Why do oils lose viscosity with use?

Viscosity Index Improvers.

An oils viscosity will decrease as the engine temperature rises. Viscosity Index Improvers are added to reduce this thinning. They are a key addative in the production of multigrade oils.

VI Improvers are heat sensitive long chain, high molecular weight polymers that minimise the viscosity loss of the oil at high temperatures. They work like springs, coiled at low temperatures and uncoiling at high temperatures. This makes the molecules larger (at high temps) which increases internal resistance within the thinning oil. They in effect "fight back" against the viscosity loss in the oil.

"Shearing"

The long chain molecules in VI Improvers are prone to "shearing" with use which reduces their ability to prevent the oil from losing viscosity. This "shearing" occurs when shear stress ruptures the long chain molecules and converts them to shorter, lower weight molecules. The shorter, lower weight molecules offer less resistance to flow and their ability to maintain viscosity is reduced.

This shearing not only reduces the viscosity of the oil but can cause piston ring sticking (due to deposits), increased oil consumption and increased engine wear.

Like basestock quality, VI Improvers also vary in quality. As with many items the more you pay, the better the finished article and more expensive, usually synthetic oils are likely to incorporate better VI improvers. All other things being equal the less VI improver an oil contains, the better it will stay in grade by resisting viscosity loss.

Which oils require more VI Improvers?

There are two scenarios where large amounts of these polymers are required as a rule.

Firstly in "wide viscosity span" multigrades. By this I mean that the difference between the lower "W" number and the higher number is large for example 5w-50 (diff 45) and 10w-60 (diff 50) are what is termed as "wide viscosity span" oils.

Narrow viscosity oils like 0w-30 (diff 30) or 5w-40 (diff 35) require far less VI Improvers and therefore are less prone to "shearing".

Secondly, mineral and hydrocracked (petroleum synthetic oils) require more VI Improvers than proper PAO/Ester (Group IV or V) synthetic oils as they have a higher inherent VI to begin with, this is due to differences in the molecular structure of the synthetic base oils compared to mineral oils.

It is a fact that many synthetics require significantly less VI Improver to work as a multigrade and are therefore less prone to viscosty loss by shearing.