Pumps + Systems
Compressors, Compressed Air and Vacuum Technology

Pumps and Compressors for the World Market 2020

with Compressed Air and Vacuum Technology

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VDMA

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Pumps and compressors are needed everywhere – even in difficult times

Dear customers, dear readers,

Dr. Sönke Brodersen

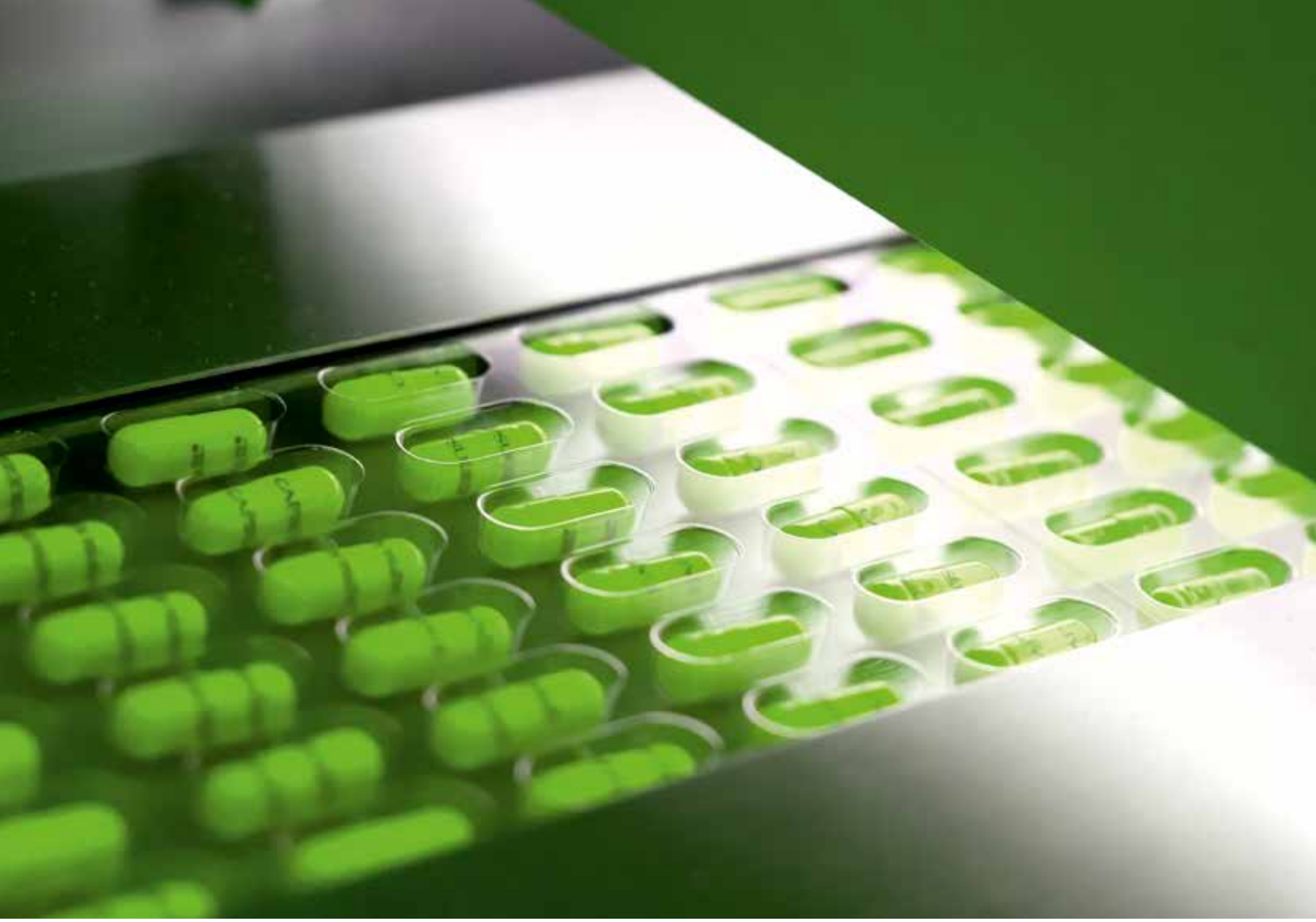
Alexander Peters

At the start of the year, German industry breathed a sigh of relief. Major sources of uncertainty, such as the trade conflict between the USA and China and the upcoming Brexit, which had both slowed the economy in Germany considerably in 2019, appeared to have been at least partially mitigated by an agreement in the trade conflict and the United Kingdom's long-awaited exit from the European Union. But the sense of relief did not last long – it soon became clear that the effects would last and that protectionist tendencies are continuing to grow around the world. They are joined by industry-specific uncertainty, such as that faced by the automotive industry in particular. This is all putting pressure on mechanical engineering – a traditionally very export-oriented industry that is expected to see a fall in production once again this year, according to VDMA figures. In view of the global spread of the corona virus, we are facing completely new challenges that are difficult to assess.

However, our pumps and compressors sector has managed to buck the trend. There are various reasons for this. One is the comparatively low significance of the automotive industry for companies in our sector; another is the continuing good economic situation in the construction industry – one of our key industries. You can find out more about the economic predictions and the tense environment in which we work right at the start of this 12th edition of "Pumps and Compressors for the World Market" in an interview with Christoph Singrün, Executive Director of our associations.

The expert articles from the companies are further impressive proof of just how broad our industry is and how varied its applications. Research and development are constant and intense, always with the aim of optimizing products and processes. The increasing role of digitalization is important in these efforts. Connection, automation and modularity are just a few of the key terms. For the first time, this issue also includes three very special articles. They originated as three presentations that won the Best Paper Award at the International Rotating Equipment Conference (IntRoEquipCon) last September in Wiesbaden, and they are each marked accordingly.

Across all companies, we are continuing to work on convincing the EU of our idea of an expanded product approach for water pumps. This would allow us to reduce the energy consumption of these pumps significantly and thus to contribute to climate protection. You will find



To ensure process and product integrity in sensitive areas of application, the compressed air is treated locally at the point of consumption, also for economic reasons.

Source: Donaldson

Modular compressed air purification enables flexible and economical use

Wolfgang Bongartz

Nowadays, for most industrial manufacturing processes, reliable compressed air purification with a degree of purity tailored to the application is a basic requirement. The growing demands that the manufacturing industry has to meet due to digitalization and the commitment to save energy, have led to the development of a compressed air purification system that combines all process steps – from pre-filtration to drying, to fine filtration and condensate management. In a compact stand-alone design, this system can be used as a plug & work solution.

For the economical use as instrument air or process air, the selection of the purification components downstream of the compressor is of decisive importance. The coolers, impact and cyclone separators, coalescence filters, condensate drains, refrigeration compressed air and/or adsorption dryers and particle filters are arranged in series according to the application profile. This is standard for central purification. This does not rule out decentralized treatment at such consumers who place particularly high demands on the compressed air, because it is uneconomical for many applications to provide high-quality compressed air centrally for the entire compressed air network, especially as contamination with pollutants in the compressed air networks cannot be ruled out. Therefore, to support process and product integrity, especially in the food and beverage industry, the pharmaceutical industry and for the supply of, for example, paint shops, it is not only for economic reasons that an additional treatment stage should be used directly at the point of use.

The new compressed air purification system was developed for these sensitive areas of application, in which the components for prefiltration, drying and fine filtration are combined into a single unit. This provides a compact stand-alone version as a plug & work solution. In addition, the modular design allows a wide range of installation and mounting options in machines and systems. During the development of the system, several requirements had to be met that are essential for direct use: Controlled and consistent quality of the compressed air in accordance with the specifications for the respective application, low-noise and energy-efficient operation, easy maintenance and, finally, the possibility of integrating the control technology into existing production lines.

Also suitable for extreme conditions

The purification system provides the required silicone-free compressed air in constant quality according to the purity classes as per ISO 8573-1:2010 with continuous recording and control of the specified pressure dew point (PDP). During the development phase, the brochure information on dryer designs from various manufacturers was evaluated. Considerable deviations were found. However, since stable adherence to the specified PDP in continuous operation with a pressure dew point control is indispensable for operation even under extreme conditions, such as in food and beverage industries, the pharmaceutical industry and in laboratory applications, the PDP was set to -40 °C (max.up to -70 °C) as standard. This is of particular importance as the dew point temperature varies with changing pressure.

The dryer cartridges filled with a highly adsorptive desiccant are designed for long-life regeneration. The system design with integrated dew point transmitter, which measures directly in the compressed air flow, proves to be particularly energy-efficient. Switching between the two cartridges is only carried out when the desiccant is absolutely saturated. This minimizes the compressed air requirement of this heatless regenerated adsorption dryer, which, in contrast to heat regenerated dryers, does not require any heating energy for the regeneration process.

Source: Donaldson

Figure 1: The compressed air purification system enables digital control and maintenance integration as well as adaptation to the various installation and mounting conditions.

The noise emission level during the switching process was reduced to the range of 60 dB(A) with a newly developed silencer. This makes this compressed air dryer so quiet that it can be used directly at the workplace without sound insulation or integrated into machines without increasing their noise level.

The modular design allows a wide range of installation and mounting options in machines and systems.

Less energy consumption thanks to large filter surface

The differential pressure that is created when filtering compressed air is significantly influenced by the new filter medium. It consists of coated high-tech fibers which are processed into a pleated filter medium with a high separation efficiency of liquid particles and a large absorption capacity for solid particles. The multi-layer structure has been designed in such a way as to achieve optimum flow conditions and at the same time to provide a filter surface area that is over 400 percent larger than that of wound filter media. For the separation of oil aerosols, an efficiency of ≥ 99.9 % according to ISO 12500-1:2007 is achieved. The filter performance data according to ISO 12500-1 and ISO 12500-3:2009 have also been validated by an independent institute for energy and environmental research. The fact that this high filtration performance was achieved, while simultaneously reducing the differential pressure by a further 50 percent, underlines the successful development of these filtration technologies to increase energy efficiency and conserve resources.

Source: Donaldson

Figure 2: 1. Dryer inlet, 2. Integrated UltraPleat™ prefilter, 3. Condensate drain, 4. Desiccant cartridge, 5. Electronic control, 6. UltraSilencer, 7. Dew point transmitter (Superplus version), 8. Integrated UltraPleat™ afterfilter, 9. Touch display, 10. Dryer outlet

The energy-saving filters used in this system therefore ensure optimum filtration performance at low differential pressure. When the compressed air enters the unit, the prefilter effectively separates or retains liquid and solid particles before the air flows into one of the two desiccant cartridges. The afterfilter, which removes solid particles down to 0.01 µm, is the effective safety element to ensure that the dry compressed air is available in accordance with the purity specifications.

The use of these energy-saving filters is worthwhile. This is shown by the example of the DF-S1100 compressed air filter type: If it is operated for 8,000 operating hours with a volume flow of 1,000 m³/h at an operating overpressure of 7 bar, the differential pressure is reduced by 190 mbar to 180 mbar, measured in the oil-wetted state. This corresponds to a saving in energy costs of approx. EUR 1,460 per year at an electricity price of 8 cent/kWh.

Modularity extends areas of application

The components for processing compressed air must also adapt to the modular machine concepts and customer-specific solutions. This can be seen very clearly in the example of the very complex packaging and filling technology in food and beverage production. Here, technologies from different innovation cycles often have to be linked together. This can be achieved most

effectively with modular designs that allow flexible adaptation to the rapid changes in market conditions and offer maximum productivity. Special demands are placed on compressed air purification systems. In this field of application, compressed air is not only used for pneumatic controls and as energy for a large number of actuators, it must also be available in continuous operation as safe, high purity and sterile process air in filling processes or for generating nitrogen on site.

Companies that need clean, inert N_2 gas, for example for modified atmosphere packaging (MAP) or for laboratory use, and want to be independent of external gas suppliers, can produce this economically with the Nitropac series of nitrogen generators. The new system with adsorber module prepares the high-purity Class 1 compressed air according to ISO 8573-1:2010 required for this.

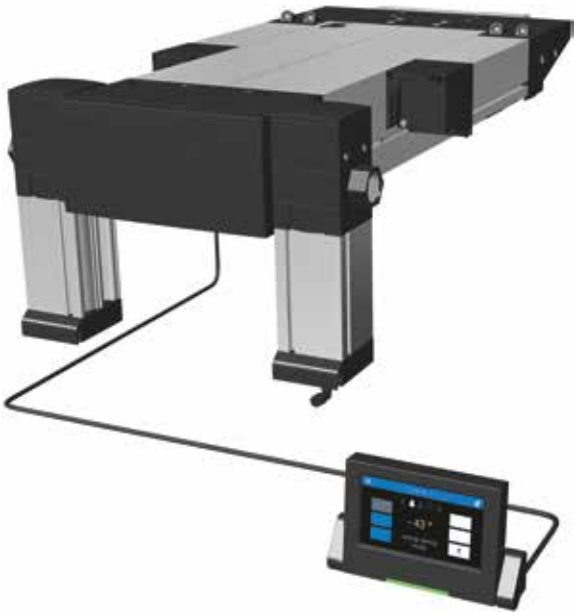


Figure 3: The flexible modularity allows a variety of installation and mounting options. Source: Donaldson

Source: Donaldson

Figure 4: Ultrapac Smart (l.) and Ultrasorp Smart supply the Nitropac nitrogen generator (r.) with high purity compressed air.

The energy-saving filters ensure optimum filtration performance at low differential pressure.

The nitrogen generators are also modular, and the capacity can be increased by adding further adsorber modules. The Nitropac meets purity levels from 95 to 99.9995 percent and can generate nitrogen flow rates from 40 to 2,025 l/min. Oxygen and other gases are separated by molecular adsorption, so that nitrogen is then available in high purity. An energy saving mode ensures that compressed air production is stopped or reduced when nitrogen is not required.

High-quality compressed air even in continuous operation

Another large field of application is plastics processing. As the moisture of the material has a decisive influence on the quality from preparation to processing, the reliable generation of clean, dry compressed air in continuous operation is just as necessary as the continuous recording and control of the specified pressure dew point (PDP). In this way, it is possible to reliably maintain the processing humidity specified by the raw material manufacturers in the drying process. If one considers that the properties of molded parts are negatively influenced by even slight deviations from these specifications and that the water content of the granulate also fluctuates with the seasons or climatic zones, the importance of compressed air quality that is precisely matched to the manufacturing process becomes clear.

How the compressed air preparation system can be used even under very individual conditions is shown by an application as a standalone version in a scientific laboratory for the investigation of nanostructures. Its task there is to bring the compressed air to a PDP of at least -40 °C so that it can then be used as dried purging air. The purging air circulates the nitrogen introduced in the crystal diffractometer. The diffractometer is used to measure crystals at the molecular level and display them spatially. If the drying of the air fails, the samples freeze, and the measurements cannot be performed. Although the previous models already provided the necessary PDP, the new system scored points in other requirements: quiet operation directly at the workplace with the new silencer technology in the range of only 60 dB(A), higher efficiency thanks to energy-saving filter technology, and up to 90 percent less regeneration air required thanks to the dew point-controlled, load-dependent operating mode.

Digitized applications possible

The greatest challenge in developing such a system was to make it compatible with existing plant technologies and processes for a wide range of applications while maintaining the same performance – whether as a standalone solution or a modular solution. This was

achieved by the flexible design and compatible sensor and control technology. A removable display allows convenient monitoring even in tight spaces. For safe operation it is crucial that a level of digitalization is achieved with this compressed air purification system, which allows continuous monitoring of the functional processes and predictive maintenance of the easily accessible components.

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Source: Donaldson

Figure 5: Stand-alone version (below) in laboratory use