



Kaeser Rotary Screw Blowers for Wastewater Aeration

By Rod Smith, Compressed Air Best Practices® Magazine

Compressed Air Best Practices® Magazine interviewed Frank Mueller (President) and Stephen Horne (Blower Product Manager) from Kaeser Compressors

Good morning. Can you elaborate on the recent growth announcements coming from Kaeser?

Good morning. Yes, Kaeser Compressors continues to grow both in the U.S. and internationally. We currently employ approximately 4800 people globally. In order to support the demand and maintain our superior quality and quality service levels, we continue to invest in people, facilities and technology.

At our U.S. headquarters here in Fredericksburg, Virginia, we are adding 50,000 square feet to the warehouse area to help us handle the volumes created by some new market segments we are investing in. We had just previously expanded the shipping and receiving areas.



Kaeser's long-standing commitment to the environment and energy management is reflected by our being an Allied Partner with the Department of Energy and an ISO 14001 Environmental certified company. The design of our headquarters expansion includes the aforementioned energy-saving elements, and our employees actively participate in energy and waste reduction programs in place for batteries, cellular phones, computer equipment, electricity and more. Reflecting this company commitment to the environment and energy management, we were pleased to recently announce our partnership with the Environmental Protection Agency's ENERGY STAR program.

Our international headquarters, located in Coburg, Germany, has started the construction of two production halls adding over 200,000 square feet of manufacturing space. The company purchased land next to the existing manufacturing campus to make this possible. One production hall will be dedicated to large equipment assembly – 150 horsepower air compressors and the other will be dedicated to intermediate size air compressors.

This follows the opening, not long ago, of the Sonnenfeld, Germany facility. This plant is dedicated to the complete manufacture of the enclosures for our air compressor, dryer and blower product lines. Moving these processes out of our central manufacturing hub in Coburg opened up needed product manufacturing space and allowed us to further optimize this sheet metal process.

Finally, our Gera, Germany campus specializes in manufacturing our compressed air dryers and blower product lines. This facility recently completed a new research and development center dedicated exclusively to blower technology.

The blower R&D laboratory has obviously been busy. Please describe the launch process of your new rotary screw blowers.

Kaeser has been engaged with blower market segments since 1994. We felt, over this time, we had optimized the potential of the rotary lobe blower packages we offered. At the same time, we became a leader in packaging blowers. In the past OEM's did this work – taking open frame, loud blowers and creating their own packages. Our approach was to build the complete package-for the OEM's application. This would include controls, sound-attenuated enclosures, motors, cooling systems and so on. We could customize OEM packages for different industries such as furniture manufacturing or wastewater treatment plants. So over time we enhanced the performance of this type of rotary lobe blower, while recognizing some of the inherent limitations of this technology with regards to energy efficiency.

As you know, Kaeser is one of the largest manufacturers in the world of rotary screw airends. We recognized, many years ago, the wastewater treatment market as an ideal market for our unique and proprietary Sigma Profile rotary screw airend technology and began our technology development process. This market matches because they look for energy efficiency, longevity, complete packaging and communication/integration capabilities with SCADA and other plant operating systems.

We tend not to be the “first-to-market” with technologies because we are obsessive about testing and quality. We take a very measured approach to product introductions and don't rush to market just so we are first. We test-market technology in the field for periods measured in years – not months. This allows us to acquire detailed application and production knowledge and refinements one only acquires through experience. This gives us an opportunity to listen to customer feedback and meet the needs of individual markets.

Kaeser's global subsidiaries benefit from this philosophy – as we only launch products with several years production and application experience already under their belt. Our company has always prided itself in excelling on the details –

Kaeser Quality is about a customer being delighted when they take the time to examine our product closely and “look under the hood.”

Please describe the benefits of rotary screw versus lobe blowers.

Rotary screw blowers have better specific performance (more air per kW) than lobe blowers due to their compression process. Lobe blowers utilize external compression—air is not compressed within the block itself. Lobe blowers have two impellers and the inlet is directly opposite the discharge port. As one impeller begins to seal off the air inlet, air is trapped between the blower case and the impeller. Meanwhile, the other rotor begins to open at the outlet. The impeller sweeps the trapped air to the discharge port where it passes on to the discharge piping—pressure builds in the piping in relation to the length and diameter of the piping and the depth of the wastewater pond. Lobe blowers all have some degree of “slip” which allows air to flow from the high-pressure side to the low-pressure side. This is a source of inefficiency.



Kaeser asserts that their new line of rotary screw blowers are up to 35% more efficient than conventional blower designs.

With rotary screw blowers, compression occurs within the block. The helical twist of the twin rotors compresses air as it moves to the discharge. Unlike lobe blowers, the compression ratio is fixed by geometry rather than by the system dynamics. Screw blower efficiency is higher in large part because they rotate much faster than lobe blowers and operate with much higher isentropic efficiency.

Additionally, rotary screw blowers have a much flatter specific performance curve, across a wider range of operation, compared to lobe blowers. Lobe and other types of blowers are typically much less efficient at one or both extremes of their operating range.

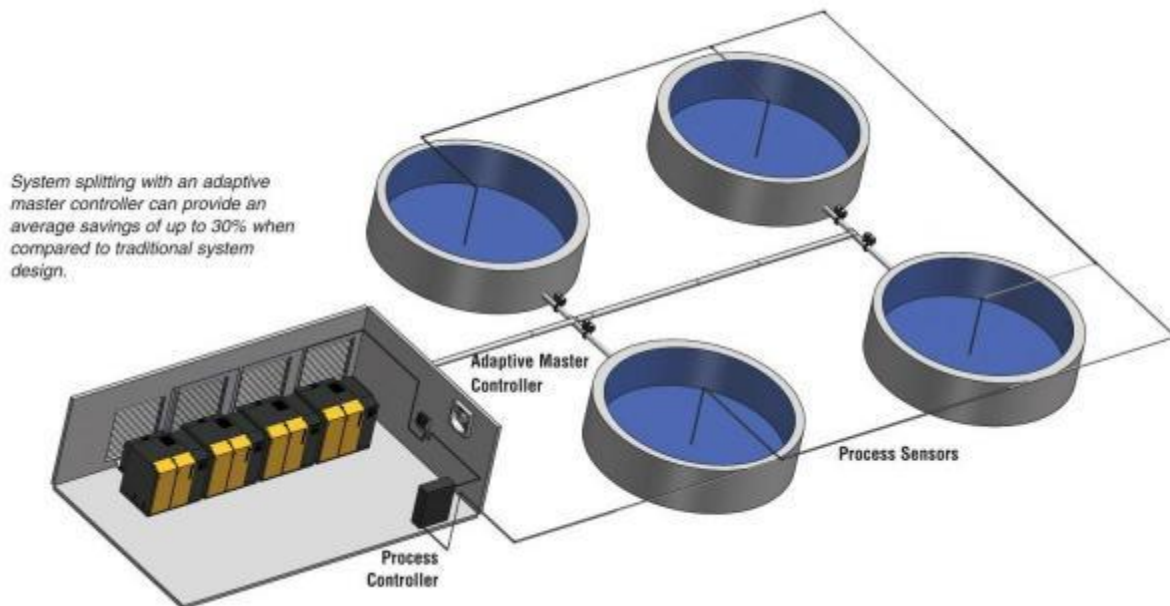
With internal compression, however, it's important the internal pressure is as close to the pressure required as possible. When the pressure required is lower than the internal compression, over-compression happens - resulting in wasted energy. To combat over-compression, we offer two pressure versions of our rotary screw blowers, one for pressures up to 9 psig, and the other for pressures up to 16 psig.

What are the specific gains in energy efficiency and specifications for the new rotary screw product line?

The new EBS and FBS Series of rotary screw blowers are up to thirty five percent more efficient than conventional rotary lobe blower designs and are also significantly more efficient than other other comparable rotary screw blower packages. The models run from 25 to 150 horsepower for flows between 530 and 2366 cfm. As mentioned before, we offer two pressure versions; one for pressures up to 9 psig, and the other for pressures up to 16 psig.

Over the past five to ten years, the blower market for wastewater treatment plants has been affected by the introduction of high-speed turbo and rotary screw blowers. There are now all sorts of different blower types on the market. Each technology has its positives and negatives. At Kaeser, we get a solid basis of what the benefits/drawbacks of a certain technology are and then optimize.

The wastewater treatment market is a strong market for us now and our screw blower is an exciting step forward for our customers. Not only does the screw blower enhance energy efficiency at the plant, it continues to provide the advanced packaging we've always provided.



System splitting with an adaptive master controller can provide an average savings of up to 30% when compared to traditional system design.

Please provide some details about the total blower package.

Rotary screw blowers run at high speeds creating a lot of agitation. Our package design features a proprietary internal sealing system on the rotary screw blower block, which eliminates the problem of escaping oil mist. The customer benefit is that our package does not require external devices like an oil-cooler or a de-foaming pump creating negative pressure in the oil sump – devices often found in other positive displacement packages.

TEFC premium efficiency motors are standard. Enclosures feature heavy gauge powder coated steel frames and sound attenuated panels. Vibration isolation, in our chassis design, eliminates vibrations to keep piping leak-free and all wiring secure.

The rotary screw blowers are available with variable speed control managed by our Sigma Control 2™ system. This advanced controller comes standard with multiple pre-programmed control profiles so wastewater treatment plants can select the one best fitting their application. The control system monitors more than twenty critical operating parameters on each unit.

Many if not all aeration blower applications require a total system controller. Kaeser's Sigma Air Manager (SAM) can control up to 16 blowers and only turn them on as needed. The SAM system allows the blowers to be controlled based on dissolved oxygen levels or other WWTP performance targets. While the desired levels of DO, NH₄ and NO₃ remain the same, the amount of air required to maintain those levels varies based on a wide range of factors such as ambient temperature and humidity. The SAM system automates and optimizes the blower's wire-to-air efficiency while delivering the required oxygen.

Can you share some blower wire-to-air efficiency recommendations?

Every wastewater plant is unique. Municipal plants are different than industrial applications. There are some common system design philosophies we can share. The first point is to focus on the system and not on individual blowers. Conventional aeration system designs include multiple oversized variable speed blowers with an identically sized back-up unit. Simple control systems are set to share the demand and the blowers operate at the same speed. This is very costly, since not only do variable frequency drive units cost more to purchase, their drive losses must be factored into the unit's efficiency. In addition, the blowers are oversized and do not operate at their most efficient design point, spending as much as ninety percent of their operating time wasting costly energy.

Our preferred approach is to split the maximum load amongst several fixed-speed blowers. You cycle these fixed-speed blowers, to share run-time hours, on auto-dual control allowing them to run idle for a defined period of time before shutting down. This allows the master controller enough time to observe the system's response and signal the units to reload if needed.

Much smaller (than the conventional system designs) variable frequency drive units are also deployed to handle the trim loads. The VFD is sized no larger than required, reducing the initial investment cost while covering the supply gaps that occur when the fixed speed machines are idle.

For more information please contact [Stephen Horne](#), Blower Product Manager, [Kaeser Compressors](#), tel: 540-898-5500

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