Basics of Rotary Screw Compressor Lubricants

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Lubricant is a critical component in rotary screw compressors. Understanding the characteristics of lubricant types helps ensure their proper application and increases customer satisfaction by extending the service life of compressors. Below we discuss the types of lubricants and then discuss factors that reduce the effectiveness of lubricants and cause premature wear or damage in rotary screw compressors.

Types

There are seven basic types of lubricants used in compressors today. Each type of lubricant has advantages and disadvantages for specific applications.

These are:

1. Mineral oils
2. Synthetic hydrocarbons
3. Organic esters
4. Phosphate esters
5. Polyglycols
6. Silicones
7. Blends (Semi-synthetics)

Mineral Oils

Mineral oils (petroleum oils) have long been used in various types of compressors. Their use in rotary screw compressors was common until the 1980's. Some manufacturers factory filled with motor oil and some used automatic transmission fluid. Mineral oils began to lose favor when oil recyclers began to charge for oil disposal. With oil change intervals as low as every 1000 hours, many manufacturing plants had to change eight times per year. An advantage of frequent oil changes is that contaminants in the compressor are removed with the waste oil. In highly contaminated environments, mineral oil is still used for this reason. Mineral oils have the disadvantage of a complex mix of natural hydrocarbon molecules. There are waxes that solidify at low temperatures, volatile components that vaporize and natural mineral oils tend to oxidize quickly, forming varnish and sludge, when exposed to high temperatures and elevated pressures.

Synthetic Hydrocarbons

Synthetic hydrocarbon lubricants are engineered for particular applications. For compressor applications, polyalphaolefin (PAO) base stock is most commonly used. PAOs provide many of the best lubricating features of a mineral oil without the drawbacks. Although PAO components are derived from petroleum base stock, they are chemically re-engineered to have a consistent, controlled molecular structure of fully saturated hydrogen and carbon. Because their molecular structure is homogeneous, their properties and characteristics are predictable. PAOs separate from water extremely well, are chemically stable and have low toxicity. PAOs, however, are not good solvents. The additive chemistry must be adjusted for that fact. Additive packages in PAO lubricants are usually blended to beyond their saturation point at cool temperatures. Under the normal operating conditions of compressors, this is not a problem. The elevated temperature and constant motion keep the additives dissolved. When PAO lubricants are stored for prolonged periods of time, it is possible for some of the additives to condense and cause the lubricant to have pockets of cloudiness in the storage container. These additives will return to solution with a bit of agitation/stirring. In a paper presented to an engineering meeting in Sweden several years ago, a major bearing manufacturer shared results of