Working with Clean Compressed Air

Two key factors play a major role in compressed air generation: high availability of clean compressed air and 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.

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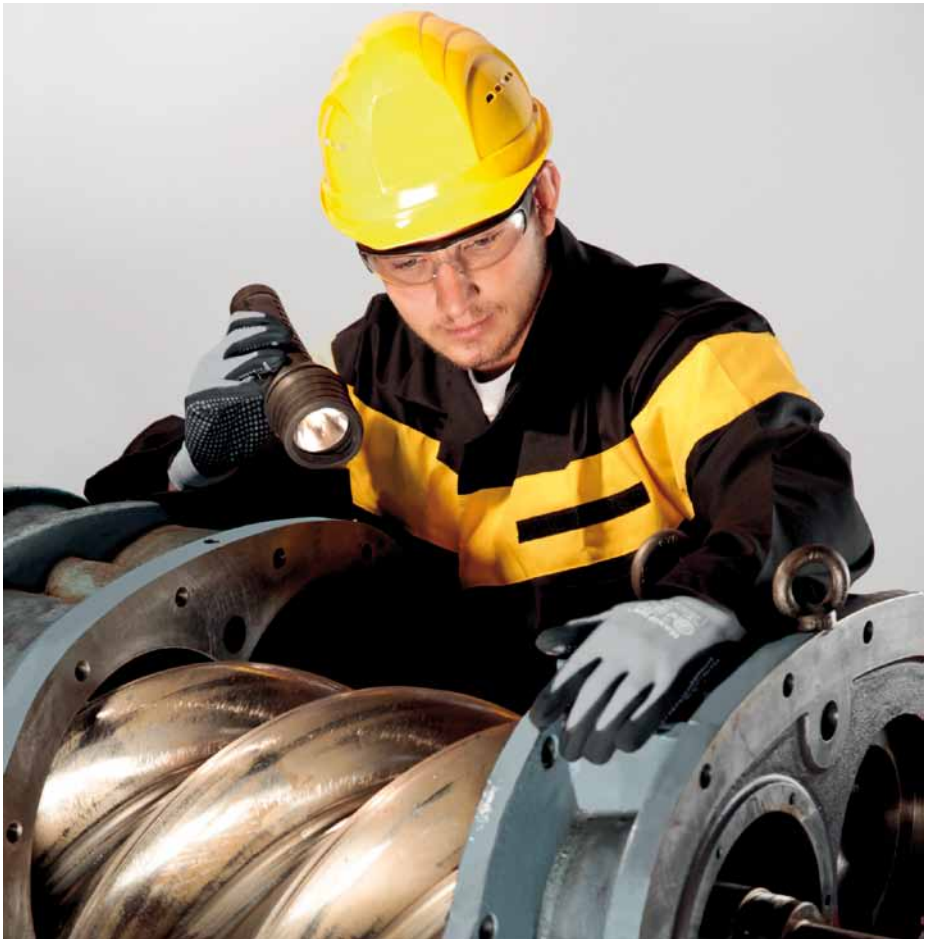
Compressed air is the fourth energy utility after electricity, gas and water. Few production lines in the world would run without it. The majority of compressed air is provided by oil-injected screw compressors and the compressor oils play a major role in generating clean compressed air in an energy-efficient 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.

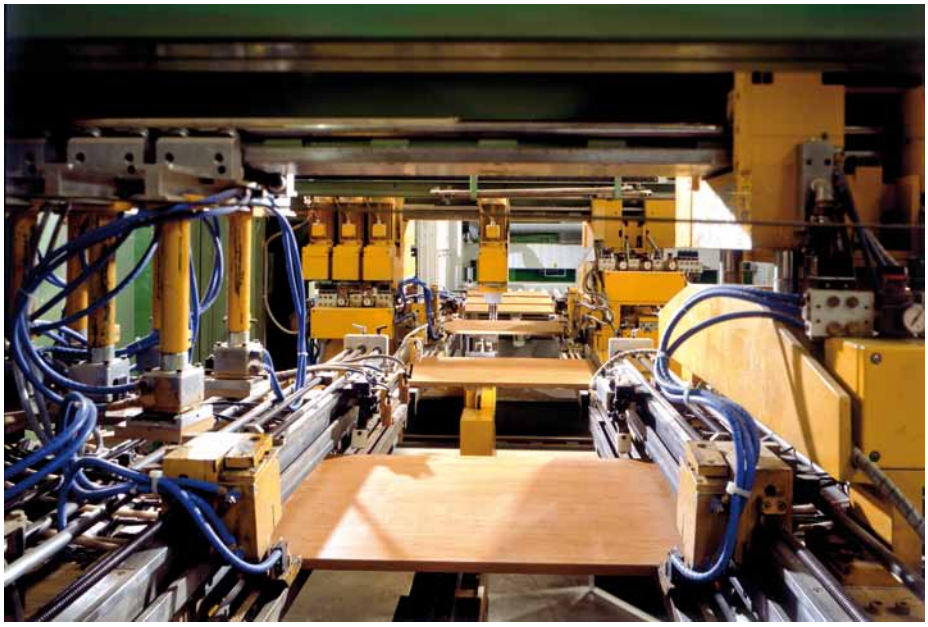
For efficient and trouble-free production, an oil with long service life and good temperature behaviour with low residual content in the compressed air is required. However, there are considerable differences between the performances of different compressor oils. A well-formulated synthetic product has considerable advantages over mineral oil-based products and stands out in particular for optimum oxidation protection, good adhesion and low residue formation. The newly-developed synthetic oils stand out 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



If and when an oil change is necessary can easily be determined with the Klüber Summit TAN kit.



Oil service life in compressors used by a manufacturer of particle boards could be quadrupled.

the compression process, this product will avoid decomposition, oxidation and residue formation of the oil.

A compressor basically "destroys" the oil during operation, with several factors having an effect on the oil: high pressure, continual intake of fresh air, high temperatures, considerable shearing forces, particle intrusion and atmospheric humidity. All these factors cause ageing 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 the oil. The concentration of such acids is expressed by the so-called neutralisation number; the lower this value is, the lower the extent of oxidation.

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, which requires more-expensive condensate separators and increases 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.

Convincing in Practical Operation

A leading sausage manufacturer was having trouble with his NSF H1 compressor oils. Oil service life of less than 1,000 hours caused high maintenance costs and frequent downtime. Following precise analyses we recommended on-line cleaning of the compressors and changeover to synthetic 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 over 4,000 and maintenance costs were decreased considerably while the oil price was comparable.

Some synthetic oils have been developed especially for compressors in the food-processing and pharmaceutical industries where compressed air can contact 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. Synthetic oils show very good resistance to oxidation, which means that the presence of oxidation residues or lacquer in the compressor is minimised. 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.

Another example is a manufacturer of particle boards. Compressor oil changes were required after 2,000 operating hours and the recommendation was to change to synthetic compressor oil. After 8,000 operating hours the used oil analysis in the laboratory revealed that additive degradation in the oil had started, however the oil would not have to be changed for another 2,000 hours. Hence, the oil service life was five times longer than with the previously used compressor oil. Summing the total costs for oil change, disposal, oil filters, oil separators and maintenance, the premium product turns out to be the most cost-efficient one. The total cost calculation in the above example reveals considerable cost savings. More compressed air can be produced with the same energy consumption (improved specific performance).

Special synthetic oils have been developed especially for the lubrication of heavily-loaded air compressors with projected oil change intervals of up to 10,000 operating hours (under normal operating conditions). They are neutral towards most elastomer seals used in air compressors. Special inhibitors keep compressors clean on the inside to avoid cleaning costs and unplanned compressor downtime.

Easy Compressor Cleaning

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

Effective ester oil based cleaning concentrates with cleaning additives are available, they are used in a 10 % concentration in 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. The operator can easily determine if and when an oil change is necessary with quick test kits to check the ageing condition of compressor oils. The test uses the breakdown acids in the oil to indicate by colour the extent of oxidation of the used oil.

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. ■