



**SA PERFORMANCE**

# Viscosity & Viscosity Modifiers

Viscosity is one of the most important indicators in determining the health of your compressor lubricant. Many of today's lubricant blenders are using low grade base stocks that rely on viscosity modifiers to improve your lubricant's viscosity index. These modifiers are composed of large viscosity controlling molecules. During usage at high speed high shear conditions, these molecules are chopped off or sheared, resulting in low viscosity and compromised lubricant performance. **Using a high-quality base stock such as a PAG fluid or PAO, will assure a stable viscosity index across the lifespan of your lubricant.**

## **What is viscosity?**

Viscosity is a measure of a fluid's resistance to flow. It varies with the type of fluid, and with temperature. Viscosity is usually expressed in centistokes (cSt) at either 40C or 100C.

## **What is viscosity index (VI)?**

Viscosity index (VI) is an arbitrary measure for the change of viscosity with variations in temperature:

- The lower the VI the greater the change of viscosity of the oil with temperature
- The higher the VI less the change of viscosity of the oil with temperature
- The viscosity is more stable with temperature changes

VI is used to characterize viscosity changes with relation to temperature in lubricants. The VI is a characteristic of the specific type of fluid.

For example, traditional Group II mineral based oils will usually have a VI a little over 100. Some types of PAG's and PAO's may have VI's as high as 170. Silicones have VI's over 400.

## **Why Does Lubricant Viscosity Drop in my Compressor Lubricant?**

There are many reasons the viscosity can drop in compressor lubricants. Some of these reasons include:

- Adding a lower viscosity fluid into the sump
- Mixing a non-lubricant fluid, such as a diesel fuel or solvents with the oil
- The use of lubricants that rely on high levels of viscosity improving additives to boost VI, can cause additive break down due to shearing, or breaking the molecules

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### **What is Shearing?**

Shearing occurs when a lubricant experiences very high stress in certain areas, such as oil pumps, shafts or any other mating surface area that squeezes the oil film out momentarily.

Many of today's lubricant blenders use viscosity modifiers because they are using lower grade base stocks. These modifiers are composed of large viscosity controlling molecules, that are chopped off or sheared. These permanently sheared molecules reduce the viscosity and the viscosity index.

### **Why Does Lubricant Viscosity Increase in my Compressor Lubricant?**

Viscosity increase in many fluids is a result of oxidation and cross-linking of the molecules. Think of spaghetti, when the strands begin to stick together. When this occurs, varnish or sludge formation is often the next step. Polyalkylene Glycol (PAG) and Polyol Ester (POE) based fluids do not cross-link to form varnish.

### **What is a viscosity index modifier?**

Viscosity modifiers are polymeric molecules that expand or contract based on temperature. At lower temperatures the molecule chains contract, and have very little effect on the fluid's viscosity. But at higher temperatures, the molecule chains expand and increase the lubricant's viscosity. Think of the molecules as long springs, when they get cold they contract and when temperature is added they expand.

### **How do I keep my viscosity stable?**

By using a high-quality base stock, you can be assured your VI will be stable over the life of the lubricant. For example, lubricants with a Group III base stock will naturally have a higher VI, throughout their life span compared to Group II fluids. PAG fluids, and PAO's may have VI's as high as 170.

### **Should I change fluid if the viscosity drifts from the factory specification?**

Some change is normal. For most applications, an increase or decrease of up to 10% is acceptable, and should not cause alarm. In hydrocarbon fluids, a continuing increase is an indicator of cross-linking and varnish formation, and is usually a good indication for a fluid change.

In some applications, a higher viscosity will also result in increased operating temperatures and energy consumption. Viscosity decrease from shearing is a concern if the viscosity decreases beyond the level specified by the equipment manufacturer, as it may result in inadequate lubrication. PAG fluids will normally increase slightly, but will not form varnish. Slight viscosity increase in these fluids is of no concern.