

Bound to the German beer purity law

Oil-free screw compressor with heat recovery used by Alpirsbacher Klosterbräu brewery



Michael Klein

Superior compressed air quality is needed in the production plants of many industrial sectors – including the food and drink sector, where all manufacturers need to be absolutely certain that their products are not contaminated by air containing oil. This explains why the Alpirsbacher Klosterbräu brewery in Germany's Black Forest is now using one oil-free, water-injected screw compressor in place of one oil-free piston compressor, three oil-lubricated piston compressors and one oil-lubricated screw compressor. Speed control and integrated heat recovery cut the amount of energy used by the brewery to generate compressed air by 12 % a year.

Rolling hills, green forests, clear water and unspoilt nature form the backdrop to the Alpirsbacher Klosterbräu brewery. For centuries beer has been brewed here using the famous Black Forest brewing water and a traditional recipe of 100 % natural hops rather than extracts. In earlier days the monks brewed their beer behind the old walls of the Benedictine monastery which now lies in the heart of Alpirsbach and is a listed building. Today the master brewers produce their beer in two modern plants situated on the main street. One of the specialities brewed in plant II at the edge of the small Black Forest town is the Alpirsbacher Ambrosius – a strong beer made from exquisite, local ingredients, brewed following a traditional recipe for Abbey beers. This product, made according to the centuries-old “Reinheitsgebot” (beer purity law) and the other 14 types of beer brewed at the

brewery, are synonymous with purity, quality and naturalness - a requirement that must also be assured through the process technology used. The management therefore assigns maximum priority to the quality and cleanliness of the compressed air, since this can come into contact with the beer. Compressed air is used in the brewery to control valves and as operating air. But it is also used to aerate the herbs and spices and rinse the fermentation tanks.

The air has to be totally free of oil

“In the past, we had two separate compressed air networks to supply the compressed air,” says Hubert Wadislohner, master brewer and plant manager at Alpirsbacher Klosterbräu. One network supplied the oil-lubricated air for the plant and the other was what is known as the sterile air network for the oil-free air which comes into contact with the product. So there was a duplicate setup. “This meant there was always the risk of a pipe being mixed up. Then oil would have got into the product



Hubert Wadislohner:
“We now use between
12 and 20 % less
energy a year.”

and that just can’t happen,” explains the master brewer. Three oil-lubricated piston compressors and one oil-lubricated screw compressor formed the network for the plant air containing oil, while two oil-free piston compressors were responsible for the sterile air. “These supplied compressed air round the clock, even if we didn’t need any – they just guzzled energy.” Minimising energy is now a major topic in all industries. But the generation of compressed air is one area offering massive potential. The brewery had long been toying with the idea of greatly reducing its energy consumption, merging the two compressed air networks into one, only supplying the

Author: Michael Klein works for Almig Kompressoren GmbH in 73257 Köngen, Germany

operating network with totally oil-free compressed air and therefore doing away with the network for operating air containing oil. "When one of our oil-free piston compressors developed a defect, we decided to revamp the whole system," says Wadislohner.

While hunting out the right partner, the master brewer's research uncovered Almig Kompressoren GmbH in Köngen, Germany. Almig is a complete provider in the oil-free generation of compressed air and can provide users with a concept suitable for anything from small piston compressors to 2 MW oil-free compressing turbo compressors.

An initial meeting quickly proved that Almig was up to the job. "As well as their great expertise, we get everything from one provider and don't have to work with lots of different companies. Also the specialists don't just handle delivery and installation, they take on all project planning too," adds Wadislohner. And there was one other important aspect which prompted him to opt for Almig Kompressoren: "They are a local company which brings many benefits with it."

Talking to Almig experts, at first Wadislohner favoured an oil-free, dry-running screw compressor. "But following a lot of advice, we were won over by the principle of "washed compressed air" as is provided by Almig's water-injected LENTO range of screw compressors," he explains. The compressed air is cleaner than the fresh air drawn into the compressor, since foreign particles contained in the inlet air are effectively rinsed out by the cooling circuit water. "And this is a fact confirmed by several renowned, independent institutes in elaborate tests," says Christian Rau, who is responsible for product marketing at Almig Kompressoren. The LENTO range is available in 15 sizes ranging from 15 to 110 kW with both speed control and fixed speeds. Depending on the power output, volume flows of up to 19.5 m³/min can be achieved.

Fresh water on tap

The LENTO system from Almig includes a refrigeration dryer. This is a key element of water treatment and serves primarily as a producer of fresh water. "In terms of compressed air, this

refrigeration dryer is sufficient because we don't have any overground pipes in the brewery," explains Wadislohner. The condensate produced is collected in the refrigeration dryer's condensate drain and is returned to the internal cooling cycle as fresh water. "During start-up the compressor is filled with ordinary tap water and from then on generates its own fresh water continuously," enthuses the master brewer. All the water is exchanged in this way once a shift on average which means that the system is always working with fresh water. And the brewery has no need for an expensive water treatment plant.

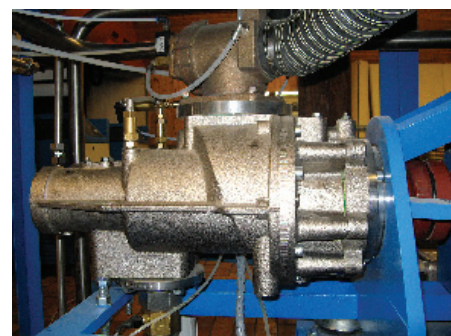
This innovative and simple system delivers key benefits to the brewery. For example, the fresh water produced by the integrated refrigeration dryer is free from limescale. "Viruses, bacteria and algae don't stand a chance in this water. The water also can be discharged to the sewer system without any treatment," says Rau.

Maximum economic viability

Ultimately the brewery chose to install the LENTO 55 system with a volume flow of 7.9 m³/min and this has been up and running since the summer of 2010 – along with the two other existing oil-free piston compressors from Almig. The LENTO system has greatly reduced maintenance costs compared with alternative technologies such as dry-running screw compressors. This is mainly the result of the system's simple setup. The compression stages in water-injected screw compressors operate at a speed four to five times slower than the dry-running variant. These low speeds contribute to longer bearing life and thus also to operational reliability. Compared with oil, water also has a much better thermal absorption capacity. "These compressors have very low final



The LENTO 55 water-injected compressor, offering a volume flow of 7.9 m³/min has been up and running in the brewery since the summer of 2010



The very heart of the system: the compression stage consists of a corrosion-resistant aluminium-bronze alloy



Integrated heat recovery with plate-type heat exchanger

Measuring and analysing

An energy balance system was recently set up in the brewery to measure both compressed air consumption and power consumption. "We can use the software to analyse the results and produce various simulations," says Almig's marketing specialist Christian Rau. Compressors are swapped specifically on the basis of this work. "We simulate and compare data to gain the optimum energy balance for the customer." Two sets of week-long measurements were taken: one at low-load times and one at full load.



The LENTO series delivers a clean and most importantly an economically viable supply of compressed air with input power of between 15 and 110 KW and volume flows of up to 9.5 m³/min

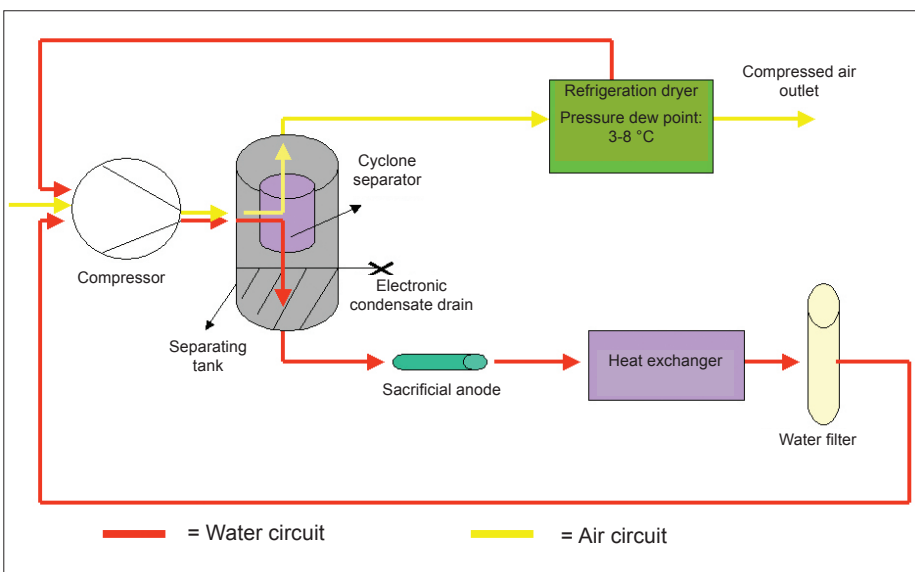


Diagram showing the water and air circuits in the LENTO system

compression temperatures well below 60°C. The compression process is undertaken close to isothermal compression, ensuring better efficiency and therefore great economic viability,” explains Rau.

As requested by the brewery, the LENTO compressor is speed-controlled.

oil-free network,” recalls the plant manager. “When idling, standard compressors without speed control need around 25 to 40 % of the energy consumed under full load – without even generating compressed air. Load / idling regulation of a standard compressor combined with a fluctuating compressed

Minimising energy is now a major topic in all industries.

“Various shift patterns are used in the brewery and our compressed air requirements are changing all the time. So the compressor is always producing the amount of compressed air we need at that time and therefore only consumes the corresponding amount of power,” says Wadislohner. The Almig experts took measurements in advance of the installation and found that consumption fluctuated from 0.4 m³/min to 1.8, 3.4, 4.2 and 6 m³/min. “And that was just in the

air requirement therefore results in expensive idling times.” Almig’s speed-controlled compressor operates at constant operating pressure and doesn’t switch between load and idling but instead continuously adapts the volume supplied to compressed air consumption.

Heat recovery from the very start

“Compressors are like light bulbs,” says

Christian Rau by way of explaining their efficiency. The lion’s share of energy used is generally converted into heat. “So we wanted to have our new compressor equipped with an integrated heat recovery system,” adds Wadislohner. Almig’s LENTO compressor works perfectly at low temperatures. “We pondered how we ourselves could make use of this relatively small amount of heat,” says Rau. The Almig compressor was therefore fitted with an integrated heat recovery system in the factory.

Wadislohner explains: “We use the heat produced by the compressor to preheat water.” At Alpirsbacher Klosterbräu, cold process water from the spring is fed straight into the water reservoir where it has to be heated to 60°C. “We introduce the compressor heat to this water reservoir.” If the cold water enters the stratified tank, it is rapidly heated to 40°C by the stored heat. This takes the strain off the heating system and uses much less gas or oil. “Through this pre-heating, we save a total of €8000 a year. The new system will rapidly pay for itself through this feature alone. We are assuming a payback period of three years.” The actual period has proved to be much shorter.

Modernisation deemed a success

“We now use between 12 and 20 % less energy a year than before”, enthuses Wadislohner. “So we have reached our goal.” The brewery has also been able to do away with its entire oil-lubricated compressed air network and all oil-lubricated compressors have been taken out of operation. Not only does this make production safer, it’s also considerably better for the environment because oil-lubricated screw compressors use huge amounts of oil and the used filters have to be disposed of as special grade waste. In the near future, the brewery is also planning to replace its next oldest oil-free piston compressor. “It is highly likely that we will again opt for a water-cooled LENTO compressor with speed control and heat recovery,” says Wadislohner.

ALMIG 28149520
www.vfv1.de/28149520

Photos: Almig Kompressoren GmbH, D-73257 Köngen