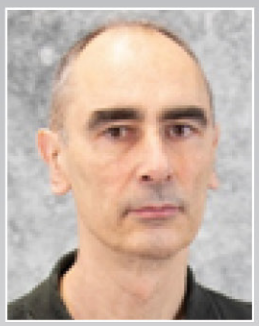
MAGNETIC BEARING TECHNOLOGY
A clean and green practice with in turbocompressor



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Abstract: ***We at Sulzer, with more than 180 years of experience and expertise, enjoy the world leader position in the pulp and paper industry. We are strongly involved in the latest developments. Intensive R&D with full-scale test facilities and our partnerships with end customers and research institutes boost our development of totally new and innovative process equipment***

An important strategy is to provide the wastewater industry with solutions that reduce both the energy consumption and the carbon footprint whereas they increase both the equipment efficiency and its reliability. To achieve these goals, several world firsts in technology have been launched during the last years.

A further range of innovative products with proven energy savings, reduced carbon emissions, and lower maintenance cost is the HST turbocompressor series. These turbocompressors are widely used to powerfully aerate wastewater during the treatment processes. Today, more than 3000 units are installed all around the world, with many of them in integrated wastewater treatment plants of pulp and paper mills.

Key Words: ***Turbocompressors, Blowers, Magnetic bearing, Wastewater,***

Introduction: HST turbocompressors are high-speed machines. Their power ranges from 69 to 400 kW and their speed from 47800 to 16200 rpm. Figure 2 shows a typical cross-section of a high-speed turbocompressor.

With turbocompressor series, lower life-cycle costs and easy operation are achieved through:

Figure 1 – Two Sulzer turbocompressors

- **Magnetic bearings** — minimal energy loss and no mechanical wear. Figure 3 shows us the basic principle of how the magnetism holds the rotor at high speed in center without mechanical wear and tear.
- **Integrated design** — compressor, motor, frequency converter, and control cabinet are built in; an easy-to-install package
- **Small footprint** — smaller compressor room, lower building costs
- **Low installation cost** — no external starters or controls required; no crane or special foundation needed
- **No lubrication oil** — no possibility of air pollution

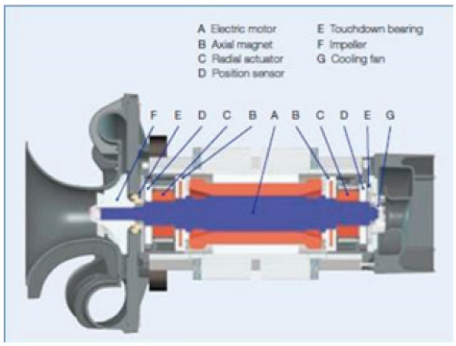

Figure 2 – xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

- **System modularity** — permits parallel operation of numerous compressors, allowing tailor-made installations
- **Compatibility** — can operate in parallel with all types of compressors, which facilitates flexible refurbishment
- **Continuous real-time monitoring of system performance** — minimizes the risk of unplanned downtime

The HST turbocompressors can be configured in groups to suit the aeration requirements. The Master Control Unit optimizes the compressor operation to match the desired output and controls the group of machines just as one would control a single unit. This optimizes the operation of the whole group in terms of output as well as energy consumption.

Material & Method

In the pulp and paper industry, the activated sludge process is the most common technology for treating wastewater effluents. In this biological process, microorganisms degrade organic impurities, i.e., convert them into carbon dioxide, water, and biomass. Because the microorganisms need oxygen, it is essential to introduce air into the wastewater. The air supply is often produced by low-efficiency conventional positive displacement (roots-type) blowers. The energy consumed by these blowers is the most important item to focus on, because the biological treatment aeration system consumes as much as 70% of the wastewater plant's total energy. By replacing old positive displacement blowers with some high-speed turbocompressors, the energy efficiency of the air production in the wastewater treatment plant can be increased by up to 45%.

The turbocompressors not only provide remarkable energy savings from wire to air, but also notable savings in maintenance costs and spare parts during their 30 years lifetime. Given the functioning principle of the Sulzer turbocompressors, the need for preventive and corrective maintenance of its mechanical parts is very low under the correct operating conditions. Only the filters need to be replaced. In contrast, positive displacement blowers require checking of oil levels and belt tension on a daily basis, replacing of filters, oil, and bearings by internal and external specialists, and demounting and dismantling of units to enable maintenance.

When comparing positive displacement blowers to high-speed turbocompressors, two other major benefits are much appreciated by operators. The small size and lighter weight of the HST turbocompressor means that this system is much easier to handle manually than a blower. It can be moved using just an ordinary trolley, there is no need for a forklift truck. With a new plant, one can build a smaller room for housing the machine. No cranes or other heavy lifting equipment are required. In addition, the quietness of the turbocompressor ensures that regulations governing noise are more easily complied with. Staff must use protective equipment when working with positive displacement blowers but not with turbocompressors. This allows more comfortable working conditions for workers and prevents complaints from people who live near the integrated wastewater treatment plant.

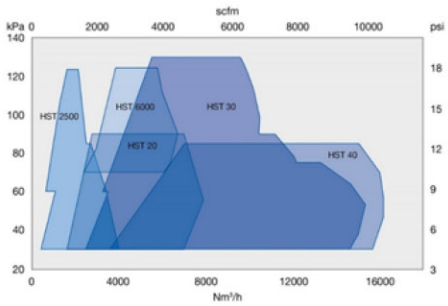

Figure 3 – Graph of pressure (kPa) versus airflow (Nm3/h) for the five turbocompressor models

The performance of the five turbocompressor models is presented in Figure 3. The turbocompressors provide an airflow from 700 to 16000 Nm3/h and a pressure range from 30 to 125 kPa.

Result and discussion
A case study at Paper mill—
Study Background

This study is done at a corrugated paper and cardboard company with two mills near Venice, Italy & production is from recycled paper close to above 200000 tons per year. Effluents from both mills go to a biological wastewater treatment plant built in 2002. In 2017, the client decided to upgrade the complete blower station, for easier operation, increased energy efficiency and optimal adjustment of the air flow to all aeration basins.

The Challenge

The compressed air station included five old roots blowers that required frequent and costly maintenance. In addition, excessive heat problems occurred in summer, both in the compressor room and in the aeration basins. Finally, working conditions were harsh with noise level frequently exceeding 100 dBA.

The Solution

Sulzer offered three highly efficient magnetic bearings turbocompressors and provided an optimal arrangement of the new equipment in the existing facilities. The PD blowers were progressively removed and replaced. During replacement, the turbocompressors could operate reliably in conjunction with the roots blowers. Turbocompressors with active magnetic bearings can withstand pulsations generated by the PD blowers discharging into the same manifold. This is a key point of difference compared with air-bearing machines.

Customer Benefit

- Dramatic increase in efficiency over old PD blowers. The customer experienced a 40% total power saving once all turbocompressors were running.
- Significant savings in maintenance costs. Those are now reduced to regular check-ups and change of the air filters.
- Huge noise reduction to less than 72 dBA. Hearing protections are no longer required in the compressor room.
- Excessive heat problems eliminated. The separate cooling system for the compressor room is now unnecessary. And the average temperature of air feeding the biological basins has dropped by nearly 20 deg. C.

Product Data

- Two units turbocompressors type HST2500 and one unit type HST20.
- Ducted motor cooling air outlets.

Inserted Picture

Operating Data	HST2500-1-A-4	HST20-4500-1-125
Quantity	2	1
Airflow range	1200 to 4300 Nm3/h	2000 to 5500 Nm3/h
Pressure rise	80 kPa	80 kPa
Input power	90	101 kW
Max. current (400 V)	140 A	198 A
Power supply	380 – 690 V	380 – 690 V
Input frequency	50 – 60 Hz	50 – 60 Hz
Thermal protection	2 x PT100	2 x PT100
Max. noise level	69	62

Conclusion:

To conclude, Magnetic bearing technology is most energy efficient and environmentally clean technology for high speed machines. This technology not only save power and environmental pollution but also wear resistance to give multiple times longer service life without major overhaul.

The HST turbocompressor is your best partner to reach all your performance, reliability, safety, and sustainability goals. For effluent treatment, the optimal aeration process can be achieved with the unique high-speed turbocompressors running with magnetic bearing technology.