

BLOWER & VACUUM BEST PRACTICES

blowervacuumbestpractices.com

May 2026

Reliability & Efficiency

AERATION BLOWER SYSTEMS

**6 East Peoria WWTP's
\$68 Million Upgrade**

INDUSTRIAL VACUUM & BLOWER SYSTEMS

**9 Designing Efficient Vacuum
Processes**
11 Vacuum System Filtration and ROI

AERATION BLOWER SYSTEMS

6 East Peoria WWTP Modernizes Aeration System

By Troy Dreier, Blower & Vacuum
Best Practices Magazine



INDUSTRIAL VACUUM & BLOWER SYSTEMS

9 Designing Vacuum Processes for Greater Efficiency

By Meike Strasheim, Pfeiffer Vacuum+Fab Solutions

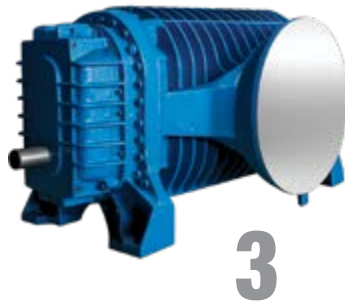
11 The ROI of Proper Filtration

By Bella Alfaro and Rich Ricciardi, Solberg
Manufacturing

EVERY ISSUE

3 Blower & Vacuum Industry & Technology News

15 Advertiser Index



Cover Image: An aeration basin in East Peoria, IL. Image courtesy of the City of East Peoria.

NEWS / Blower & Vacuum Industry & Technology

Busch Vacuum Solutions Opens Arizona Service Center

Busch Vacuum Solutions celebrated the grand opening of its newest U.S. facility: a nearly 60,000-square-foot Arizona Service Center located in Tempe. The event marked a major milestone in the ongoing expansion of Busch across North America and underscored the company's commitment to innovation, customer service and regional growth.

“This investment represents more than just added square footage – it is about proximity, partnership and performance,” said Turgay Ozan, President and CEO, Busch Group USA. “With our new Tempe Service Center, we are strengthening our ability to deliver world-class service, faster turnaround times and technical expertise that our customers depend on. We are excited to deepen our roots in the Southwest and support the region's growing industrial and semiconductor ecosystem.”



Busch Group USA cut the ribbon on a new 60,000-square-foot service center located in Tempe, AZ.

Mayor Corey Woods said, “We are thrilled to officially welcome Busch Vacuum Solutions to Tempe. Their investment in this facility highlights the strength of Arizona's semiconductor ecosystem and reflects the collaborative, forward-thinking spirit that defines our city. The new Arizona Service Center will create high-skilled jobs, strengthen local partnerships and ensure Tempe remains a hub for advanced manufacturing and technology.”

The new Tempe facility serves as a regional hub specializing in the repair, service and overhaul of vacuum pumps, vacuum systems and overpressure equipment – including turbomolecular vacuum pumps, leak detectors, valves and accessories – from all major brands. The expansion enhances the company's ability to provide flexible, responsive and expert service to customers across the semiconductor, industrial, medical and environmental sectors throughout the U.S.

With more than 8,000 employees worldwide and over 1,200 in the United States, Busch continues to grow its network of facilities to support mission-critical operations across diverse industries. For more information, visit <https://www.buschvacuum.com>.



AERZEN
EXPECT PERFORMANCE

Efficient by Nature Sustainable by Design It's in our DNA.

AERZEN offers BABA compliant blowers, as well as controls that are designed, programmed, manufactured, and supported in the USA.

BABA Compliance
reviewed by the EPA



LET'S TALK

+1 610-380-0244
www.aerzen.com/baba_blowers

NEWS **Blower & Vacuum Industry & Technology**

Atlas Copco Group Acquires US Vacuum and Leak Testing Company

LACO Technologies, a designer and manufacturer of vacuum solutions and leak testing systems, will become part of Atlas Copco Group.

LACO is based in Salt Lake City, UT, and manufactures comprehensive vacuum solutions, vacuum chambers and advanced leak detection equipment designed for aerospace, research and development and diverse industrial applications. The company has 110 employees who will join Atlas Copco Group as part of the acquisition.

“LACO was founded in 1975 as a family business and has exhibited strong growth by becoming a trusted partner through the quality of its products and dedication of its people,” said Koen Lauwers, Business Area President, Vacuum Technique. “This acquisition further enhances our expertise in leak detection while adding a U.S.-based manufacturer of turnkey leak detection and vacuum systems to our portfolio.”

The purchase price is not disclosed. During 2025, the company had revenues of approximately 25 MUSD (247 MSEK*). The acquisition is subject to regulatory approval and is expected to close during the second quarter of 2026. The company will become part of the Scientific Vacuum division within the Vacuum Technique Business Area. For more information, visit <https://www.atlascopcogroup.com>.

*Average exchange rate in 2025

Pfeiffer Vacuum+Fab Solutions Introduces UltiDry Multi-Stage Roots Vacuum Pumps

Pfeiffer Vacuum+Fab Solutions launched the UltiDry multi-stage roots vacuum pumps. Designed for demanding semiconductor applications, the UltiDry combines robust performance with efficiency and flexibility.

UltiDry vacuum pumps are engineered to withstand corrosive gases, aggressive by-products and heavy powder loads. Their oil-free, multi-stage compression ensures clean, dry vacuum generation without contamination, making them ideal for processes such as chemical vapor deposition, atomic layer deposition and physical vapor deposition.

One of the key innovations in the UltiDry is its patented purge injection system, developed to protect the vacuum pump by flushing out contaminants like powder. This feature ensures stable performance and smooth operation, even in powder-intensive processes.

Sulzer Launches Global Water Treatment Center of Excellence

Sulzer has launched a global Center of Excellence (CoE) for Water Treatment Solutions. The CoE consolidates Sulzer’s wastewater treatment expertise in a unified and global manner. This enables municipalities and essential industries to execute their projects more easily and efficiently and set up their operational processes reliably, sustainably and in compliance with regulations.

The CoE brings together Sulzer’s expertise in wastewater treatment and combines state-of-the-art engineering competence, in-depth process knowledge and a comprehensive technology portfolio.

By consolidating the strengths of Sulzer’s brands, including Nordic Water, FRC Systems, IPEC, JWC Screens, Owatec and Probig, Sulzer has created a powerful, end-to-end offering minimizing complexity, reducing risk and optimizing lifecycle costs.

The CoE serves as a global competence center for technology development, solution design and knowledge transfer, ensuring the highest quality worldwide. Customers benefit from tailor-made solutions from a single source, aligned with their individual process requirements. The combination of centralized engineering and regional implementation teams accelerates projects and delivers reliable, predictable results.

In addition, the CoE drives innovation in tackling new challenges, including the removal of micropollutants such as PFAS (forever chemicals), and provides solutions for water reuse.

“The Center of Excellence is a cornerstone of our strategy to lead in water treatment solutions,” said Mathias Pruessing, Division President, Flow, Sulzer. “Our customers seek simplicity, reliability and sustainability. With the new Center of Excellence, Sulzer is uniquely positioned to deliver all three – helping communities and industries secure water for generations to come.” For more information, visit <https://www.sulzer.com>.

With its optimized multi-stage roots design, the UltiDry offers energy savings of up to 87% compared to other vacuum pumps in its class.



UltiDry multi-stage roots vacuum pump. Source: Pfeiffer Vacuum+Fab Solutions.

The vacuum pump operates reliably across a wide thermal range from 122°F (50°C) to 518°F (270°C), adapting flexibly to different process requirements. This makes it equally suitable for temperature-sensitive coating processes as well as corrosive semiconductor applications. By maintaining stable operation over varying temperature conditions, the UltiDry supports consistent product quality and long service intervals. The combination of a corrosion-resistant coating, reduced purge gas usage and high energy efficiency makes the UltiDry a durable, low-maintenance solution for demanding manufacturing environments. For more information, visit <https://www.pfeiffervacuum.com>.

Eurus Blower Introduces ZAS20 Heavy-duty, Large Rotary Blower Series to North America

Eurus Blower announced the introduction of the ZAS20 blower series to the North American market. These blowers are used in a wide range of applications.

The Eurus ZAS20 series is a modern, heavy-duty blower. Its impellers are made with ductile iron (60,000 psi tensile strength) and statically/dynamically balanced to industry standards for long-term durability. The shafts have alloy steel forgings and are flange-mounted with high-tensile cap screws. The blower's double-row spherical roller bearings support the shaft assemblies and control impeller axial position. The cylinder and headplates feature precision-machined grey iron with cast ribs for strength and heat dissipation and support horizontal or vertical flow.

This series uses a standard energy-saving splash lubrication system or an optional positive-pressure lubrication system. It includes a


gearbox oil sump, oil filter and cooler, pressure gauge, relief valve and low oil pressure safety switch. It has optional special materials such as the 304/316 stainless steel or ductile alloys for enhanced corrosion resistance.



Eurus ZAS20 series rotary blower


The Eurus ZAS20 series flow range is up to 42,276 cfm, max delta pressure is 15 psi (1 bar), max delta vacuum is 15" Hg, max rpm is 980 and minimum rpm is 730.

“This exciting ZAS20 Series blower offers our customers a greater selection of high-quality blowers. The ZAS product introduction complements recent ZCS824 Vacuum Truck Blower, ZDL Bulk Truck Blower, EBox Factory Standard Packages, ISB Series Screw Blower, VR Series (steam blower) product introductions and growing success with our multistage centrifugal product. Eurus Blower’s customer service focus is unmatched in the North American market as we continue meeting customer needs,” Roger Blanton, General Manager, Eurus Blower. For more information, visit <https://eurusblower.com>.



THE
POWER
OF INDUSTRIAL
VACUUM

ENGINEERED
VACUUM
SOLUTIONS
FOR
DEMANDING
INDUSTRIES



NES[®]

COMPANY

Liquid Rings • Dry Claw • Dry Screw • Rotary Vane • Rotary Air Locks • Engineered Systems

NESCO.MY.COM

East Peoria WWTP Modernizes Aeration System

By Troy Dreier, Senior Editor, Blower & Vacuum Best Practices Magazine



► In 2019, the City of East Peoria, IL, began a comprehensive modernization of its wastewater infrastructure, including a \$68 million upgrade covering two operating facilities, Wastewater Treatment Plant No. 1 and Wastewater Treatment Plant No. 3. The project addressed aging equipment, regulatory pressure and the need for improved process control.

Jeremiah Boyd, Wastewater Foreman, City of East Peoria, said the project was driven by both mechanical realities and regulatory requirements. “Our infrastructure was basically 20 years past the end of its service life, and, at the same time, our permit renewal was coming up,” Boyd said. “The EPA stepped in and said, ‘Look, you guys need to invest in your system. You need to upgrade your infrastructure.’ With that came new nutrient removal requirements.”

Antiquated Wastewater Treatment System Needs Updating

The two facilities operate extended aeration treatment processes with different design capacities. Plant No. 1 has a design average capacity of 5.43 million gallons per day (MGD) with a maximum of 10.86 MGD. Plant No. 3 operates at a 1.2 MGD design average and 2.4 MGD maximum. At the start of the project, both plants relied on aging equipment with limited automation or process visibility.

“Plant one and plant three were antiquated systems,” Boyd said. “We had no visibility on SCADA, and we had no control over anything. Most everything was either on a soft start or across-the-line start with no VFDs.” Blowers ran continuously at full speed, and operators controlled airflow by manually adjusting valves. “A soft start will always go to 60 Hz and full speed. You get a slow ramp-up

and ramp-down, but you can’t adjust speed like you can with a VFD. We were basically running the blowers at 100% all the time.”

The lack of automation extended beyond airflow control. Alarm notifications relied on a simple telephone dialer system rather than modern monitoring. “If something faulted, it would just call and say ‘channel one fault,’” Boyd said. “You had to come in and figure out what the issue actually was.”

At the same time, the plants struggled to meet environmental requirements. The U.S. Environmental Protection Agency pushed for improved nutrient removal performance, particularly phosphorus.

“We were having issues with effluent solids, and nutrient removal was the big one,” Boyd said. “At plant one, they wanted us to treat better for phosphorus removal. Part of the issue was we couldn’t control our

Above: 100 hp geared centrifugal blowers supply air to elevated sludge storage tanks in Plant No. 1.

dissolved oxygen (DO). It was always way too high.” Without precise aeration control, the biological process couldn’t consistently maintain the DO levels required for effective biological phosphorus removal.

Introducing Three Anaerobic Treatment Zones

To address the regulatory pressure and aging infrastructure, the city launched a complete modernization program, including major process modifications. One of the most significant changes was the introduction of anaerobic treatment zones.

“We added three anaerobic basins ahead of the aeration basins,” Boyd said. “That was a big part of being able to treat phosphorus effectively.”

Additional equipment upgrades supported the new treatment strategy. The plants installed a high-pressure coarse bubble mixing system powered by two air compressors. The system provides mixing and oxygen transfer to support biological nutrient removal.

The project also introduced modern instrumentation and control systems. New sensors monitor DO and communicate with plant automation systems through a supervisory control and data acquisition platform.

The timing of the investment proved beneficial for the city. “We started the project before COVID, so the cost of everything wasn’t as crazy as it is now,” he said. “We were able to secure EPA financing with loan forgiveness and low interest rates. From a taxpayer standpoint, we did it at the right time.”

Rebuilding Wastewater Treatment Plant No. 3 from the Ground Up

Engineering for the modernization project was led by Farnsworth Group. The firm had prior experience specifying industrial blowers in similar wastewater applications. “They had used Inovair on a couple of other plants and had good luck with them,” Boyd said. “They put them in the spec and recommended them to us.” Gasvoda was the local distributor. The

plant’s operators immediately recognized the potential advantages of the blower design.

“We looked at the information on them, and right away we could see the simplicity,” Boyd said. “From an operator standpoint, I liked the idea of being able to get my preventive maintenance done quickly and not have a machine I have to babysit all the time. We needed equipment simple to operate and maintain.”

The first blower installation occurred at Wastewater Treatment Plant No. 3. The plant was essentially rebuilt from the ground up during the modernization project. “We added two automatic bar screens, new pumps on VFDs and a brand new grit removal system,” Boyd said. “We also installed a HUBER dewatering screw press so we could process sludge directly at that plant instead of hauling it to Plant 1.”

The blower installation included three 100 hp geared centrifugal blowers. Plant No. 3 reached operational completion in January 2022. The blower system was integrated with DO sensors from YSI and controlled through a master control panel (MCP) communicating with the plant SCADA system.

“I’ve got YSI process sensors out in the plant measuring DO, and I set my target on the MCP,” Boyd said. “The sensor feeds back to the control panel and the blower ramps up or down to maintain the dissolved oxygen level. We’re usually within two- or three-tenths of our target at all times. That allows us to maintain consistent treatment.”

Adding a Fail-Safe Mode to Guarantee Air Delivery

The system is designed with a fail-safe mode to maintain aeration if instrumentation fails. “If we lose communication with the DO probe, the blower automatically goes to 100%,” Boyd said. “It guarantees we have enough air going into the basin.”

Ken Jones, CEO, Inovair, said the approach reflects typical customer preferences. “You can change the default behavior, but many operators prefer to have the blower go to full output if communication is lost,” he said. “It ensures the process always has plenty of air.”

“Most days, the blower is running at exactly the same output when we come in,” Boyd said. “If I walk in and see it at 100%, I know something changed. Usually, the DO probe needs cleaning.”



An MCP shows the status of a blower at Plant No. 3.

» East Peoria WWTP Modernizes Aeration System



Plant Operator Brett Benefield performs an annual oil and filter change at Plant No. 3.

The installation reduced energy consumption across the treatment system. “Our finance director and I looked at the numbers, and we’re seeing about 18 to 21% energy savings across the plants, depending on the month,” Boyd said.

Those results align with typical performance improvements when modern blower technology replaces older equipment. “Where older multi-stage blowers are running without VFD control, it’s common to see around 25% energy savings when switching to more efficient designs,” Jones said.

Second Phase: Additional Blowers at Plant No. 1

After the successful deployment at Plant No. 3, the city installed additional blowers at Plant No. 1 roughly two years later as part of the final construction phase. The larger plant required high-capacity aeration equipment for the main basins. Four 100 hp geared centrifugal blowers supply air to elevated

sludge storage tanks with a combined capacity approaching 800,000 gallons. The largest tank holds approximately 513,000 gallons, and two additional tanks hold 168,000 gallons each.

“These blowers provide mixing in the sludge holding tanks,” Boyd said. “We repurposed an old anaerobic digester and installed diffusers at the bottom. The bottom of some tanks is actually lower than the others. When a tank is empty, the air wants to go there because it’s the path of least resistance.”

Variable speed control allows operators to adjust blower output and maintain proper

mixing in whichever tank is active. Typical operating pressures are around 8 to 9 psi (0.6 barg), but can rise above 10 psi (0.7 barg) when all tanks are full.

Meeting Future EPA Phosphorus Limits

With both plants modernized, the East Peoria wastewater system now operates with full SCADA integration and automated aeration control. The improvements have dramatically simplified plant operations.

“Ease of maintenance and control are the biggest benefits,” Boyd said. “If I get an alarm, I can open my iPad and see exactly what the plant is doing and what the blowers are doing.”

The upgrades also positioned the city to meet upcoming regulatory requirements. Current permits require a monthly average phosphorus concentration of 1 milligram per liter in effluent. Beginning in 2029, the limit will tighten to 0.5 milligrams per liter. The plant is already meeting the future standard.

“Our deadline is 2029, but we’re already there,” Boyd said. “The anaerobic zones, the ability to control DO and the mixing from the blowers all help us treat phosphorus effectively.”

“It’s a great example of what happens when a knowledgeable operator gets equipment that’s simple and reliable,” Jones said. “You end up with a plant that runs efficiently and meets its environmental goals.” **BP**

For more information, visit <https://inovairblowers.com>.

To read similar articles on **Wastewater Treatment Plants**, visit <https://www.blowervacuumbestpractices.com/industries/wastewater>.



Visit our Webinar Archives to listen to expert presentations on **Aeration Blower Systems** at <https://www.blowervacuumbestpractices.com/magazine/webinars>.



Designing Vacuum Processes for Greater Efficiency

By Meike Strasheim, Head of Market Management Content Strategy, Pfeiffer Vacuum+Fab Solutions

► Improving the efficiency of a vacuum system does not simply rely on choosing the optimal vacuum pump. Much of the long-term performance is influenced by how the vacuum process is designed. This includes factors such as energy consumption, productivity and operating costs.

Typically, efficiency is defined not only as the reduction of resource consumption, but also as an increase in productivity. Smart choices at the outset of designing a vacuum system can therefore have a profound impact on efficiency over its whole life. This article explores four key considerations for more efficient vacuum processes.

Multiple Pumping Stages Improve Energy Efficiency

In many vacuum applications, especially those requiring rapid pump-down times or low ultimate pressures, using a single vacuum pump to cover the full pressure range can be inefficient. A more effective approach is using multiple pumping stages, typically by combining a backing pump with a vacuum booster.

In this arrangement, each vacuum pump can operate within its optimal pressure range, avoiding the need to operate the backing vacuum pump at lower pressures where it would be less efficient. Pumping

speed is improved at lower pressures. The combination of a backing vacuum pump and a vacuum booster achieves pumping speeds at low pressure much greater than the backing pump could achieve alone. Smaller vacuum pumps can be used without compromising performance.

For example, a vacuum booster used in conjunction with a dry screw or rotary vane backing pump can significantly reduce energy consumption compared to a single large vacuum pump. This is because vacuum boosters have excellent volumetric efficiency and can increase the performance of a vacuum system by up to a factor of 10.

Designing a vacuum system with the appropriate number and type of pumping stages ensures the system meets process requirements without excessive energy consumption. This staged approach is particularly beneficial in vacuum packaging, drying or degassing processes where evacuation or processing time is critical and high pumping speeds are often required.

Handle Vapor Loads through Pre-condensation

Processes that generate large volumes of vapor, such as drying, evaporation or solvent recovery, present a challenge for vacuum systems. If vapors are drawn directly into

the vacuum pump, they can condense inside the equipment, reducing performance and potentially causing long-term damage. One widely used solution is installing a pre-condenser upstream of the vacuum pump.

The benefits of pre-condensation include reducing the vapor load reaching the vacuum pump, preventing condensates from collecting in the pump, which improves vacuum pump longevity. It improves vacuum stability, as condensates can result in inconsistent pumping performance. It can also reduce the required pumping capacity by up to 70%, depending on the process and vapor type, as the condensed vapor no longer needs to be evacuated by the vacuum pump.

Some vacuum pump technologies, such as liquid ring vacuum pumps, offer built-in benefits in handling vapors. The liquid ring acts as a condenser, removing vapors from the gas stream and improving the effective pumping speed without external equipment.

In any case, assessing vapor loads during the process design phase and planning for condensation management can significantly improve system efficiency and reliability.

Prevent Efficiency Losses from Condensates and Carryover

In certain vacuum processes – especially those involving moisture, solvents or fine particulates – condensates or process liquids

Above: Using multiple pumping stages can enhance efficiency in many vacuum applications.

» Designing Vacuum Processes for Greater Efficiency

may enter the vacuum pump. If these are not properly managed, they can reduce system efficiency and performance over time. Possible effects include corrosion of internal components, blockages or fouling, degradation of lubricants or seal fluids and reduced pumping speed or stability.



A gas-ballast system has been installed on this rotary vane vacuum pump.

Design strategies to prevent these problems include using materials or coatings resistant to corrosion and chemical attack, or installing gas-ballast systems to allow non-condensable gases to enter the vacuum pump. Opening the gas ballast, implemented as a pre-outlet valve, allows vapor to vent from the system before it has the chance to condense. This prevents internal condensation. Also, ensure adequate gas throughput to purge residual condensates, especially after process interruptions or shutdowns. This can be achieved by installing a gas purge system and running the pump for a period of time while isolated from the process.

Designing for condensate management is particularly important in systems that operate intermittently or process gas compositions with high condensable vapor loads, such as in drying applications. Maintaining clean, dry internals isn't just a maintenance task; it's also a design responsibility if long-term efficiency is to be achieved.

Control Vacuum Pump Operating Temperatures

Vacuum pump performance can be influenced significantly by operating temperature. If a vacuum pump runs too cold or too hot, its efficiency and lifetime can be affected. When it is too cold, condensation may form inside the vacuum pump, especially in humid or vapor-heavy processes, such as drying applications. This can lead to emulsification of oil, corrosion or unstable pumping

performance. On the other hand, elevated temperatures can cause thermal degradation of oil, increased wear or polymerization of process gases.

The optimal operating temperature depends on the vacuum pump type (e.g., dry vs. oil-lubricated), the process gas composition, ambient environmental conditions and the type of lubricant oil used.

Where there is a risk of condensation or polymerization, vacuum systems should be designed with the vacuum pump operating temperature in mind to ensure efficiency is maintained and the system remains reliable over time. Cooling systems, ambient ventilation and thermal insulation may all play a role in controlling vacuum pump operating temperature. Additionally, operators should ensure vacuum pumps are allowed to warm up to operating temperature before they're exposed to the process and operating cycles are long enough for the vacuum pump to generate sufficient heat to keep temperatures within the optimal range. During shutdown, vacuum pumps continue to run after they are isolated from the process to allow condensates to clear. These warm-up and shutdown steps are often automated. **BP**



This dry screw vacuum pump includes a thermostatic valve.

Summary

Vacuum system efficiency begins long before the vacuum pump is switched on. The design of the process – including how vacuum is generated, how vapors are handled, how contaminants are cleared and how operating temperatures are managed – all play a crucial role in determining energy use, maintenance needs and overall system productivity. By considering the four areas outlined in this article, vacuum systems can be built to operate more efficiently, more reliably and at a lower cost over their lifetime.

Images courtesy of Busch Vacuum Solutions.

About the Author

Meike Strasheim is Head of Market Management Content Strategy at Pfeiffer Vacuum+Fab Solutions. She holds a degree in industrial engineering and has over 10 years of professional experience in vacuum technology, including responsibility for the chemical industry market. Her work focuses on industrial vacuum applications and their role in technical process environments.



About the Busch Group

The Busch Group is one of the world's largest manufacturers of vacuum pumps, vacuum systems, blowers, air compressors, chambers and gas abatement systems. Under its umbrella, the group houses two well-known brands: Busch Vacuum Solutions and Pfeiffer Vacuum+Fab Solutions. For more information, visit <https://www.buschgroup.com>.

For similar **Rough Vacuum Systems** articles, visit <https://www.blowervacuumbestpractices.com/technology/rough-vac>.



Visit our Webinar Archives to listen to expert presentations on **Rough Vacuum Systems** at <https://www.blowervacuumbestpractices.com/magazine/webinars>.



The ROI of Proper Filtration

By Bella Alfaro, Marketing Coordinator, and
Rich Ricciardi, Market Manager, Solberg Manufacturing

► The importance of filtration is often underestimated – that is, until equipment failure makes its role impossible to ignore. Whether it's a furnace filter in a home HVAC system, an automotive air filter or a clogged shop vacuum, many users delay replacement well beyond the intended service life. At home, a delay may result in higher utility bills or reduced comfort. In an industrial environment, the consequences are more serious. Filtration directly influences equipment reliability, plant productivity and energy consumption.

Industrial filters are more than accessories. They are protective devices engineered to safeguard capital equipment and preserve operational performance. Whether installed on dust collectors, industrial blowers, air compressors, vacuum pumps or other process-specific systems, filtration protects both machinery and margins. When filters become overloaded or clogged, they introduce resistance in the form of pressure drop. That restriction limits airflow, degrades performance and increases energy consumption for certain types of rotating equipment. What may appear to be a minor increase in restriction can quietly translate into thousands or even tens of thousands of dollars in lost productivity and higher electricity costs each year.

In severe cases, neglected filters can bypass or fail catastrophically, allowing contaminants to travel downstream into critical equipment. The result can include emergency service calls, unplanned downtime, product contamination and major mechanical repairs. In nearly every case, those costs far exceed the expense of routine filter maintenance.

This article examines how industrial facilities can quantify the return on investment associated with disciplined filter change scheduling. By connecting pressure drop, energy consumption, maintenance costs and equipment longevity, facilities can move from reactive maintenance to measurable operational control.

The Value of Industrial Filtration for Rotating Equipment

Industrial filtration systems play a central role in protecting and sustaining rotating equipment. Filters serve as the first barrier against airborne or process-generated contaminants. These contaminants may include fine powders, abrasive particulate, fibers, metal shavings and aerosols. While many are microscopic, their cumulative effect is not. Wear accelerates, clearances change, efficiency declines and equipment life shortens.

Effective filtration is about achieving and sustaining equipment performance. Proper filtration reduces maintenance costs, stabilizes airflow or vacuum levels and extends the usable life of high-value equipment. In industries such as food and beverage, pharmaceutical processing, chemical production, bulk material handling and packaging, even minor deviations in airflow stability can disrupt throughput and compromise product integrity. Filtration is therefore an operational control component, rather than a maintenance afterthought.

At the center of filtration performance is the concept of pressure drop, which deserves more attention than it typically receives.

Pressure Drop and Differential Pressure

Pressure drop, also referred to as pressure differential, is the reduction in pressure occurring when a fluid passes through a restriction point in a system. In filtration applications, restrictions may include piping, valves, fittings and the filter itself. For this discussion, the focus is on the filter element.

A filter element is engineered to capture particulate while allowing clean air or gas to move downstream. However, every filtration system involves a trade-off. As contaminants accumulate on the media surface and within

Above: In severe cases, neglected filters can bypass or fail catastrophically.

» The ROI of Proper Filtration



Filter neglect at a Chicago food packaging facility led to significant replacement costs and hours of downtime.

its depth, resistance increases. The system must work harder to maintain the required flow. That added resistance appears as rising pressure drop across the element.

When a filter is new, resistance is at its lowest. This is known as the clean or initial pressure drop. Manufacturers carefully design filter surface area, pleat geometry, fiber density and pore structure to balance contaminant capture efficiency with acceptable airflow resistance. As the element loads, airflow pathways constrict. Effective open area decreases. Resistance rises.

Differential pressure is measured as the upstream pressure minus the downstream pressure and is commonly expressed in inches of water column in air systems.

Consider an industrial blower operating at 500 cubic feet per minute (cfm). With a clean inlet filter, pressure drop may measure 1 to 2 inches of water column. After several weeks in a dusty environment, the value may rise significantly. If ignored, it may climb to 20 or 25 inches of water column. The numbers may appear small, but the operational impact is not.

Pressure Drop, Energy Consumption and Heat Generation

Rotating equipment is selected to operate within defined airflow, pressure and load parameters. Industrial blowers, air compressors and vacuum pumps are selected based on expected system resistance, including the contribution from filtration. When actual resistance exceeds design assumptions, performance shifts.

As restriction increases, mechanical load increases and energy consumption rises as motors draw more current to sustain airflow. For certain equipment types, elevated inlet restriction can reduce delivered flow while simultaneously increasing power demand. Oil mist filters on the discharge of oil-lubricated pumps and air compressors have a similar impact on performance and power consumption as they clog.

Even modest increases in pressure drop can generate measurable energy penalties. A moderate rise in restriction may increase motor load by several percentage points. In systems that operate thousands of hours per year, that incremental load becomes a recurring energy expense. Across multiple motors in a facility, the compounded effect is significant.

Increased load also generates additional heat. Elevated operating temperatures accelerate wear on bearings, windings and seals. In pressure and vacuum applications, inconsistent airflow and pressure levels can degrade process consistency and reduce throughput. What begins as a loaded filter can ultimately shorten equipment life and erode operational reliability.

Facility managers who want to control

these risks must move beyond visual inspection. A defined filter change plan based on measured differential pressure establishes a clear maintenance threshold. Monitoring restriction and replacing filters before excessive loading occurs preserves system efficiency, protects capital equipment and reduces the likelihood of unscheduled downtime.

Case Study: Maintenance Failure at a Chicago Food Packaging Facility

A modern food packaging facility in the Chicagoland area provides a clear example of how quickly pressure drop can escalate into operational and financial disruption. The plant relied on multiple 20 horsepower (hp) side channel blowers to provide stable vacuum for product conveying and automated form, fill and seal operations. Under normal conditions, with clean inlet filtration, each industrial blower operated at slightly under 15 brake horsepower (bhp) or roughly 11 kilowatts (kW). At that load, each blower delivered optimal vacuum and airflow required to keep production stable across multiple packaging lines.

Over a six-month operating period in normal operating conditions, the inlet filters loaded with dust and debris. As restriction increased, differential pressure climbed from roughly 2 inches of water column at startup to more than 40 inches at failure. That increase contributed an additional 5 hp load to each blower motor.

Filter Replacement Trigger Indicators

- Visual Inspection
- Time Based
- Differential Pressure
- Reduced Equipment Performance
- Contaminated Process
- System Failure

A differential pressure gauge provides a clear indication when to change the filter element.



Instead of operating near 15 bhp, the units were pushed beyond full load amperage, reaching nearly 20 bhp or 15 kW.

The facility contacted its equipment supplier in a state of extreme urgency, reporting several industrial blowers had seized. Upon inspection, the equipment showed visible discoloration consistent with overheating. The inlet vacuum filters were subsequently inspected and found to be completely clogged with dust and debris. The excessive differential pressure forced the blowers to operate beyond their design limits, resulting in elevated temperatures, bearing failures and, in one case, catastrophic mechanical damage.

Multiple industrial blowers failed. Two units were salvageable with bearing replacement. Each repair required approximately 2.5 labor hours plus \$200 in replacement parts per blower at a total cost of approximately \$395 per unit. The repairs also required equipment removal, disassembly and reinstallation, resulting in production downtime.

The third industrial blower was beyond repair. A complete replacement unit, priced at \$15,000, had to be air freighted into the facility at a shipping cost of approximately \$1,500. Installation required eight labor hours. The total cost of replacement was approximately \$17,500. The direct repair and replacement costs were significant, however the indirect costs were far greater.

The failure shut down the packaging operations for two full days. The plant operated two shifts totaling 16 production hours per day, resulting in 32 hours of lost runtime. The estimated cost of downtime was approximately \$3,000 per hour and production losses alone approached \$96,000.

Beyond the measurable financial impact, the disruption created backlog, customer shipment delays, idle labor and overtime expenses required to recover production. Customer confidence was strained. The entire event was triggered by neglected inlet filtration.

This maintenance failure could have been avoided. The pressure drop change was gradual and went unnoticed until the industrial blower equipment failed. The recommended filter changeout is approximately 15-20 inches above initial pressure drop, which occurred somewhere around the three-month mark. The replacement cost of each filter element was \$96. Changing a filter requires approximately 0.5 labor hours per blower. Even including labor, had the filter change occurred at the three-month time frame, the preventive maintenance cost would have been insignificant compared to the six-figure operational impact.

Energy Consumption and Preventable Cost

To understand the energy penalty, consider the incremental load increase experienced at the Chicago packaging facility. With a 2.5 bhp or 1.87 kW increase due to pressure

drop, at \$0.12 per kW, the cost to run an industrial blower for three months at 16 hours per day increases by roughly \$320. In this case, it is still more cost-effective to change the filter and maintain a lower pressure drop with lower energy consumption. This example illustrates a fundamental principle. Pressure drop is not merely a number on a gauge. It is a measurable indicator of energy consumption, equipment stress and operational risk.

When facilities establish a defined differential pressure threshold and replace filters before excessive loading occurs, they control energy costs, preserve equipment life and protect production continuity. When they ignore it, the consequences compound quickly. Filtration is not a consumable expense to be delayed. It is an operational control strategy that directly influences reliability, efficiency and profitability.

BEST PRACTICES

EXPO & CONFERENCE CABPEXPO.COM
COMPRESSED AIR / VACUUM / COOLING



Pneumatic Conveying Workshop

October 13 at the Best Practices 2026 EXPO & Conference – Indianapolis

Strengthen your skills in pneumatic conveying system design, operation and troubleshooting. Join Jonathan McPherson of Kansas State University for a hands-on, practical workshop covering:



Jonathan McPherson
Director of Advanced
Manufacturing and Bulk
Solids Technology Center,
Kansas State University

- Dense vs. dilute phase conveying
- Velocity and pressure drop fundamentals
- Rules of thumb for system design
- Sizing blowers, airlocks and filtration equipment
- Troubleshooting approaches and best practices
- Live sizing exercises and case study discussions

A high value session for engineers, operators and anyone responsible for material handling performance. *Attendees earn PDH credits.*

KANSAS STATE UNIVERSITY | Advanced Manufacturing and Bulk Solids Technology Center

REGISTER NOW!
CABPEXPO.COM



>> The ROI of Proper Filtration

Hidden Costs Beyond Energy

Clogged or neglected filters introduce secondary costs that extend far beyond electricity consumption.

Equipment fatigue

- Bearings run hotter
- Motors experience higher load
- Fan blades or impellers work harder

Bypass failure

- Coating of internal components
- Contamination of instrumentation
- Machine malfunction or failure
- Product quality defects
- Lost product batches

Unplanned downtime

- Technician overtime
- Rush shipping for replacement parts
- Production line stoppages



Filter collapse

- Loss of filtration
- Motor ingestion of dust and debris
- Damage to downstream valves, sensors, and ducting

the equipment or process stream. Internal components can become coated with particulate, degrading balance and airflow characteristics. Additionally, sensors and instrumentation may become contaminated, leading to inaccurate readings or system malfunction.

Operational disruption often follows. Production lines may slow or stop. Technicians are called in for emergency repairs. Overtime labor is required. Replacement parts are expedited at premium freight rates. In certain industries, product contamination may result in scrapped batches or compromised quality. What begins as a neglected filter can cascade into equipment damage, production loss and customer dissatisfaction. The cost of prevention remains small. The cost of inaction rarely is.

Conclusion: Filtration as an Operational Strategy

In industrial environments where uptime, efficiency and product quality define competitiveness, filtration should be managed with the same discipline applied to any other critical operating parameter.

Pressure drop and energy consumption are measurable. Equipment wear is predictable. When differential pressure rises beyond recommended limits, the consequences are real. They show up in increased kilowatt hours, elevated temperatures, shortened equipment life, reduced performance and, in extreme cases, catastrophic failure.

The Value of Proactive Filter Maintenance

When a replacement filter costs only a few hundred dollars, the payback period is rarely measured in months. In many continuous duty applications, the energy savings associated with reducing pressure drop can offset the cost of a new filter within a short operating window. The financial logic is straightforward. Lower restrictions reduce motor load. Reduced motor load lowers energy consumption. Over time, the savings accumulate quickly.

Postponing filter maintenance doesn't reduce costs. It merely redirects them. Instead of appearing as a modest maintenance expense, it shows up as elevated energy consumption and accelerated mechanical wear. The system continues to operate, but it does so less efficiently and under greater strain. That strain is cumulative. Bearings experience higher temperatures. Motors overheat and burn out. Rotating components work harder to maintain flow and target pressure. Each additional hour of operation under elevated restriction incrementally shortens component life.

Proactive filter maintenance is more than a scheduled task on a checklist. It is a strategic

decision protecting capital equipment, stabilizing energy consumption and preventing minor inefficiencies from escalating into measurable financial loss. When facilities monitor differential pressure and act before excessive loading occurs, they maintain control of both operating cost and reliability.

Hidden Costs Beyond Energy

The financial impact of neglected filtration extends beyond energy use. Clogged or overloaded filters introduce secondary effects often not captured in a simple energy calculation. Elevated restriction increases heat within the motor and bearing assemblies, accelerating fatigue and reducing service life. Rotating components operate under greater load to sustain airflow, increasing stress on shafts and couplings. In severe cases, excessive loading contributes to filter collapse, allowing unfiltered contaminants to pass downstream.

Once bypass or structural failure occurs, the consequences multiply. Dust and debris may enter



The Chicago packaging facility demonstrates how quickly a neglected maintenance item can escalate into a six-figure expense. The direct repair costs were significant, however the production losses were far greater. The root cause was not a design flaw or an unpredictable failure mode. It was excessive inlet restriction going unaddressed.

Facilities treating filtration strategically gain control over performance and cost. Establishing a defined pressure threshold, monitoring restriction routinely and replacing filters before excessive loading occurs transforms maintenance from reactive to preventative. Energy consumption stabilizes. Equipment life extends. Production reliability improves. **BP**

About the Authors

Bella Alfaro serves as Marketing Coordinator at Solberg Manufacturing, contributing to technical content strategy and market communications within industrial filtration. She collaborates with cross-functional teams to ensure accuracy while translating complex system processes into practical insights for customers. She holds an MBA and focuses on aligning market needs with engineered solutions.



Rich Ricciardi is the Plastics Industry Market Manager for Solberg Manufacturing. He brings nearly two decades of filtration expertise, complemented by extensive technical knowledge developed over a 12-year tenure as a Sales Engineer



for a leading vacuum pump and blower OEM. This background has provided him with a comprehensive understanding of vacuum and air-handling technologies and their wide-ranging industrial applications.

About Solberg Manufacturing

As an international market leader in filtration, separation and silencing, award-winning Solberg

Manufacturing, based in Itasca, IL, is recognized as a trusted partner to its customers, colleagues and suppliers. Its diverse and effective filtration solutions play a role in operations around the globe. Solberg believes that having the proper filtration and separation technology is essential for any business operating rotating equipment. For more information, visit <https://www.solbergmfg.com>.

For similar **Rough Vacuum Systems** articles, visit <https://www.blowervacuumbestpractices.com/technology/rough-vac>.



Visit our Webinar Archives to listen to expert presentations on **Rough Vacuum Systems** at <https://www.blowervacuumbestpractices.com/magazine/webinars>.

BLOWER & VACUUM BEST PRACTICES
www.blowervacuumbestpractices.com

ADVERTISER INDEX

Company	Page	Web Site
Eurus Blower	Outside Back Cover	https://www.eurusblower.com
AERZEN USA	3	https://www.aerzen.com/baba_blowers
NES Company	5	https://nescompany.com
Best Practices 2026 EXPO & Conference	13	https://cabpexpo.com/

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 104, Pittsburgh, PA 15241

Blower & Vacuum Best Practices is published quarterly and mailed together with Compressed Air Best Practices®.

Compressed Air Best Practices® is a trademark of Smith Onandia Communications, LLC. Publisher cannot be held liable for non-delivery due to circumstances beyond its control. No refunds. **SUBSCRIPTIONS:** Qualified reader subscriptions are accepted from compressed air professionals, plant managers, plant engineers, service and maintenance managers, operations managers, auditors, and energy engineers in manufacturing plants and engineering/consulting firms in the U.S. Contact Patricia Smith for subscription information at tel: 412-980-9902 or email: patricia@airbestpractices.com. **REPRINTS:** Reprints are available on a custom basis, contact Patricia Smith for a price quotation at Tel: 412-980-9902 or email: patricia@airbestpractices.com. All rights are reserved. The contents of this publication may not be reproduced in whole or in part without consent of Smith Onandia Communications LLC. Smith Onandia Communications LLC. does not assume and hereby disclaims any liability to any person for any loss or damage caused by errors or omissions in the material contained herein, regardless of whether such errors result from negligence, accident, or any other cause whatsoever. Printed in the U.S.A.



EurusBlower

High Quality Blowers at an Excellent Value

Eurus Blower is a \$100 million corporation with 55 years of experience building high quality positive displacement blowers.

Don't be fooled into paying more. Receive the same quality and performance while profiting from significant savings.



*ZCS824 Vacuum
Truck Blower*



*ZDL Series Bulk
Truck Blowers*



*ISB Series
Screw Blowers*



*EBox Blower
Package*



*MB Series Bi-lobe & ZG
Series Tri-lobe Blowers*



*ZZ Series Drop-in
Replacement Blowers*



*Multistage
Centrifugal Blower*



*RR & ZR series
Large Rotary Blowers*

Flows from 30 to 44,425 cfm / Pressure to 15 psi. / Vacuum to 15" Hg.

**For more info contact Eurus Blower, Inc. / 3701 S. Harvard Ave. / Suite A, #544 / Tulsa, OK 74135
tel: 918-361-0285 / email: sales@eurusblower.com / www.eurusblower.com**