



### **The Truth about SYNTHETICS**

Misunderstanding regarding the difference between mineral and synthetic oils coupled with a genuine suspicion as to what the alphabet spaghetti performance claims mean and why the price range of oils can vary from under £5 a can for mineral to over £50 a can for synthetic is bound to lead to confusion and suspicion and lead to the question:-

**“Are we being ripped off”, or is there more to it?**

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What you need to know about synthetics.

High performance engine oil typically comprises of 15% performance chemicals (detergent/inhibitor additive package), 7% viscosity improvers (to provide multi-grade oil) with the balance being base fluid - mineral, synthetic or other.

The base fluid provides a carrier for the chemical additives, acts as a heat transfer medium and provides basic lubricity.

There are 4 families of base oil;

1. Mineral oil - conventional base oil derived directly by refining crude oil.
2. Hydrocracked – extra highly refined base stocks.
3. PAO - pure synthetic hydrocarbon (SHC)
4. Esters - fully synthesised from a reaction between acids and alcohols.

#### History:

- Traditional engine oils used mineral base stocks with performance additives.
- The first major promotion of a SYNTHETIC motor oil for automotive use can be attributed to Mobil who promoted Synthetic Hydro-Carbon (SHC/PAO), with the brand name of Mobil 1. This oil was a SAE 5w50.

The use of PAO synthetics with their high resistance to oxidation and high viscosity index (less viscosity improver required) that enabled Mobil to formulate an oil with a wide viscosity range i.e. a low (5w) cold viscosity and a high (50), high temperature viscosity.

Mobil 1 and subsequent full synthetic oils have significant performance advantages over mineral oils.

- Better cold flow properties – flow down to  $-50^{\circ}\text{C}$  for rapid oil circulation on start-up.
- Higher thermal stability – reduced oxidation and evaporation-vital for turbo-charged engines.
- Higher film strength – load bearing capacity approx. 6 times that of an equivalent mineral base oil.
- High viscosity index with no shear – maintains its film strength in bearings and between cams and followers.

BUT, the downside is that PAO/SHC synthetics cost around 5 times that of a conventional mineral oil and it is in short supply.

The cost and availability issues forced oil companies into some creative thinking, which resulted in the development of a new form of base oil termed HYDROCRACKED.

The oil refineries strive to minimise waste and aim to maximise the value of any low value by-product. An example is wax (which must be removed from fuels & lubricants to ensure they will flow under sub-zero conditions). This surplus “Slack wax” has little value.

By incorporating new refinery process called “extreme hydro-treating”- the waxes could be processed to produce conventional refinery products and extra highly refined mineral oil.

Hydro-cracked base oil has many improved features over mineral base stocks, but they still have some inferior characteristic:-

- light and volatile components
- waxy and thickening
- a wide range of chemical types with a low/medium chemical structure precision and medium purity.

**Hydro-cracked base oils are better than mineral but inferior to pure synthetics like PAO/SHC.**

They do however have the advantage of being significantly cheaper.

The oil companies who produce or use these types of fluids have tended to perpetuate the spaghetti letters the industry likes to use and such descriptions as:- XHVI;LHC;NCH;MC etc. add more confusion.

The legal position:

The legal position on calling lubricant fluids SYNTHETIC is different in some parts of Europe and in America.

Many years ago, a case was brought by Castrol Germany against BP over claims by BP that their motor oil, formulated with LHC hydro-cracked, was a SYNTHETIC oil. Castrol won the case meaning that if SYNTHETIC is claimed it must be formulated with genuine synthetic, not hydro-cracked.

Some years later-when hydro-cracked materials became widely available in the market place-Mobil took Castrol to court in America over the claims that their oil was a SYNTHETIC when formulated with hydro-cracked stocks. The American court ruled against Mobil & as such opened the "flood gates" for the oil industry to call hydro-cracked stocks SYNTHETIC everywhere except in Germany.

Today, BP own Castrol, Esso (Exxon) own Mobil & Silkolene are owned by the German Fuchs company who use MC stocks.

Therefore HYDROCRACKED (extra highly refined mineral stocks) can legally be defined as SYNTHETIC **but not in Germany.**

Esters.

We have still not mentioned Ester in any detail.

Esters are made from a chemical reaction between acids and alcohols. Unlike the other base oils, they are not derived from crude oil.

They are used extensively for the gas turbine aircraft engines and have certain advantages and certain limitations. For instance, Ester fluids can often be acidic, have high polarity and have a swelling effect on polymeric materials. This latter property is useful since PAO/SHC tends to have the opposite effect.

The downside is that esters are even more expensive to produce than PAO/SHC full synthetics.

The optimum performance comes from a balanced blend of PAO and esters. The esters have a "synergistic response" to each other to provide extra load bearing capacity. It enables the amount of polymer in the formulation to be reduced, (polymer is the additive that gives an oil it's multi grade capability)and this results in greater protection. This will be evidenced by reduced wear on highly loaded bearings, cam shafts etc.

It is the critical balance between the PAO/SHC, the esters and other performance additives that generate the improvement in the performance of a motorsport oil.

Therefore a 10w60 or 15w60 PAO/ester blend will have superior performance to a 15w50 hydro-cracked synthetic blend even though it has a wider viscosity range.

Conclusion.

From an performance point of view, it is important to ascertain whether a given "synthetic performance oil" is formulated from;

- Hydrocracked (XHVI, LHC, NHC, MC etc)
- PAO/SHC
- A blend of PAO and esters.

Hydro-cracked is a lower cost, lower performance solution, followed by PAO/SHC.

**The best performance will be achieved from a blend of PAO/SHC and esters.**

The Millers CFS range of motor sport oils are PAO/SHC/ester blends, using the very latest additive technology.

We are therefore confident that they will provide the best possible performance and protection for your engine.

CFS oils are available in 4 viscosities to suit every application;

i.e. CFS5w40, CFS10w40, CFS10w60 and CFS15w60.

Hopefully this explains what you are paying for when you invest in a premium quality performance oil.