy consumption. Whether it's an on-or-off PD blower, a throttle controlled multi-stage centrifugal blower, or an energy-efficient variable high-speed turbo blower, best-practice inlet filtration keeps wastewater treatment plants operating efficiently while reducing costs. Upgrading intake filters is a scalable, cost-effective plant upgrade. BP

About the Authors

Rob Geyer, Business Developer, has over a decade of manufacturing experience in Endustra Filters Manufacturers production facility in Schererville, Indiana. Email: Rob.geyer@endustra.com. Joe DiFederico, Outside Sales Representative at Endustra Filters Manufacturers, has worked to improve blower intake filtration for more than 150 installations across the Midwest. E-mail: Joe@endustra.com.

Endustra Filter Manufacturers would like to thank Chris Rebone of the St. Charles Wastewater Treatment Plant and Jon Diller of the City of Eugene Wastewater Division for their contributions to this article.

About Endustra Filters Manufacturers

Endustra Filter Manufacturers, Inc., a family-owned company in Schererville, Indiana, designs and manufacturers Tri-Vent® Intake Filters and Filter Silencers that not only protect equipment but reduce power consumption enough for a first-year payback. Endustra has been in operation for over 50 years and has helped installations all over the country protect their investments and save thousands of dollars in energy costs. Learn more at www.endustra.com.

All photos courtesy of Endustra Filters.

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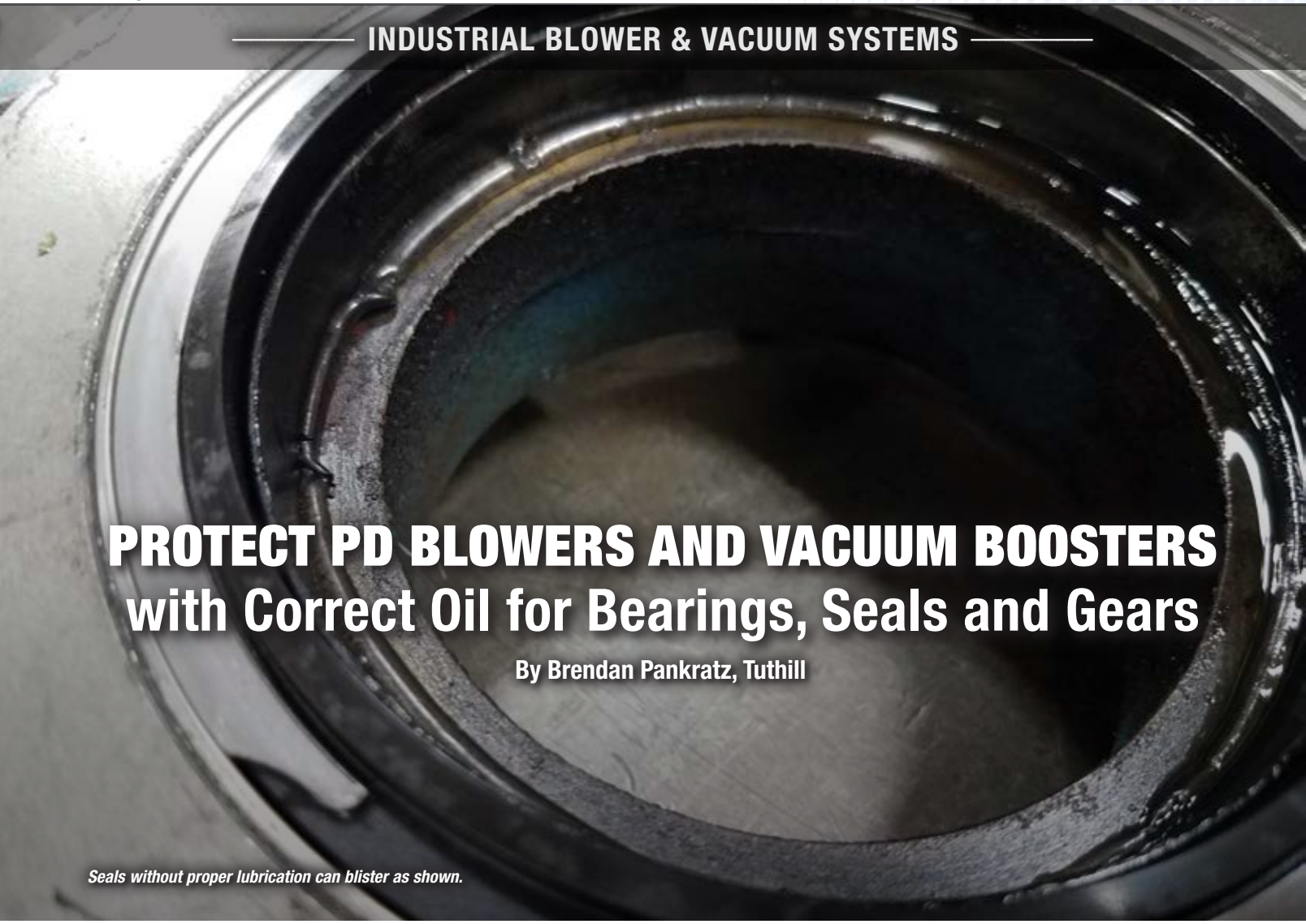

PROTECT PD BLOWERS AND VACUUM BOOSTERS with Correct Oil for Bearings, Seals and Gears

By Brendan Pankratz, Tuthill

Seals without proper lubrication can blister as shown.

When selecting the right oil for Positive Displacement (PD) blowers or vacuum boosters, it's important to consider the three primary components the oil is formulated to protect: bearings, seals and gears. Oftentimes, the best option for one of these is not the same as the best option for the others, so a choice needs to be made for the most critical component, while also accounting for the secondary ones.

Failure to use the correctly specified oil for bearings, seals and gears often results in reduced performance, higher operating temperatures, unexpected maintenance, and catastrophic failure. All of these affect the bottom dollar and production. Also important to remember is that while ambient air temperature has some effect on the overall temperature of the blower, the unit's gears, seals, and bearings are first and foremost concerned with what is occurring inside of the oil sumps, not outside.

The oil temperature, speed, shaft diameter, gear size, and bearing type are of primary importance, and overlooking these parameters in specifying the proper oil is an oversimplification that may result in

"Failure to use the correctly specified oil for bearings, seals and gears often results in reduced performance, higher operating temperatures, unexpected maintenance, and catastrophic failure."

— Brendan Pankratz, Tuthill

machine damage and a foreshortened operating life. Here's a review of these critical components and what to know to help specify oil for these components to help ensure peak performance and machine longevity.

The Vital Role of Bearings, Seals and Gears

Let's first discuss bearings. The differential pressure, rotor weight, belt tension, and helical gear loads are all fully supported by the bearings. They have a big job to perform and must perform at full speed for months or years without failing. Additionally, roller and ball type bearings are often a considerable source of wear due to the metals and heat. Correct oil specification is critical for protecting these key components from metal-to-metal contact, high temperatures, sludge build-up, corrosion, and chemical outbreak. When specifying the oil formulation for bearings it's important to balancing various factors such as bearing type, speed, size, and loading characteristics.

Seals, meanwhile, perform a crucial function in providing a barrier between the oil in the sumps and the process gas and ambient air. Unlike bearings, which experience mostly rolling friction, lip and mechanical face seals endure perpetual sliding and the resistance and heat generation that accompany it. It is critical that the specified oil is properly suited to provide the adequate film strength and cooling capacity under load and at the necessary operating temperature and speed. Improperly lubricated seals blister, crack, and can even leak.

Perhaps the most critical components considered when determining the proper oil for a positive displacement rotary lobe blower are the gears. Some manufacturers use hardened, matched helical gearsets for higher load capacity, longer life, ease of timing adjustment, and quieter operation. This style of gear requires special consideration because of the relative sliding that occurs between meshing teeth. The oil must be equipped to handle the accelerated thermal breakdown occurring in localized hot spots which are created by the immense pressure at the points of contact. Viscosity must remain sufficient at the operating temperature in order to maintain a proper film thickness between sliding faces. Improper gear lubrication leads to abrasive and fatigue wear, loss of timing, increased wear metals, and catastrophic failure.

Factors Impacting Oil Temperatures

While blower speed, shaft diameter, gear size, and bearing type are all known with certainty after sizing a blower or booster for an application, bulk oil temperature tends to be a bit more elusive. In an existing installation, this can be measured relatively easily but it may be difficult to predict for new applications. Several factors play a role in pushing the bulk oil temperature one direction or another:

- Inlet and discharge temperatures.
- Cooling methodology.
- Ambient conditions.
- Blower speed.
- Geometry and mass.

The dominant drivers of oil temperature in positive displacement blowers are inlet and discharge gas temperature. With regards to the inlet, a cooler incoming gas produces a notable convective cooling effect. The compression of the process gas produces tremendous heat which is then transferred through the housing and end plates and into the oil sumps where it is absorbed. The discharge temperature is directly dependent on the amount of compression across the machine

All oils wear out, creating the potential for sludge buildup.

PROTECT PD BLOWERS AND VACUUM BOOSTERS WITH CORRECT OIL FOR BEARINGS, SEALS AND GEARS

which is a function of shaft speed and the amount of restriction downstream. The combination of the two phenomena plays a large role in the bulk oil temperature at steady state.

The introduction of an external cooling source also drastically impacts the bulk oil temperature by its flow rate, temperature, and thermodynamic properties. This includes oil-cooling options for PD blowers and vacuum boosters, such as cooling coils used with splash submerged in the oil sumps or external heat exchangers.

NUMBER OF PARTICLES/ML		
Lower Limit	Upper Limit	ISO Code
80,000	160,000	24
40,000	80,000	23
20,000	40,000	22
10,000	20,000	21
5,000	10,000	20
2,500	5,000	19
1,300	2,500	18
640	1,300	17
320	640	16
160	320	15
80	160	14
40	80	13
20	40	12
10	20	11
5	10	10
2.5	5	9
1.3	2.5	8

Table 1: ISO cleanliness codes.

Naturally, convective cooling occurs on the exterior of the machine at all times. Ambient temperature, relative humidity, and wind conditions all play a role in the amount of heat carried away via convective cooling. Colder air, higher relative humidity, and higher wind speed all work to cool the machine more effectively. Additional consideration must be given to the ambient temperature at startup.

Another factor influencing oil temperature is when blower speed varies while constant differential pressure remains constant. This is likely due to one of two trends. The first is a consequence of the convective cooling produced by the gas flowing through the inside of the machine. Faster, more turbulent flow removes heat more effectively than slower, more laminar flow. The second is simply a function of friction heating in the oil. The rate of the oil between rubbing surfaces like gear teeth or seal faces affects the amount of frictional heat generated in the oil, and consequently the oil temperature. A higher blower speed equates to more frictional heating. These two opposing trends compete with each other so the outcome may be unique for each model and application.

The last driver of oil temperature, and perhaps the most difficult one to predict, has to do with machine geometry, mass distribution, and thermal mass properties. The presence or absence of ribs or cooling features, surface roughness, machine shape, materials of construction, and overall bulkiness all contribute to or diminish heat transfer out of the pumping chamber and into the oil and ambient air.

Lubricant Delivery Systems

There are two common types of blower and vacuum booster lubrication systems: splash lubrication and integral, or forced, lubrication methods.

Splash lubrication utilizes the gears and an oil slinger to distribute oil by centrifuge to all critical locations inside the machine. If the blower speed is varied, the amount of oil delivered to the critical components will also vary proportionally. Submerged oil cooling coils are an important option available with splash lubricated models in high-temperature applications.

Integral lubrication systems distribute the oil to key locations using an onboard positive displacement pump and an oil line distribution network. It also features an oil filter and heat exchanger (shell-and-tube type or cooling coils). For larger blowers and vacuum boosters, the oil

sump volume is substantial and distributing adequate lubricant to all of the critical components using splash lubrication becomes challenging, especially in applications where the machine speed is varied to match the changing demand conditions. Forced lubrication allows for greater accuracy in delivering lubricant to critical components such as bearings, gears, and seals, even at varying speeds. For this reason, integral lubrication is recommended for large blowers and vacuum boosters, especially above the five-inch gear size.

Factors Influencing Useful Oil Life

All oils eventually wear out and lose their effectiveness over time. The rate at which this occurs can be influenced by many factors including application and operating conditions.

Being comprised of a mixture of short and long hydrocarbon chains of varying purity and quality, mineral oils in API groups I through III will eventually break down. The tendency for these molecules to interact with oxygen and form more stable compounds is relatively high and the presence of oxygen, acids, water, or other catalysts increase this rate of degradation. The byproducts of this process are organic acids, varnish deposits, and sludge buildup on the components in the oil sumps.

Similarly, heat plays a large role by increasing the rate at which chemical reactions can occur. This rate is governed by a generally accepted rule known as the Arrhenius equation, named for the Swedish chemist Svante Arrhenius. This formula demonstrates the temperature dependence of chemical reaction rates. For mineral oils, the general rule states the useful life of the oil halves for every 18 degrees above 160°F.

One indication of oxidative breakdown is a change in the Total Acid Number, or TAN. TAN represents the number of milligrams of potassium hydroxide (KOH) needed to fully neutralize one gram of oil to a pH of 7.0. Since no blower experiences ideal conditions, monitoring changes in the oil's TAN can be helpful for determining the end of the oil's useful life due to oxidation. It is important to emphasize that new oils may

PROTECT PD BLOWERS AND VACUUM BOOSTERS WITH CORRECT OIL FOR BEARINGS, SEALS AND GEARS

PARTICLE COUNT		
"Size in Microns (µm)"	Number of Particles Larger than Size (per mL)	ISO Code
4	1422	18
6	284	15
10	108	
14	31	12
20	8	
50	2.1	
75	0.15	
100	0.03	

Table 2: Sample particle count.

begin their life with a TAN above zero and that the change in the TAN is important to track. Significant changes in TAN indicates a substantial chemical change or contamination has occurred, and the base oil and additive package have been broken down to an ineffective level.

Contamination of any kind can prompt a notable change in the tribological, chemical, and thermodynamic properties of any oil. For example, dissolved water content of just 0.1% (1,000 ppm) can reduce the bearing life by up to 80%. In some cases, the presence of water can accelerate the oxidation rate of the oil by up to 10 times, resulting in acid generation, corrosion, and additive mortality. If the water content increases beyond the temperature dependent saturation level, additional water can no longer be dissolved and will become emulsified, or suspended, in the oil. A cloudy appearance and a significant viscosity change are the results of emulsified oil.

Other contamination, such as that from the processed gasses or from wear metals, can also pose a significant threat to the critical components of the machine. If this type of contamination is unavoidable and significant, a magnetic drain plug and an onboard or stand-alone oil filtration system should be considered. The International Organization for Standardization (ISO) provides guidelines for fluid cleanliness in ISO 4406:99 by setting targets for the maximum number of particles per mL in the size ranges of 4 µm or larger, 6 µm or larger, and 14 µm or larger. (See Table 1.)

The target fluid cleanliness rating for oil used to lubricate gears is 17/15/12. This means it should contain fewer than or equal to 1,300 particles per mL (code 17) larger than 4 µm, fewer than or equal to 320 particles per mL (code 15) larger than 6 µm, and fewer than or equal to 40 particles per mL (code 12) larger than 14 µm. Table 2 shows an example particle count for a used oil sample with an ISO rating of 18/15/12.

Oil Sampling Program Recommended

Given the uniqueness of each real-life scenario, it is impossible to accurately predict oil life without firsthand application experience. The oil may become contaminated or wet long before it has reached an unacceptable level of oxidation. It may become diluted with condensable process fumes and lose its viscosity long before it becomes contaminated with particulates or wear metals. Therefore, a regular oil monitoring or sampling program is always recommended to stay ahead of changes in the oil's condition so problems can be addressed before they lead to catastrophic failure and expensive downtime. BP

About the Author

Brendan Pankratz is an Application Engineer with the Applications Engineering Group at Tuthill Vacuum & Blower Systems. For more information, email: springfield@tuthill.com, tel: 800-825-6937.

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BLOWER UPGRADE SAVES FRASER COLORADO Wastewater Treatment Plant Energy Costs

By Mike Grennier, Blower & Vacuum Best Practices Magazine

The Upper Fraser Valley Wastewater Treatment Plant, Colorado, is located near Winter Park Ski Resort at an elevation of 8,574 feet. The ski season requires the plant to process nearly triple the amount of wastewater versus the off-ski season. (Photo courtesy of Upper Fraser Valley Wastewater Treatment Plant.)

If there's a way for the Upper Fraser Valley Wastewater Treatment Plant in Fraser, Colorado, to do things better, improvements are made. If something needs to be fixed, it gets fixed.

That's because the Town of Fraser and the Joint Facilities Oversight Committee that oversees the treatment plant take pride in ongoing efforts to cost-effectively process wastewater to high environmental standards. It's also because Plant Manager Joe Fuqua manages the plant with care – and a can-do mindset.

When the plant's original aeration blowers became costly to operate and newer technology offered the promise of energy-savings, Fuqua took decisive action and replaced the older blowers with high-speed turbo blowers. As a result, the plant saves ratepayers approximately $30,000 per year in energy costs and bolsters the plant's ability to maintain uptime and achieve extremely clean effluent.

Plant Loads Triple with Ski Season

Located in the heart of the Colorado Rockies at an elevation of 8,574 feet, the Fraser treatment plant is permitted as an activated sludge facility with a hydraulic design capacity of 2.0 Million Gallons Per Day (MGD).

"We're always looking at ways to save energy costs and protect the environment, whether it's new blowers or a project we have underway for an even higher level of treatment for metals and phosphorous."

— Joe Fuqua, Plant Manager, Upper Fraser Valley Wastewater Treatment Plant

Sulzer HST turbocompressors provide aeration to the Fraser wastewater treatment plant's aeration basins and digester tanks. (Photo courtesy of Sulzer Pump Solutions, Inc.)

The plant, which was built in 2003, is located near Winter Park Resort. The resort ranks as one of the most popular ski destinations in Colorado, especially during weekends since it's located approximately 90 miles from Denver.

When ski season isn't in full swing, the plant normally treats approximately 0.6 MGD of wastewater when measured over a 30-day period. However, things change considerably for the plant during the ski season when the local population climbs from approximately 2,000 people to as many as 20,000 people. The increase in population calls for the plant to operate at high capacity without fail. The plant typically sees a major increase in loads on weekends during the ski season, said Fuqua.

"Our flows on Thursdays are usually around one-half million gallons, but by Friday night during the peak season we're at 1.5 million gallons. That puts a premium on the reliability and efficiency of the plant, including machinery like aeration blowers," Fuqua said.

Dual Wastewater Treatment Processes

To treat wastewater, the Fraser plant uses pre-treatment, nitrification in dual activated sludge basins with clariflocculators followed by ultraviolet disinfection. The plant is one of only a few in the United States that uses a combination of re-air, anoxic and standard aeration zones for nitrogen and ammonia removal.

The plant is designed with two identical wastewater treatment trains, each of which is used to process approximately one MGD. The plant normally operates one train from mid-July until early November when it then activates the second train to handle the increased loads as the population begins to swell in advance of the peak ski season.

BLOWER UPGRADE SAVES FRASER COLORADO WASTEWATER TREATMENT PLANT ENERGY COSTS

Primary systems at the plant include the pretreatment operation with a grit removal system, which then feeds into separate anoxic basins for denitrification. From there, sewage flows onward to two separate aeration basins with fine-bubble diffusers and secondary clarifiers before effluent is discharged to the Fraser River. Waste Activated Sludge (WAS) is pumped from the clarifiers to two separate aerobic digesters. The WAS is then pumped to the plant's drying and solids handling operation, which leverages a centrifuge for Class B solids for use as fertilizer.

Originally, the plant was designed to use two, 150 horsepower (hp) centrifugal aeration blowers to feed air to the aeration basins on each wastewater processing train. Each centrifugal blower is rated to provide to 2,500 scfm at seven psi. The plant was also originally equipped with three 125 hp Positive Displacement (PD) blowers to supply air to the digester with one blower serving each process train and the third unit serving as a standby machine. Each PD blower is rated to provide 1,200 scfm at 11 psi.

After being named plant manager Fuqua placed aeration and blowers on his list of priorities, knowing the plant could save energy and improve a number of maintenance-related issues with upgrades.

Tackling Multiple Aeration Blower Issues

Early on, Fuqua decided to focus on the centrifugal blowers used on the aeration basins. The blowers were a relatively easy target for energy savings, he said.

"The two original centrifugal blowers were oversized for the loads and flow for most of the year," Fuqua said. "I basically had a setup that provided more air than I needed."

To better match blowers to the aeration basins – and save energy costs – the plant installed a 60 hp centrifugal blower rated to deliver up to 800 scfm at seven psi. The blower supplied ample air for aeration during the off-peak season when the plant experienced relatively low flows. When the ski season kicked in, the plant's SCADA system would shut down the 60 hp blower and activate the two 150 hp blowers to meet the need for more air due to increased flows. The strategy allowed the plant to save energy costs while promoting the growth of microorganisms to breakdown waste in addition to maintaining targeted Dissolved Oxygen (DO) levels.

Fuqua said operating the 150 hp blowers for short periods during peak load conditions, however, still proved costly.

"When we had peak loads coming in, the 150 hp blowers would cycle on quite a number of times," Fuqua said, adding that the larger centrifugal blowers would operate as much as 30% of the time during the ski season. As such, electric utility demand charges began to add up.

"We're billed on a demand charge so every time one of those 150 hp centrifugal units would cycle on it bumped up our costs for electrical power, which is one main reason why we began to look at other options for aeration blowers."

Another reason to evaluate blowers was the need to address noise levels created by the PD blowers used for the digesters, which would waste as much as 20,000 gallons of water a day during peak season. Given the noise issue, Fuqua opted to only run the blowers from 6 pm until 7 am when no plant operators were normally at the facility. Hearing protection was essential for operators anytime they needed to be at the plant during those same hours.

By installing Sulzer HST turbocompressors, Fraser wastewater treatment plant reduced its annual energy costs by 10%. (Photo courtesy of the Upper Fraser Valley Wastewater Treatment Plant.)

Fuqua, a trained mechanic, also wanted to replace older model blowers with newer technology to bolster the reliability of the aeration blower system.

"During peak loads, the centrifugal blowers would cycle on and off so much the system couldn't keep up and they'd throw a fault, or we'd get an alarm at 2 am because our ammonia levels were starting to get high," he said. "Those types of issues made it imperative to look at newer blowers."

A main concern related to reliability with any new blowers, he said, was the ability to withstand the dry, dusty environment.

"We have very low humidity here and the air is super dry. That means we get a lot of fine dust that can be hard on blowers and other equipment," Fuqua said. "That's something I wanted to ensure we dealt with as far as new blowers."

Upgrade Features Two High-speed Turbo Compressors

After evaluating blower technologies, the Fraser wastewater treatment plant chose to upgrade its blower system with two Sulzer HST™ 20 turbocompressors to provide aeration for the plant at low pressure. The plant also reconfigured the aeration piping to allow the new blowers to provide air to both the aeration basins and digesters as needed – meaning the plant can meet its aeration goals with far fewer blowers.

Installed in fall 2018, each 200 hp turbocompressor delivers 2,100 to 2,550 scfm at pressures ranging from 7.2 to 10.7 psi. Each blower also offers a turndown ratio of 50%. The new blowers, which were installed in the same blower room as the original blowers, replaced one 150 hp centrifugal blower and one 125 hp PD blower.

Today, the plant typically operates only one turbocompressor throughout the year, regardless of load fluctuations and including the first full peak winter ski season. The remaining blowers serve as standby machines.

BLOWER UPGRADE SAVES FRASER COLORADO WASTEWATER TREATMENT PLANT ENERGY COSTS

Shown from left to right are Logan Wray and Joe Fuqua of the Upper Fraser Valley Wastewater Treatment Plant. (Photo courtesy of Sulzer Pump Solutions, Inc.)

"Now, I can run the one turbocompressor and supply air to the aeration basins or the digesters, depending on water depths and the DO level," Fuqua said. "If the digesters are full, I run air to the digesters and shave off air to the aeration basins. If the digesters are somewhat empty, I supply more air to the aeration basins. I'll alternate the two turbocompressors based on current conditions, but I'm only running one blower at a time to supply air to everything. I've haven't had to turn the other blowers on in a year."

The HST turbocompressors use magnetic bearings instead of air bearings. When the machine is powered, a single shaft that functions as the motor's rotor is lifted and levitated by balanced magnetic forces. There is no contact between rotating and static components of the machine, which appeals to Fuqua.

"With the fine dust we have, I was more inclined to choose machines with magnetic bearings since they never touch," he said, adding how a single blower has allowed the plant to keep pace with the plant's demand for air and greatly diminished the need for operators to address warning alarms.

"During the peak season before the installation of the new blowers, we were probably getting three alarms a week. I don't think we've had three alarms in the last nine months," Fuqua said.

The HST turbocompressor also operate quietly since each machine is rated to keep noise to 70 dBA when fully operational. It's a marked difference from the old machines, allowing the team to forget worries about working in a noisy environment, Fuqua said.

"I never envisioned that things could be as quiet at this plant as they are now," he said.

Project Nets Annual Energy Savings of $30,000

While improved reliability and less noise were top priorities for the aeration blower upgrade project, Fuqua said energy savings drove the decision to upgrade to new blowers. Toward that end, he said the project was a success.

"We're always looking at ways to save energy costs and protect the environment, whether it's new blowers or a project we have underway for an even higher level of treatment for metals and phosphorous," he said.

Since the upgrade, the treatment plant has reduced energy costs by approximately 10%. With the new blowers in place the plant saves approximately $2,500 per month, which equates to an energy savings of $30,000 per year.

"The main reason we went with the project was because of the potential energy savings and the hope that we would save that much," Fuqua said. "It's the green thing to do."

Looking back, Fuqua said the biggest challenge to the project was to talk his two plant operators into taking on the blower upgrade installation with little outside help – which was especially important since the plant is in a remote location.

"I had no doubt in my mind we could do it. It was just a matter of convincing my team, Logan Wray and Zach Sawatzky, we could do it," he said, adding the project achieved every goal.

"I'm tickled to death," Fuqua said. "It worked out better than I expected." BP

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Protecting Your Equipment, PROTECTING YOUR ENVIRONMENT

By Clint Browning and Mike DeLisi, Solberg Manufacturing

In a world increasingly reliant on vacuum technology, the consequences of not protecting a vacuum system or its surrounding environment can be costly. For decades, vacuum pumps have enabled new technologies and processes to evolve in rapidly advancing industries such as food processing, pharmaceuticals, electronics, solar, semiconductor, and many more. These processes generate various contaminants that can cause catastrophic vacuum pump failure when ingested. Furthermore, toxic process contaminants must not be exhausted into the surrounding atmosphere due to health and safety concerns. When operating a vacuum system, careful consideration to inlet and exhaust filtration is critical in protecting both your equipment and your environment.

"Working with vacuum filtration experts in the early stages of design and specification will save money and prevent countless future hours of frustration for engineers and operators."

— Clint Browning and Mike DeLisi, Solberg Manufacturing

In this article, we discuss both vacuum pump inlet and exhaust filtration and explore how protecting your vacuum pump can increase productivity and help businesses reach their sustainability objectives.

Vacuum Technology and Filtration

A vacuum pump is used to pull air from a process or closed system and will frequently encounter contamination from the process. As the pump pulls air out of the system, it exhausts that same volume of air to atmosphere. Vacuum principles show that as process vacuum level increases, mass flow through the pump decreases.

Process flow rate, vacuum level, temperature, and vapor pressure, all interact to pose a tremendous challenge when developing vacuum filtration solutions. Vacuum level can also affect the physical properties of a contaminant such as boiling point. A change in boiling point can cause a phase transition from liquid to vapor further increasing complexity with the filtration and separation selection process. Understanding the critical interactions between all variables is essential to the success or failure of a filter or separator.

There are two competing priorities when designing an effective vacuum system. The first is adequately protecting the vacuum pump from the process. The second is optimizing system performance over an extended time period. When designing a vacuum system, filtration should be at the forefront of the design process so field issues can be minimized. Properly identifying the contaminant type and load up front ensures the proper filtration technology is deployed. This is critical to ensuring system optimization.

Vacuum Pump Inlet Filtration

Vacuum filtration and separation is an art just as much as it is a science. The concept of filtration and separation is quite simple: remove any contaminant from an air or gas flow before the contaminant can enter a piece of equipment. However, contaminant removal becomes extremely complex when vacuum conditions and multiple process variables exist.

Ultimately, the purpose of an inlet vacuum filter is to protect the pump from the process. A typical particulate filter consists of a media, like paper, that air must pass through to be cleaned. Many types of particulate removal media exist, all of which have varying micron ratings and removal rate efficiencies. They have different physical and chemical properties which make them suitable for different operating conditions

Vacuum pump filtration is key to protecting an operation's equipment and environment.

and applications. Paper, polyester, polypropylene, HEPA, ULPA, and PTFE are commonly used filtration medias. Other media types can include adsorbents such as activated carbon and activated alumina or coalescing medias which usually contain fiberglass and are proprietary in nature.

It is worth restating that many vacuum processes are extremely complex. Involving a trained filtration expert early in the design and specification process can prevent costly mistakes caused by "self-selecting" a standard filtration product for a complex vacuum application.

Types of Contaminants

Anything other than clean air entering the inlet of a vacuum pump or exiting the exhaust can be harmful. There are three primary contaminant types that require meticulous review as each can react very differently under vacuum conditions.

Particulate is the most common contaminant that can damage a vacuum pump. Particulates can be abrasive and come in many solid forms with the most common being powder, dust, sand, or large mass. Most

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particulates are non-reactive and a standard vacuum filter is suitable for these applications. However, there are applications, such as chemical vapor deposition, metallurgy, and silicon crystal growing in which particles can be dangerously reactive if exposed to oxygen or other reactive agents. Under these circumstances, adding a standard vacuum inlet filter to the system may not offer the appropriate protection for the equipment or employees. When volatile particulates are present, specialty medias and features like oxidation ports, collection tanks, and specialty filtration media are necessary to ensure adequate protection for vacuum systems and the workers that interact with the equipment.

This bank of Solberg ST style particulate filters protects vacuum pumps from dust and flakes produced during a consumer goods packaging process

The Solberg SRS Liquid Removal System protects a vacuum pump from ingesting liquids in a vacuum drying application.

Liquid can be much more difficult to stop from entering a vacuum pump as it can be present in a variety of forms: slugs, droplets, or aerosols. (Not a vapor.) Effective liquid removal systems include different mechanisms such as baffles, demister pads, and low velocity expansion chambers, to effectively separate the liquids in these different forms. If a vacuum pump ingests enough liquid from a process, it will essentially flood the pump causing a catastrophic failure very quickly. Liquid contaminants include water, solvents, oils and various chemicals. Applications with extremely high volumes of liquids require constant maintenance of the liquid removal filter. In these circumstances, an automatic draining system can be integrated with the filter to minimize maintenance and maximize production runtime.

Vapor is the most elusive and difficult to capture of the three contaminants. As a process begins to operate at deeper vacuum conditions, liquids will transition into a vapor phase. To avoid ingestion by the pump, this vapor must be condensed back into a liquid state so there is a better chance of recovery. In order to condense vapors, a significant temperature reduction Delta (ΔT) must be introduced so vapor can transition back to a liquid state. The required ΔT is based on a liquid's vapor pressure and system's dew point. Effective separation can be accomplished by using multi-stage vapor condensing and filtration technology which provides "cold" surfaces for condensing to occur. For trace amounts of vapors coming from a process, adsorbent technologies can be deployed as effective alternatives to condensing technologies.

Vacuum Pump Exhaust Filtration

For complete optimization of a vacuum system to occur, the exhaust side of the vacuum pump must also be addressed up front to minimize field issues.

The purpose of an exhaust filter is to protect the environment from the equipment. Properly addressing contaminants at the inlet of the vacuum pump is the best strategy for minimizing issues at the discharge. However, there are applications that require additional care with

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The JRS vapor condenser protects a vacuum pump from ingesting vapors given off during a plastics production process.

discharge air quality such as food preparation/packaging, medical vacuum systems, electronics manufacturing and research facilities. These applications may require multiple stages of filtration to meet strict air quality requirements for the work environment.

An OEM's wet technology vacuum pump package will generally offer adequate performance for light- to medium-duty applications that have low levels of oil carry over and odor. However, environments with zero tolerance for these issues, such as laboratories and hospitals, will need high-performance oil coalescing filters to keep the environment significantly cleaner and odor free.

Other instances where additional exhaust filtration would be appropriate include oil-sealed pump technologies with frequent cycling to atmosphere or pumps that run at higher temperatures. Under these circumstances, piping configuration and placement of the oil mist exhaust filter can have a significant impact on the vacuum system's performance. Again, involving a trained filtration expert early in the design and specification process can prevent costly mistakes.

A Complete System

As innovative industries continue using vacuum technology to grow and evolve, reliable and complete vacuum systems are essential for continued success and sustainability. Filtration is often an afterthought, and when there is a problem, an emergency fix can be costly and stressful for those involved.

A vacuum pump system is incomplete without the proper filtration and separation protection. When considering all the process variables and potential filtration options, properly protecting a vacuum pump can be a challenge. Working with vacuum filtration experts in the early stages of design and specification will save money and prevent countless future hours of frustration for engineers and operators. Not only will the proper filtration and separation solution help users save on maintenance costs and energy consumption, it can help improve worker safety and morale with consistent process up-time and higher quality outputs. Whether protecting the pump or protecting the environment, implementing the right filtration and separation technologies will complete the system. BP

About the Authors

Clint Browning is Vice President of Sales & Marketing, Solberg Manufacturing, and Mike DeLisi is responsible for Vacuum Technology for the company. With their combined filtration experience of more than 35 years, they have helped some of the largest companies around the world select the right filtration and separation solutions. Contact Clint, or Mike at tel: 630-616-4400.

About Solberg Manufacturing

With a global team of dedicated filtration and separation professionals, Solberg Manufacturing designs and manufactures high quality filtration solutions for most industrial market segments. Solberg's products can be found protecting critical machinery, including vacuum pumps, blowers, fans, compressors, and engines in some of the most challenging environments. For more information, visit www.solbergmfg.com.

All photos courtesy of Solberg Manufacturing.

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BLOWER & VACUUM SYSTEM INDUSTRY NEWS

Pfeiffer Vacuum Celebrates 130 Years of Setting Vacuum Standards

Pfeiffer Vacuum has been setting standards in vacuum technology for 130 years. Science and industry have benefited equally from the numerous innovations developed and successfully brought to the market by Pfeiffer Vacuum. The best example of this is the turbomolecular pump, which was developed by the company in 1958 and has been indispensable in the market ever since. Thanks to its expertise, Pfeiffer Vacuum is still a world market and technology leader in this field.

Pfeiffer Vacuum has been characterized by its pioneering spirit and passion from the very beginning. When Arthur Pfeiffer founded the company in Wetzlar, Germany, in 1890, he initially devoted his attention to the production of remote ignition systems for gas lamps. Once electric light bulbs had established themselves on the market, the company founder quickly turned his attention to the new lighting technology that led him to look at the vacuum technology used in its production. Arthur Pfeiffer quickly recognized the significance that vacuum technology could have in practically all areas of industry and research – and he subsequently concentrated entirely in the vacuum field. Since then, Pfeiffer Vacuum has played a pivotal role in shaping vacuum technology.

Pfeiffer Vacuum Headquarters in Asslar, Germany.

Today, Pfeiffer Vacuum products still stand for high-tech solutions with excellent reliability and efficient performance. Customers such as the Max Planck Institute, CERN (the European Organization for Nuclear Research), XFEL (The European X-Ray Free-Electron Laser Facility) and EADS (European Aeronautic Defense and Space Company) are proof of this reliability – vacuum pumps made by the Asslar, Germany-based manufacturer are even in use in the ISS (International Space Station). There, as in many other applications, the customer's requirements are often very complex – not only with regard to the vacuum requirement itself, but also to the specifics of the system in question, the materials and products used or to be processed, and the process conditions. The focus at Pfeiffer Vacuum is always on quality. This is why vacuum solutions from Pfeiffer Vacuum undergo continuous optimization in close cooperation with customers from various industries and by means of ongoing development work. In this way, the optimal solution can be found.

Automotive components, smartphones, pacemakers, textiles – vacuum technology is used for all these products. Pfeiffer Vacuum solutions also play an important role in food production and in the pharmaceutical industry. Without them, it would not be possible, for example, to freeze-dry products such as instant coffee or powdered milk under vacuum.

As a leading supplier of vacuum technology, the company offers a comprehensive product portfolio: from individual components to complex vacuum systems. 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.

Products and solutions from Pfeiffer Vacuum are developed for the fields of analytics, industry, research and development, coating systems and semiconductors and are optimized for the specific application.

Dr. Eric Taberlet, Chief Executive Officer of Pfeiffer Vacuum Technology AG said "With our durable products and customized vacuum solutions, we are able to satisfy practically every customer requirement and to establish relationships that will endure for years to come. At Pfeiffer Vacuum, 'sustainability' is not just an empty word. We are aware of our responsibility. And this is why, at all our locations around the world, we establish the necessary conditions to make sure that our staff enjoy working for Pfeiffer Vacuum. We are socially committed, because we want to give something back, and we produce our products in the most energy-efficient and environmentally-compatible manner possible. We have been living and breathing sustainability – by tradition – for 130 years."

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 3,200 people and has more than 20 sales and service companies as well as eight manufacturing sites worldwide. For more information please visit www.pfeiffer-vacuum.com.

BLOWER & VACUUM SYSTEM INDUSTRY NEWS

Tuthill Corporation Announces New President

Tuthill Corporation has announced Tony Thill as President of Tuthill Springfield, Missouri. Thill is a senior executive leader with over thirty years of experience with industrial manufacturing companies. He will lead Tuthill's commercial and operational strategies for Kinney® vacuum pump and M-D Pneumatics industrial blower product lines.

Thill will bring well-rounded leadership experience for Tuthill Springfield's global sales strategy, product development, and channel development efforts. His manufacturing leadership experience blends well with Tuthill's Continuous Improvement spirit and Conscious Company team development. Thill's experience will guide market share growth, lean manufacturing advancement, and support Tuthill's enterprise-wide digital expansion and realization.

Thill graduated from the University of Kansas with a B.S. in Business Administration and completed the Executive MBA program. He has served on several Board of Directors including a current position with The NOVA Center, Inc. providing services for individuals with developmental disabilities. Thill also possesses several United States patents.

Tony Thill, President of Tuthill Springfield.

"I look forward to seeing Tony's passion and energy lead the Springfield team," said Steve Westfall, Tuthill Corporation Chief Executive Officer. "He not only has the strategic capabilities to move and lead this business forward, he also has the ability to create relationships with his team and organization. I am honored to have Tony join the leadership team of Tuthill."

About Tuthill Corporation

Tuthill Corporation is a privately held manufacturer of industrial goods specializing in rotating equipment. Founded in 1892, James B. Tuthill originally manufactured common brick to Chicago construction companies. Today, Tuthill manufactures fuel and chemical transfer pumps and meters at Tuthill Fort Wayne and Tuthill Lenexa; vacuum pumps and positive displacement blowers and systems at Tuthill Springfield; lubrication, magnetically coupled and process pumps at Tuthill Alsip; and custom injection-molded plastics at Tuthill Clearwater. Tuthill serves markets including agriculture, construction, chemical, food and beverage, energy, pharmaceuticals and medical, and transportation. For more information, visit www.tuthill.com.

New Sulzer Turbocompressors Boost Efficiency at WWTP

Sulzer engineers helped a plant in the Netherlands cut its energy costs with a turnkey project. Sulzer's HST turbocompressors were specifically designed for the water industry's need for high volume, low pressure air to feed aeration tanks. Four of the company's first-generation HST 2500 machines have been doing that job for almost two decades at the Deventer wastewater treatment plant in the Netherlands. Now the plant's owners have worked with Sulzer engineers to upgrade its existing units with three latest generation machines.

In 2001, the Deventer wastewater treatment plant in Overijssel, Netherlands, was the first in the country to install HST turbocompressors, using four 83 kW HST 2500 machines to run its large-scale aeration and denitrification systems. In 2018, the plant's owners asked Sulzer to make proposals for refurbishment of the installation to make use of the latest developments in compressor technology.

Working with the plant team, Sulzer specialists investigated several possible options, including overhauling the existing machines and upgrading them with new control electronics. Their calculations suggested, however, that replacing the existing compressors with three new generation HST 20 machines would result in energy efficiency improvements of around seven percent, a saving that would more than compensate for cost of the new machines. Under its circular economy principles, Sulzer would also buy back, refurbish, and resell the original machines, keeping waste to a minimum.

The compressor replacement was delivered by Sulzer as a turnkey project, with the company's engineers carrying out the design, installation, commissioning and testing of the compressors, pipework, and control systems. As well as

reducing the number of compressors on the site from four to three, the new pipework allowed the air inlet for the system to be moved from the roof of the building – where it had suffered from water ingress – to a filter box assembly outside at ground level. Cooling air for the compressor motors is drawn from the same inlet source, then vented into the plant room in winter and outside during the summer months.

Rated at 150 kW, the new HST 20 compressors are around twice as powerful as the units they replace. Lucas Vrijdag, Product Manager, Benelux for Sulzer, said "Our team configured the system so that in normal operating conditions the compressors run at approximately 50% of their top speed, the point of maximum efficiency. Rather than keeping one compressor as a standby unit, all three act as duty machines. If any maintenance is required on a unit, the other two have sufficient capacity to run the process."

At the heart of the new process control system are six high capacity valves which precisely control the air flow rate into the plant's aeration tanks. The system relies on accurate flow measurement, an important consideration for the Sulzer team responsible for the pipework design. To achieve this, long straight lengths of pipe run upstream of the valves to ensure the airflow passing through the flowmeters is stable, thereby improving accuracy.

The PLC, controlling the compressors, continually monitors pressure in the header pipe feeding the control valves, then instructs the units to adjust their speed to maintain optimum pressure in the system as demand changes. The control systems are fully integrated with the plant's existing SCADA system.

In any upgrade project involving critical infrastructure, speed is of the essence. The Deventer plant brought in temporary, hired compressors to keep its systems running while the Sulzer team managed the removal of the original compressors and the installation and commissioning of the new units. The whole process was completed on schedule in just over three weeks, and the new system performed as required from the point of handover to the customer.

The HST 20 compressors have now been in continuous operation at the plant for more than a year. In that time, they have reduced energy consumption by 200'000 kWh saving more than EUR 20'000 per year. "Our previous HST turbocompressors have served us smoothly for over 17 years. We have no doubt the new HST 20's will perform as well, but with even lower energy costs. Sulzer did a great job in supporting us during the preliminary phase, at the construction works and with aftercare," said Jim Cramer, Specialist Mechanical Engineering at Water Board Drents Overijsselse Delta.

About Sulzer

Sulzer is a global leader in fluid engineering. We specialize in pumping, agitation, mixing, separation, and application technologies for fluids of all types. Our customers benefit from our commitment to innovation, performance, and quality and from our responsive network of 180 world-class production facilities and service centers across the globe. Sulzer has been headquartered in Winterthur, Switzerland, since 1834. In 2019, our 16,500 employees delivered revenues of CHF 3.7 billion. Our shares are traded on the SIX Swiss Exchange. For more information, visit www.sulzer.com.

The new installation of three HST 20 units.

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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

Brown and Caldwell Hires Seasoned Industrial Water Expert

Leading environmental engineering and construction firm Brown and Caldwell announced Dr. Randall Watts has joined the company as industrial water senior process engineer. Having spent his 24-year career until now at Merck, Dr. Watts brings an impressive background of specialized water and wastewater experience in the pharmaceutical manufacturing industry. He has served as technical lead on numerous high-profile projects to improve treatment system performance – including the treatment of endocrine-disrupting compounds and other active pharmaceutical ingredients and constituents – at production facilities in multiple countries. His expertise covers water supply and sustainability, wastewater process design, wastewater system optimization, field and pilot study design and coordination, system start-up and operational support, and operational efficiency.

As a key addition to Brown and Caldwell's Industrial Water Group, Dr. Watts will be responsible for developing and implementing tailored solutions to the chemical and pharmaceutical industry's most complex water and wastewater challenges. He will lead process engineering and design on projects encompassing water use reduction, water and wastewater treatment and reuse, active pharmaceutical ingredient management, nutrient removal, smart utilities, and systems operation and optimization.

"I am delighted to welcome Randall to our team of industrial water experts," said Brown and Caldwell Director of Industrial Water Si Givens. "His deep knowledge of chemical and pharmaceutical manufacturing and water and wastewater treatment in these industries will provide our clients with heightened technical knowledge, rigor, innovation, and responsiveness, translating to the development of unique and robust solutions that provide long-term value." Based in Philadelphia, Watts has a doctorate and a master's in environmental engineering and a bachelor's in chemical engineering from the University of Florida.

Dr. Randall Watts, Industrial Water Senior Process Engineer, Brown and Caldwell.

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About Brown and Caldwell

Headquartered in Walnut Creek, Calif., Brown and Caldwell is a full-service environmental engineering and construction firm with 52 offices and 1,700+ professionals across North America and the Pacific. For more than 70 years, our creative solutions have helped municipalities, private industry, and government agencies successfully overcome their most challenging water and environmental obstacles. As an employee-owned company, Brown and Caldwell is passionate about exceeding our clients' expectations and making a difference for our employees, our communities, and our environment. For more information, visit www.brownandcaldwell.com.

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Advertising / Editorial — Rod Smith, rod@airbestpractices.com, Tel: 412-980-9901

Subscriptions Administration — Patricia Smith, patricia@airbestpractices.com, Tel: 412-980-9902

A Publication of — Smith Onandia Communications LLC, 37 McMurray Rd. Suite 106, Pittsburgh, PA 15241

Blower & Vacuum Best Practices is published quarterly and mailed together with Compressed Air Best Practices®. Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 106, Pittsburgh, PA 15241. Periodicals postage paid at Pittsburgh, PA and additional mailing offices. POSTMASTER: Send address changes to: Compressed Air Best Practices®, 37 McMurray Rd, Suite 106, Pittsburgh, PA 15241.

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