

# **Working With Clean Compressed Air**

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Two key factors play a major role in compressed air generation: high availability of clean compressed air and compressed air generation at reasonable cost. Newly developed synthetic compressor oils have proven their worth in practice. Long oil lifetime, high efficiency and a very low oil content in the compressed air combine to reduce operating costs considerably.

Compressed air is the fourth energy utility after electricity, gas and water. Few production lines in the world would run without it. The majority of compressed air is provided by oil-injected screw compressors and the compressor oils play a major role in generating clean compressed air in an energy-efficient way. They account for less than one percent of the cost of compressor operation; however, the right oil helps save a considerable part of the total cost. The oil has three key functions: First, it ensures that the rotors and rotor bearings in the compressor are lubricated; second, it dissipates the heat of the compression process; and third, it forms a sealing film at the seal edge between the rotor and the compressor casing.

For efficient and trouble-free production, an oil with long service life and good temperature behavior with low residual content in the compressed air is required. However, there are considerable differences between the performances of different compressor oils. A well-formulated synthetic product has considerable advantages over mineral oil-based products and particularly stands out for optimum oxidation protection, good adhesion and low residue formation. It is important to consider synthetic and NSF H1-registered products because of their considerably increased performance compared to conventional compressor oils.

### **Benefits of synthetic compressor oils**

Special oxidation-resistant compressor oils ensure reduced maintenance costs, higher compressor availability, reduced total cost for oil, oil filters and oil separators as well as reduced disposal costs. Furthermore, the right compressor oil increases compressor performance with the same power input owing to its high lubricity base oil combined with the optimum additive package. During the compression process, this product will avoid decomposition, oxidation and residue formation of the oil.

There are several factors which affect the oil in the compressor: high pressure, continual intake of fresh air, high temperatures, considerable shearing forces, particle intrusion and atmospheric humidity.

All these factors cause aging of the oil, which shows mostly as oxidation. At temperatures between 90°C and 100°C or more and under continual oxygen intake, organic acids produced by oxidation quickly decompose, or rapidly age, the oil. The concentration of such acids is expressed by the so-called neutralization number. The lower this value, the lower the extent of oxidation. The right products ensure a

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low neutralization number through carefully selected high-quality additives.

Condensate produced by air humidity is another factor leading to high maintenance costs as it must be processed prior to disposal to the sewage system. Unsuitable oils or low-quality additives lead to emulsification of the condensates, making it impossible to separate oil and water in a normal separator, requiring more expensive condensate separators, increasing cost. Particularly in the food processing and pharmaceutical industries, the oil content in the compressed air must be as low as possible and compressor oils must be registered as NSF H1.

### **Saving real money**

A leading sausage manufacturer was having trouble with its NSF H1 compressor oils. Oil service life of fewer than 1,000 hours caused high maintenance costs and frequent downtime. Following precise analyses, they were recommended to perform an on-line cleaning of the compressors and changeover to an NSF H1-registered synthetic compressor oil. After cleaning, the compressor could be operated up to 15 Kelvin cooler than before. Additionally, the cooler no longer required an annual strip and clean. The operating hours increased to more than 4,000 and maintenance costs were decreased considerably while the oil price was comparable.

NSF H1-registered synthetic compressor oils are especially developed for compressors in the food processing and pharmaceutical industries where compressed air can have contact with the end product during the production process. With NSF H1 registration and certification according to ISO 21469, these oils support manufacturing plants in their compliance with demanding hygiene requirements. These oils show very good resistance to oxidation, meaning that the presence of oxidation residues or lacquer in the compressor is minimized.

Oil change intervals can be extended, e.g. up to 5,000 operating hours in oil-injected screw-type compressors. Besides reduced maintenance and operating costs, this enables higher operational reliability.

### **Easy compressor cleaning**

Mineral oil-based compressor oils can cause varnish and carbon buildup, especially in oil-injected screw compressors and rotary vane compressors, which settle in the entire oil circuit. In hydraulic systems, mineral oils can cause gluing of valves on hot surfaces, resulting in high energy consumption, clogged oil ducts and filters, and high maintenance costs and downtime.

Concentrated conditioner fluids that contain synthetic ester oil and cleaning additives can be substituted in a concentration of 10 percent to the oil filling 60 hours prior to the next oil change and run normally. The cleaning concentrate dissolves residues on the surfaces while the compressor is in operation and ensures that they remain dissolved in the oil to be flushed out at the oil change. This method is much more effective than flushing the compressor with normal compressor oil.

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An operator can easily determine if and when an oil change is necessary with a test method kit to check the aging condition of compressor oils. The kit uses the breakdown acids in the oil to indicate by color the extent of oxidation of the used oil. Alternatively, a full used oil analysis can be performed to determine any contamination and wear in the unit.

### **Conclusion**

Practical examples show that changeover to fully synthetic compressor oils can be made very easily. Oil service life can be considerably extended and compressor performance increased to save costs and valuable resources.

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