# Transparent supply

## Generate compressed air with maximum efficiency and transparency

Norbert Barlmeyer Is it possible to run a compressed air supply with three compressed air stations distributed across the factory premises and a total of seven screw compressors (two of which are speed-controlled systems) via a single central control with an idle cost share of less than 1%? One can! This is proven by the exemplary solution at Fischer Edelstahlrohre GmbH in Achern-Fautenbach, Baden. There, a single airleader master control from WF Steuerungstechnik GmbH controls all compressed air generation and processing components with the highest possible efficiency and reliability. And it also enables a “transparent compressed air supply” in every respect.




The fischer group, founded in 1969, has developed as a medium-sized family business through a consistent quality policy into a significant global supplier of pipes and components made of stainless steel and special alloys. The group of companies, a classic supplier for the automotive industry and its suppliers and for chemical apparatus construction, with its own production facilities in Achern, Baden, Austria, South Africa, Mexico, the USA, Canada, Uruguay and China and 20 international subsidiaries, employs more than 1,600 people (as of July 2010). At the Achern location, the fischer group produces monthly

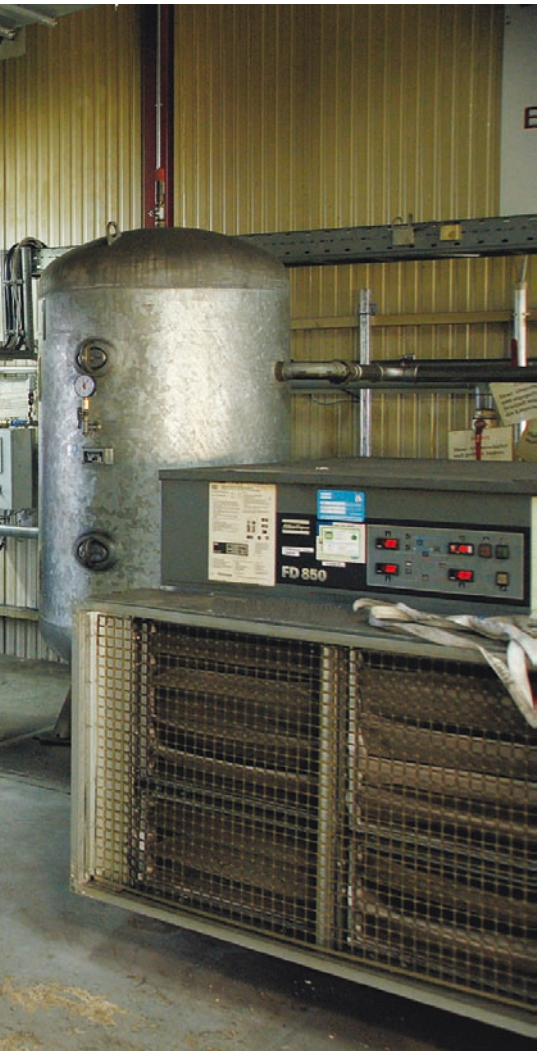
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Around 4,000 t of welded stainless steel pipes with a diameter of 8 to 170 mm using the longitudinal seam welding process. At the customer's request, they are also further processed into a variety of, sometimes very complex, components. In Achern, Fischer also develops and manufactures complex internal high-pressure formed components as well as complete systems for seawater desalination and heat recovery and has its own machine and tool construction.

"Compressed air is essential for our three-shift production. We have the greatest need for blow-out and blow-off work because our customers expect absolutely chip-free, dry and clean products. We also have to always keep our production facilities in optimal condition for dimensionally accurate production," emphasizes Johannes Ganter, responsible for purchasing and safety and environmental protection at Fischer in Achern and has been with the company for over 20 years. When the new plant was commissioned in 1993/94, two uncontrolled screw compressors with nominal outputs of 37 and 55 kW were initially sufficient and were operated with staggered switching points without a higher-level control system. The consequence: many switching points and high, cost-intensive idling rates. Increasing demand for compressed air led to an expansion in 2003 with a second 55 kW compressor and the first speed-controlled system with 90 kW.

### Recommendation for airleader control

This increased the number of available compressors to a total of four systems and the total installed capacity to 92




237kW. Fischer quickly realized that particularly economical operation of this new station was only possible with a higher-level control system. However, the manufacturer of the compressors was unable to integrate the speed-controlled machine into its control system and recommended the airleader control system from WF Steuerungstechnik in Wiernsheim - for Johannes Ganter the decisive step forward.

no. The airleader control immediately operated all four systems in a network based on requirements. She first activated the regulated 90 kW system. Once demand reached the upper end of its optimal performance range, the controller activated one or more unregulated compressors based on demand. Thanks to the availability of systems with drive powers of 37 and 2 x 55 kW, the optimal combination could always be created. In this network, the regulated 90 kW system always operated in the specifically optimal medium power range and, thanks to its wide range of 1.5 to 15 m3/min, guaranteed long load times with maximum energy utilization and negligibly short idle times for the selected unregulated compressors. “At this stage, the airleader control system at the time initially only provided detailed calculations and diagrams about the energy used to generate compressed air. For the first time, not only the cost structure of our compressed air supply became transparent. We recognized e.g. "We also monitored the development of leakage air and were able to initiate effective countermeasures - in short: we already received a very transparent compressed air supply," explains Johannes Ganter.

When the supply was last expanded in 2009, an additional unregulated screw compressor with a drive power of 110 kW and a second regulated compressor with a drive power of 160 kW followed. The supply of the factory network at the Achern location currently consists of seven screw compressors in three stations with a total nominal output of 617 kW (only halls 1 and 2 on the other side of the street are supplied separately). Thanks to the speed-controlled compressors, the concept now has a considerable controlled delivery range of 2.6 to 43 m3/min. The following services are currently installed:

| | Example 1 | Example 2 | Example 3 | Example 4 |
|---|---|---|---|---|
| Operating time/year Bh/year 2,000 4,000 6,000 8,000 | | | | |
| Installed compressor power kW 100 200 250 500 | | | | |
| Taken compressed air index kWh/m3 0.135 0.135 0.13 0.12 | | | | |
| Air requirement/year million m3 1.11 4.44 8.65 27.38 | | | | |
| **Energy saving/year E/year 2,813 11,250 21,094 61,594** | | | | |

**Table 1: Possible energy savings per year (average utilization: 75%; electricity price: 0.075 euros/kW)**




**The airleader master control controls and monitors all seven compressors in the three spatially separated compressed air stations**

- two speed-controlled compressors with drive powers of 90 kW (2.6 to 15 m3/min) and 160 kW (9.0 to 29.0 m3/min);

- five uncontrolled compressors with drive powers of 37 kW, 2 x 55 kW and 2 x 110 kW.

## New airleader master control

However, the previous airleader control could only operate for a single regulated system in conjunction with other uncontrolled compressors. Thanks to the good experiences with the previous airleader concept, it was decided to install an expanded airleader version. Johannes Ganter says: “With the new airleader master control, we can not only control all seven systems in our three spatially separated compressed air stations, we can even monitor them comprehensively from our desk and react immediately in the event of deviations from the target values. On-site inspections now only take place at longer intervals, which reduces our maintenance department’s inspection expenditure to a minimum.” The new airleader master module controls e.g.. via the oil temperature also the oil level and via dew point sensors in the network that the refrigeration dryer is functioning properly. The power consumption for each compressor can even be precisely determined using current measuring devices in the compressors and small three-phase kW display devices. Increased current consumption values enable timely conclusions and reduce the risk of major consequential damage.

In the meantime, even the states of the vibration sensors can be determined

Airleader MASTER displays the air-end bearing readings. Establish baseline values when the equipment is new and monitor them continuously. Exceeding a set maximum triggers an alarm and shuts down the compressor. Werner K. Weidner of WF Steuerungstechnik explains that continuous monitoring has enabled serious damage to be detected early and consequential damage reduced. The MASTER module lowers running costs in the following areas:

- up to 99% reduced idle costs;
- up to 30% reduced maintenance costs;
- up to 50% less wear. A possible savings potential of up to 35% is only offset by additional investment costs of a maximum of 5% for the module. In the Fischer example, these one-off costs for the airleader master control, including additional costs, only corresponded to the compressed air energy costs of a single month of around 20,000 euros. The 50 x 50 x 20 cm (W/H/D) airleader master module with a large LCD display (240 x 128 pixels) is mounted on a wall. The easy-to-use module drives, optimizes and monitors up to

- 16 compressors from all manufacturers and systems, including 2 speed-controlled systems via RS485 connection modules,
- 8 connectable analog modules for auxiliary units (sensors and accessories) via RS485 connection modules,
- 52 connectable sensors via analog inputs (4 to 20 mA). The module adapts itself to changes in a self-learning manner, constantly determining the network dynamics, the network volume and other parameters without complex adjustment, running in, adjusting, etc. All you have to do is enter the delivery quantities of the compressors and the desired pressure range. The system automatically combines different compressors into a unit that continuously adjusts to the current compressed air consumption. That's why the compressed air is always produced by the most efficient compressor combination. The combination works with sensible hysteresis calculation, with minimal idle switching cycles and therefore with the lowest idle times. Thanks to the possibility of connecting several pressure sensors in front of sensitive consumers, the combination always operates in the optimal, particularly low and energy-saving pressure range. The missing performance of a faulty or serviced compressor is immediately replaced by other compressors. “The eight-fold, self-learning calculation depth guarantees constant

The compressors adapt to air demand, reducing load/unload switching from 800-1,000 to 10-20 times per day across the Fischer station. Unloaded power becomes negligible, says Werner K. Weidner of WF Steuerungstechnik. Fewer switching cycles protect bearings and switchgear. Reducing compressor depressurisation to atmospheric pressure also saves air.

The 1 GB data memory collects the ten-second averaged data of all connected compressors and components over four years, which can be read out at any time using a laptop. Even in the smallest module version, up to 20 analog sensors can be connected to monitor compressed air quality (pressure, dew point), cooling water (pressure, temperatures), room air and compressed air balances.



**Johannes Ganter: “All systems now work with the highest possible energy efficiency.”**

be closed. In addition, up to 24 digital inputs for fault or operational messages can be recorded, monitored and visualized simultaneously for complete verification. The easy-to-use module has four RS 485 interfaces and an Ethernet connection. The current module version is no longer connected via cable, but via bus modules with Profibus cables. Two analog inputs and one analog output are available for each compressor. All malfunctions appear in the web-based visualization and are listed in a monthly report. The web server runs as a service on a server at the operator, so that the airleader master control can be accessed on any PC within the network - even with different processing levels if desired.

## Optimal energy efficiency

The data provided by the airleader master control proves the optimal utilization of all seven existing compressors. In addition, the control has made it possible to reduce the pressure when entering the network without limiting performance from an initial 8.4 bar to 7.0 bar, with a 6 before the decimal point being Johannes Ganter's goal. This reduction in pressure alone reduces energy costs by around 10%, because an increase in pressure of 1 bar already requires energy. Additional effort of 6 to 7% is required. In addition, the idle cost share of all seven connected compressors is reduced to less than 1%. Calculations have shown the annual energy savings shown in the table with an average utilization of 75% and an electricity price of 0.075 euros/kWh.

For Fischer in Achern, the data for 27 July 2010 shows that three of the seven available compressors operated throughout the day, while a fourth ran for only 15 minutes. Loaded energy cost EUR 917.08 that day, while unloaded energy cost only EUR 1.45 (0.158% of the loaded cost). “Immediately before switching, the controller knows the current compressed-air demand. It determines the average rate of pressure change over eight time windows of different lengths, and uses this to predict demand at the next switching point. On this basis, the compressor configuration for the next switching point is determined, always within the centre of the predefined pressure band,” explains Werner K. Weidner.

## A recommended solution

Johannes Ganter puts it in a nutshell: "The airleader Master module enables our compressed air station to be operated with maximum efficiency. With this control we can optimally control the use of all seven compressors of different sizes despite being installed in three stations. All systems now work with the highest possible energy efficiency. Thanks to the negligible idle share, our idle energy costs are now well below 0.5%. In addition, the airleader master control enables a “transparent compressed air station” thanks to the large number of data and control functions provided and reduces maintenance and repair costs. With this control we have our compressed air supply firmly under control in every respect. Because we are absolutely convinced of the airleader concept, we have already recommended this solution to others.”

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