

Seepage water treatment: ZS screw blower supplies bacteria with air

Efficient and Low-maintenance Using Direct Drive

In the seepage water treatment installation at the Münster waste management center, a screw blower from Atlas Copco supplies aerobic bacteria with air. The low-maintenance technology and the integrated frequency inverter were the deciding factors to use the energy-efficient ZS 55+ VSD.

Essen/Münster, Germany, February 2011 – “I can’t smell anything at all here,” the visitor comments as he enters the seepage water treatment installation at the Münster waste management center. The installation has been treating the seepage water from the two central waste dumps, one of which is still in operation, for 15 years. “One of the two waste dumps has already been closed,” operating manager Christian Lüke explained. “But water will still seep through for a long time, which we will need to treat in the main waste water treatment plant before final cleaning.” Household garbage deposited there contains decades-worth of medicines, half-empty containers of home oil changes, or paint leftovers, despite waste separation. “Certain active ingredients eventually find their way in, in spite of the best waste separation efforts,” Lüke said.

Although this garbage is poisonous, which is why it needs to be treated, “This water is normally nearly odorless,” Wilfried Rasch tells the visitors. “If it smells bad, then something is wrong.” Rasch is a specialist for sewage technology who helped to set up the installation, and he checks the water daily in the 7500 m³ aeration basins. In order to work properly, the bacteria in the biological basins need a reliable air supply. Nitrification is the process where they break down the organic components. For a year now, the correct air feed has been provided by a speed-controlled type ZS 55+ VSD screw blower from Atlas Copco. This machine is supported by two other older machines from another manufacturer. The Atlas-Copco compressor was purchased by the Münster organization as a replacement for an old, defective rotary lobe blower.



Fig. 1: The seepage water waste water treatment plant at the Münster waste management center

Excess Operating Pressure Up To 1.2 Bar

The oil-free ZS screw blower range is designed for volume flows from around 250 to just under 4600 m³/h and excess operating pressures up to 1.2 bar. The integrated speed regulation (variable speed drive, VSD) installed in the machine in Münster automatically adjusts to the precise current air requirement. The speeds of the old blowers could only be regulated with external frequency inverters. The ZS 55+ produces volume flows of up to 1680 m³/h and is suitable for pressure increases between 0.3 and 1.2 bar.

You can see the muddy brown water from the bridges over the basins. The clarifier basins where the seepage water is pumped in first are six to seven meters deep. Münster uses the energy-saving process of upstream denitrification; this is done in the first fifth of the basin where anaerobic bacteria are active and do not need any oxygen. The sewage water flows over an overflow into the aerated nitrification. The nominal pressure for aeration is about 0.86 bar. “We need 0.6 to 0.7 bar just to compensate for the pressure of the water column,” Rasch explains, “and an additional 0.2 bar to inflate the membranes of the aeration pipes.” In the meantime, the Atlas Copco screw blower operates permanently in the installation; one of the two rotary lobe blowers is switched on if there is a large air requirement. The third blower is used as a reserve and is operated alternately with the second old device.

The Advantage of Direct Drive

“The direct drive and the integrated frequency inverter were the the deciding factors,” Christian Lüke said about the decision to acquire the ZS 55+ VSD when one of the three old rotary piston blowers had expensive motor damage. These machines require more maintenance due to the v-belt drive between motor and gear than the Atlas Copco screw blower where the motor and compressor element form one unit, Lüke said. The variable speed motor and the screw element are flange-mounted directly on the gear housing. “The bacteria can survive for a maximum



Fig. 2: Compressor station for the seepage water treatment installation. In the foreground, the new speed-controlled screw blower ZS 55+ VSD, which already runs significantly more efficiently than rotary lobe blowers due to their design.

of half a day without aeration,” the engineer stressed, “so we need to be sure that the blower will operate absolutely reliably.” The new compressor fulfills this requirement, ensuring an uninterrupted supply of oil-free compressed air.

Screw blower technology is Significantly More Efficient Than Rotary Lobe Technology

An exciting additional advantage is that screw technology significantly reduces energy costs compared to rotary lobe technology. From a purely technical viewpoint, we can assume an average of 30%, Atlas Copco expert Thorsten Poggenmöller said. The performance of the ZS screw blower is compared with one of the rotary trilobe blowers by the German TÜV in accordance with the international standard ISO 1217, version 4. Tests results show that the new ZS blower at 0.5 bar has a 23.8% higher efficiency than rotary trilobe blower. At 0.9 bar the efficiency is even 39.7% higher. Poggenmöller, specialist at Atlas Copco for low pressure systems, calculates the efficiency for the Münster installation at an energy requirement of 0.028 Kilowatt-hours (kWh) per cubic meter of air, compared with 0.036 kWh/m³, if the group-internal ZL rotary lobe blower had been used. The advantage in efficiency is over 20% even compared to a “modern” rotary lobe blower and must be even more dramatic compared to the 15 year-old machines. “That’s why Atlas Copco has not offered the rotary lobe technology since 2010, since we consider them inefficient and believe that the future is in energy-saving systems,” Poggenmöller emphasized.

Aeration of the Biological Basin Accounts for 70% of Energy Consumption

Since 70% of the energy consumption for a typical biological waste water treatment plant can be down to the system the blower system of the aeration basin, the energy costs of installations running continually can often fall significantly.



Fig. 3: The ZS+ screw blower is supplied by Atlas Copco as a complete package, ready for operation, with PLC-based electronic control unit, integrated inverter, and much more.



Fig. 4: Pipeline to aeration basins. The ZS blower provides the bacteria with up to 1680 m³ of air per hour

Rasch and Lüke have not yet been able to estimate the energy efficiency clearly. “The additional cost for a speed-controlled screw compressor will be covered in three to four years,” Christian Lüke calculates.

The tip to send an inquiry to Atlas Copco came from one of the employees at ITT Water & Wastewater. The company offers products, service, and environmental complete solutions for water and sewage technology and has a maintenance agreement with the Münster waste management center.

ITT has worked with Atlas Copco since 2009 on aeration blowers because the Essen company focuses on energy efficiency for their blowers. Atlas Copco was quickly awarded the contract in Münster for their offer. “Now there is no longer any bad material in this segment,” Christian Lüke said. “We considered it important that the machine runs as smoothly and reliably as possible, and we can rely on their service.”

He also liked the fact that the cost for delivery and connection of the new blower was directly included in the price. “We didn’t have to worry about anything,” the operating manager said. The installation was handled quickly as the ZS+ screw blowers are delivered as a complete package, ready for use, with PLC-based electronic control unit, integrated inverter, forklift slots, check valve, air filter, blow-off valve, and muffler. No extras are needed because of the compact construction. The ZS screw blowers are designed for simple integration in existing compressed air networks, so they take very little time for commissioning.

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Fig. 5: Wilfried Rasch, specialist in sewage technology, helped set up the seepage water treatment installation and checks the air quality daily in the basins, as well as the performance of the compressors.