



Compressor Lubricants

Facts About Varnishing and
Air Compressor Performance

Toll Free: (800) 333-6650

There are a number of choices available in air compressor lubricants. Those of you who work with Blake & Pendleton know that our number one lubricant recommendation for any rotary screw air compressor is the polyglycol based Sullube. Reasons for this reach beyond that fact that it is a product that we offer. We have other choices, as do you, but our commitment is to provide you with products that maximize equipment protection so that you realize cost savings.

There are many benefits to using polyglycol lubricants over hydrocarbon based fluids: polyglycols are non-varnishing, they have a higher flash point than hydrocarbon fluids, compressors will run cooler under normal conditions and will be easier to start in cool or cold weather. We should open this topic with a discussion on the significance of a non-varnishing lubricant. For those of you who have not yet experienced it, varnish has been an issue with rotary screw air compressors since their inception. In a hydrocarbon based fluid (remember that word, hydrocarbon) when new and at ambient temperatures, all of the components of a lubricant are liquid.



New Rotors

However, at elevated temperatures and in the presence of high concentrations of oxygen, some of these components will begin to solidify. These newly formed solids will plate the "wetted" parts of an air compressor, insulating them to where the lubricant cannot effectively transfer heat. As the operating temperatures rise, so do the number of solids. This becomes a self-generating cycle. As solids multiply, the heat intensifies, as the heat intensifies, more solids are generated – you get the picture. The accumulation of these types of solids is called varnish. Polyglycol/ester blends are fully synthetic and contain no hydrocarbons. Therefore, they will not varnish.

Back in the days when hydrocarbon-based automatic transmission fluids and torque fluids were the recommended lubricants for rotary screw air compressors, varnishing was an everyday issue. There were a lot of replacement airends and spare parts sold to users because of this. In addition, a product called Therma-Solve was popular. Therma-Solve was used on a regular basis as part of end-user preventative maintenance programs to remove varnish from air compressors. It was sold in many instances to users who realized that varnishing was a real problem and that it needed to be addressed before compressor failures began to occur. It is indeed interesting to note the number of varnish removal fluids that are still in the market today. Many of these are supplied by manufacturers of air compressors. To give credit where it's due, we can say with absolute confidence that these are all excellent products and do exactly what they say they will do which is remove varnish from air compressors.

This being said, why are these products still needed? The answer is that factory-fill and service lubricants supplied by many major air compressor manufacturers, contains some form of hydrocarbon and air compressors sold or serviced with these fluids are at risk of varnishing. Many manufacturers sell synthetic air compressor lubricants with a polyalphaolefin base, commonly referred to as PAO's. PAO's are the most common synthetic lubricant used in air compressors. Though qualified by definition as synthetic, they are actually petroleum derived. Polyalphaolefin, by definition, is a synthesized

hydrocarbon. Yet it is being used in countless compressor lubricating systems. Although a PAO may be a long life fluid, when failure occurs, its mode of failure is to form varnish. This varnish may result in coated and restricted oil coolers, plugged separators, and even airend failures. Know that there are alternatives if your compressor is using a PAO or hydrocarbon based lubricant. Also know that if there is any form of hydrocarbon in your compressor lubrication system, the potential for varnish formation will always be there. That risk simply cannot be avoided with these types of lubricants.

Operating temperature is another facet of lubricant choice. We have noticed that users who convert their lubricant to a polyglycol-based alternative often report that their compressors operate noticeably cooler. There are specific reasons as to why this occurs. First, the new lubricant cleans existing varnish deposits from internal compressor components. This allows for better heat dissipation from rotors, housings and other compressor components. Second, these products have excellent heat transfer characteristics. The thermal conductivity of polyglycol based lubricants is about 10% better than PAO based lubricants. Field experience



Varnished Rotors

has shown that conversion of an air-cooled machine that is running hot to Sullube will normally lower the discharge temperature 10-15° F.

Heat is generated during the process of compression. Oil-flooded rotary screw air compressors are designed such that most of this heat is taken away from the airend and other components by the lubricant and expelled via an air-cooled or water-cooled oil cooler. Compressors operating with polyglycol base lubricants do not run cooler because there is less heat generated during compression, but instead, they operate at lower temperatures because heat is more efficiently managed. Specially formulated lubricants achieve this more efficiently than other standard lubricants; the result being an overall lower operating temperature. Note that as a general rule of thumb – service life for almost any fluid will decrease by half for every 18°F temperature increase.

Beyond the characteristics around varnishing and heat transfer, polyglycol-based lubricants also exhibit lower carryover rates than PAO based lubricants. Carryover occurs when lubricant passes through a discharge separator element. Every oil-sealed air compressor exhibits some level of oil carryover, some more than others. When compared to a PAO, polyglycol lubricants have three to four times less carryover. This means that there is less need to add make-up fluid to an air compressor and there is less lubricant downstream in system piping, valves, filters and plant production equipment.

There are several choices available for polyglycol-based lubricants. Some are low cost and contain diesters, which is a common lubricant used in reciprocating compressors. When a diester degrades in the presence of water, which is always present, it forms an alcohol and an acid. Analysis of sludge deposits from compressors running on diester fluids have shown to have the metal salts of these acids. These salts tend to plug separators and filters. Their presence could also result in coated or restricted oil coolers and even airend failures. High quality polyglycols are blended with a polyol ester. Polyol esters are best known as jet engine lubricants and because they are expensive, they are used in applications where performance is critical. These blends are free of diesters. Note that Sullube is manufactured by the Dow Chemical Company with specifications that were developed by Sullair and are exclusive to Sullube. Dow produces the highest quality polyglycol base stock available in the market. The fluid additive package is engineered specifically for rotary screw compressors with the longest life components available to handle the wide range of compressor environments.

There are many examples of lubricants that have performed well over the years and for good reason.

PAO based products are a good example of this. Modern refining technology and additives greatly reduce the probability that a synthesized hydrocarbon will varnish in an air compressor. However, the risk cannot be completely eliminated. The only way to totally avoid that risk is to remove the source of the hydrocarbon and replace it with a polyglycol non-hydrocarbon based fluid.

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