Temperature vs Lubrication

The primary physical characteristics of lubricants that are affected by temperature include viscosity, viscosity index, pour point and the base oil.

Viscosity

The viscosity of an oil has been said to be the most important consideration when selecting a lubricant. The viscosity of an oil is its ability to flow or its internal resistance to flow. Since oil with a lower viscosity and high potential shear rate must still maintain a sufficient oil film, it is quite apparent that as temperatures rise, the oil film may fail and metal-to-metal contact may occur. If the oil's viscosity is too high with a low potential shear rate, the internal resistance to flow will increase the temperature dramatically, causing an overheated condition, which can also cause a breakdown of the oil film and may cause oxidation of the oil. Therefore, it is critical that oils be selected by always taking the operating temperature of the equipment into account.

Pour Point

The pour point of an oil is defined as the lowest temperature at which a lubricant will flow. It is frequently and erroneously used as the oil viscosity selection criteria. For example, let's say an oil has a pour point of minus 30 degrees C. Most people assume that this means that the oil will flow to the bearings of the equipment even when the ambient temperature is at minus 30 degrees C. This is a fallacy. At best, this oil with a pour point of minus 30 degrees C and operating in an ambient temperature of minus 30 degrees C will merely churn at the oil pump until the churning causes an increase in the oil's temperature. This in turn allows the oil's viscosity to thin sufficiently so that it slowly begins to flow through the oil passages to the lubricated components.

Frequently, this process takes 5 to 10 minutes or more, during which severe damage can occur at various components, because the oil is actually too thick to flow. Do not select lubricants based on pour point alone.

Viscosity Index

The viscosity index (VI) of an oil is the term used to express an oil's "resistance to viscosity change as the temperature changes." For example, an oil that thins out (reduced viscosity) significantly as its temperature increases is said to have a low VI. An oil whose viscosity does not change significantly as it is heated up is said to have a high VI.

This temperature/viscosity relationship is the most critical and important consideration when selecting oils that will be operated in temperatures that change dramatically. Viscosity index is of particular importance when selecting oils for northern U.S. and western Canadian winters or high arctic operations.

Base Oil

The base oil should also be considered when selecting lubricants. Mineral-based (non-synthetic) oils have various bases depending upon their molecular and chemical structure. Base oils can be paraffinic, naphthenic or aromatic, and the selection process should take into account the type of base oil.