

Hybrid Air Compression

Blower-Compressor Combination does the Trick



Pictures: Aerzener Maschinenfabrik

The new hybrid air compressor technology was tested at the Rohrdorf cement plant in Germany.

N. Barlmeyer, Germany

Until recently, the oil-free compression of air to pressures of 1.0 to 1.5 bar was somewhat challenging. Rotary lobe blowers for this pressure range proved to be unreliable and using screw compressors was often too costly. A new hybrid air compressions system introduced by Aerzener combines the advantages of both systems.

In addition to three existing screw compressors for central air conveying station at the Rohrdorf Cement Plant in Germany, a new Aerzen Delta Hybrid rotary lobe compressor was installed in 2008. This unit delivers 43.9 m³ / min (1550 cfm) of air at a pressure of 1.5 bar g (22 psig). This unique series combines the advantages of a rotary screw compressor and of a positive displacement blower in a ground-breaking 'blower-compressor concept'.

Significant compromises were previously necessary to exceed pressures of over 1 bar (15 psig) so this new symbiosis is the ideal conveying air producer. Once

installed, the new Delta Hybrid produced all the air and pressure needed for this coal conveying line and the screw compressor could be de-commissioned.

Pulverized Coal Transport

The Rohrdorf Cement Plant produces about 1 million tonnes of cement per year. Compressed air plays a central part in the production of cement from its very beginning as raw materials to the finished product. The 'heart' of the multi-stage production cycle is the rotary kiln, with pulverized coal as the primary fuel. This

coal dust is stored in two parallel silos and is transported pneumatically in two independent pipes to the rotary kiln.

The plant switches regularly between one and the other parallel coal storage and conveying systems. The coal dust comes out of the silo system through a dust filter, a weight feeder, and a transfer pump and is then pneumatically conveyed with the help of pressurized air at 1.5 bar g (22 psig) through a 65 metres (213 feet) pipe to the rotary kiln.

The volume of material transported amounts to approximately 75 metric tonnes per day. Up until two years ago, a screw compressor generated the air flow required in each conveying line. A third unit, available as a back-up system in case of a disrupted pipeline, could be turned on in case of failure.

All three air-cooled machines are located in a central air conveying station and operated via a central control system. Operating data transmitted via profi-bus can be monitored on screen or printed. The plant switches monthly between the

two pulverized coal storage and conveying systems. A switch between the systems takes place if one system has worked four weeks in a row, 24/7 without interruption. Since 2008, the Delta Hybrid has therefore completed twelve four-week phases of nearly 700 hours of work under load. This has resulted in 8000 hours of operation.

A Global Novelty

The Aerzen Delta Hybrid series is a unique and innovative idea. Conventional rotary lobe blowers only previously achieved reliably pressures of up to 1 bar (15 psi). Single stage screw compressors were designed for higher pressures from 2 to 3.5 bar g (30 to 50 psig). While very efficient, these machines were 'overkill' and the investment too costly at low pressures.

The new oil-free compressing Delta-Hybrid series by Aerzener Maschinenfabrik fill this gap because it combines the advantages of both technologies. However, plants in need of low pressure systems tend to use blowers and those in need of high pressure systems use screw compressors.

The new Delta Hybrid series was designed for all applications where air and neutral gases need to be compressed up to 1.5 bar (22 psig) such as in sewage treatment plants, in the chemical industry, in power plants, or for the pneumatic transport or unloading of powders. This new rotary lobe compressor series has been successfully tested for three years in a variety of applications under harsh conditions in plants of Aerzener customers. All of the field test units were continually



The rotary kiln which produces up to 3500 metric tonnes of cement clinker per day.

monitored by Aerzen's remote control. The new series is available with flow rates from 10 to 70 m³/min (350 to 2500 cfm) for air, positive pressure and vacuum applications in a pressure range of 0 to 1.5 bar g (0 to 22 psig) and a vacuum range up to -0.7 bar g.

The new modular Aerzen Delta Hybrid offers important advantages:

- A very attractive price-value ratio, well below the investment, energy and maintenance cost of a comparable turbo or screw compressor.
- Significantly improved power efficiency with energy savings of up to 15 per cent compared to conventional systems.
- Low maintenance and service costs.
- Robust bearing design (rated for 60000 hours even at maximum capacity).
- Low air-outlet temperatures thanks to excellent heat management, compact design, belt drive, automatic belt tension with motor hinged plate, side-by-side setup, front operation, oil check and refilling during operation, low noise level, optional control AS300 Aertronic, and suitable for outdoor installation.
- Very wide control range (25 to 100 per cent) and easy to use and service.

Right-sizing would make it possible to use less air and a smaller motor, the demand of electricity even further. The plant is currently equipped with a 110-kW motor. According to the latest calculations, a 55-kW motor would have sufficed. The unit would be equipped with a smaller motor and a lower belt drive transmission ratio. This motor change is entirely unproblematic in the new belt-driven Delta Hybrid.

That type of change would be problematic in a direct-coupled system. "The proposed new conveying line design will enable us to shorten our conveying line in the near future, which will lead to a further reduction in pressure. With a further reduction in drive power, we will be able to precisely adjust the delta Hybrid unit to our specific needs and operate the plant extremely efficiently" said Peter Reiter, mechanical maintenance manager at the Rohrdorf Cement Plant.

Low energy costs are of central importance in the selection of a blower or a compressor because they can amount to 90 per cent of the total cost, while the initial investment and maintenance costs account for the remaining 10 per cent. ■



One of the Aerzener Delta Blowers installed at Rohrdorf Cement.

Robust and Energy Saving

The new Delta Hybrid unit in Rohrdorf's cement plant now constantly supplies 43.9 m³ / min (1550 cfm) of air at up to 1.5 bar g (22 psig). Despite a trying environment, the machine has proven its robustness and reliability in its 2 years of operation; the rotary lobe compressor uses 5 to 8 per cent less electrical energy than a comparable screw compressor despite the fact that the system has been oversized.

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