



SYNTHETICS IN THE USA ©2006

In the USA there are a few different types of synthetic base stocks used in engine oils. We will just touch on three in this paper.

The word *Synthetic* is confusing; it describes a process, not a material. For example, White sand is synthesized into glass, but glass is never called “synthetic sand”. Most people *think that ALL Synthetic oils are made of the same base, THIS IS WRONG!* For most of the USA, there are mainly Two types of synthetic oils (or as we like to say, synthetics are DESIGNER oils).

The first type is a GROUP 3. This is a Petroleum oil that is re-refined to deliver a good base oil. The process and end product is the least expensive of the 3 types of synthetics. Actually this type of product was considered a Petroleum oil until a recent legal battle was lost. The molecules are not as consistent in their size as in a PAO or ESTER (mentioned below) but are better than a Group 1 and 2 petroleum oil. The advantages of the G3 are a cleaner base, a higher Viscosity index (ability to flow) and better all around performance.

The second type is a PAO, *short for POLY-ALPHA-OLEFINE* -or easier to understand, it is SYNTHESIZED PETROLEUM oil. It is refined in a special process, or in simple words “synthesized”. It still starts out by being pumped out of the ground. PAO’s are better than regular petroleum oil for handling heat, oxidation, low temperature startups and higher film strength. Drawback, PAO and PETROLEUM are dynamic types of oil, you have to build up oil pressure and have rotation before a film is produced. Better said, you have to HYDROPLANE the engine parts like you hydroplane a car in the rain, to create a film! (Or in the case of water-skiing, you have to build speed for the skier to get up and plane on the water) PAO’s are *NOT VERY* expensive because they are made from *crude oil* and produced in large quantities.

The third type of synthetics is a, *SYNTHETIC ESTERS*. (Diester, Polyolesters, polyesters and complex esters) Motul® uses esters in its products. *ESTERS ARE MOSTLY MADE OF VEGETABLES*, minerals and animal fatty acids. (Motul’s® esters contain a lot of *coconut* derivatives) Esters are much more expensive because the ingredients all have to be collected from natural *RENEWABLE* resources and synthesized (a very expensive process) in smaller quantities. Esters have all the advantages of a PAO but more of them. *ESTERS CAN HANDLE HEAT BETTER THAN PAO’S AND WHEN BURNED, ESTERS LEAVE FAR LESS (COKING) DEPOSITS. ESTERS ARE POLAR/STATIC types of OILS and ARE ATTRACTED TO METAL PARTS WITH AN ELECTRO-CHEMICAL BOND. THIS MEANS NO MORE METAL TO METAL START UPS*, This also means that a film is *THERE BEFORE* The Oil Pressure Light Goes Out preventing Premature Ware Of High-Stressed Parts Like Cam Lobes. The Film created is up to 5 times stronger than petroleum oil..

THE NUMBER 1 REASON TO RUN AN ESTER SYNTHETIC OIL is BOND. The Electro-chemical bond is made because the *ESTER MOLECULE IS POLAR!* Sort of like a refrigerator magnet! It is attracted to metal and it sticks.

THE PAO MOLECULES ARE NEUTRAL and act like a piece of plastic placed on the Frig. They just fall off. FYI, all commercial jet planes use an ester synthetic of some type and not a PAO! You need to run an ester of some sort for maximum protection!

LET'S EXPLAIN WHY HANDLING HIGHER RUNNING TEMPS IS IMPORTANT.

With petroleum oils there is a much better risk of failure from volatility problems than with synthetics. Why?

HAVE YOU EVER BURNED BUTTER while cooking? YES, everybody has burned butter! The running temp or maximum temp is low. When butter reaches its' maximum running temp it starts to evaporate (*volatility*) then it carbonizes and then it sticks to the metal pan. Now compare butter to VEGETABLE OIL in which you deep fry "French fries"! The only way to heat vegetable oil so hot as to make it carbonize, you would almost need a direct flame.

Petroleum oil is like Butter as far as handling heat! And SYNTHETICS are like VEGETABLE oils, synthetics won't burn up and stick to your engine parts or go out the breather as fast as petroleum oils will. (Remember ESTERS leave almost no DEPOSITS if they do burn)

THIS IS THE SECOND REASON to run a SYNTHETIC OIL. (Because you're not supposed to have extreme heat problems everyday)

BASIC TECH POINTS: RACING AND HIGH PERFORMANCE OILS (MOTUL 300V RACING SERIES ARE RATED AS SG/SH, WHILE OR HIGH PERFORMANCE STREET OILS ARE THE NEW SJ RATED.

- Engines, especially air or oil cooled designs need lubricants that can handle higher running temps to INCREASE VISCOSITY RETENTION, while reducing consumption and oil film breakdown.
- High Performance engines always increase the load pressures placed upon moving components. High lift cams and stiffer valve springs load up the lifters, rocker arms and valve ends. Newer designs incorporate gear driven overhead cams which bring a new challenge. More internal gearing will shares the engine oil faster. Because of that, Motul® adds more medium EXTREME PRESSURE (EP) additives such as ZINC and a STRONG EP additive, called a SULFURIZED ESTER to handle the shear / meshing of the engine.

1. EP additives come into play at the instant a medium extreme pressure is applied and high temperatures are created. ZINC lays down a barrier that prevents metal to metal contact and the SULFURIZED ESTER produces a sacrificial film that is destroyed during very strong extreme pressures as it prevents SEIZING. EP additives are generally corrosive especially those used in gearboxes. WE use this ESTER because it is FAR LESS CORROSIVE and more environmentally safe than others that can do the job. (This is what those TV advertised products forget to tell you when you see them test a ball bearing under 100,000 pounds of pressure)

2. To explain it easier, let's take a sandwich wrapped in plastic wrap (the EP additive would be the plastic wrap). If you were to squeeze the sandwich you would contact the plastic wrap with your fingers (your fingers representing the gears) and the sandwich would squish, however, your fingers NEVER actually made contact with the sandwich!

- Performance engines NEED A BALANCED FRICTION MODIFIER PACKAGE! So that the ring seal stays strong, roller and ball bearings roll in the race and plain bearings have as little drag as possible.

NOTE: The SULFURIZED ESTER is a part of this friction reduction package due to its ability to STICK to engine parts (ferrous metals)

- Performance engines used in endurance type of competition need strong ANTI-ACID (BASE) (TBN, total base number)!

1. Condensation (the steam that you see coming out of your tail pipe in the morning) which is a natural by-product of combustion in an engine. This condensation which is acidic water, passes by the rings under compression into the crankcase and mixes with the sulfur, SULFURIC ACID is created. ANTI-ACID (base) neutralizes the acid before it can cause any damage.

- High revving engines need strong ANTI-FOAM ADDITIVES.

1. Higher RPM aerates the oil more.

We must pop the bubble before it causes damage! Why.

- a. Foam is air, air does not lubricate: friction from metal to metal produces higher heat and wear.
- b. Foam is air; air is a better insulator than a transmitter of heat. It does not transmit heat from hot metal parts to the oil very well or vice versa.
- c. Problems - OIL PUMPS DO NOT PUMP AIR!
 1. Oil pressure can DROP!
 2. TEMP'S can RAISE due to inefficient heat exchange

Endurance engines NEED STRONG DISPERSANTS to suspend the combustion by-products that are created and materials rubbed off during normal operations. If you find worn components in your older race engine, ask yourself a question? WHERE DID THE MATERIAL GO?

- a. The parts were beaten or compressed and the material is still there
- b. The materials were rubbed off and washed RIGHT INTO THE OIL!!! We want the material to stay in tiny pieces and stay mixed in the oil, so that the oil filter can do its job. There are many devices on the market now that surround the filter with a magnet to capture some wear metals.

- Race engines NEED A STRONG DETERGENT, WHY? Because of more heat generation (more horsepower per ci) trying to fry the oil onto the engine parts, and added dirt being dropped into the oil from the by-products from combustion.

- Motul SYNTHETICS CAN be mixed with MOST high quality mineral, Group 3, PAO or ESTER synthetic oils, without major problems. Try to stay close to the viscosity range. (I.e. 10w40 mixed with 10w40). If you have mixed oils, Motul Recommend an oil change when you get home from the Event, since the oil additives and base from our oil is now not balanced.

THESE ARE SOME OF THE MAIN ISSUES THAT MOTUL® LOOKS AT WHEN DESIGNING A PERFORMANCE ENGINE OIL.

As discussed earlier, synthetics can handle much higher running temperatures than conventional petroleum oils and can withstand more stress. Many people ask, so what! I don't push my vehicle that hard and I change oil every 1000 miles! I don't need expensive performance oil in my car.

This type of thinking is wrong!!!!

The question we have for you folks is a simple one?

Why do you wear a helmet, Gloves, boots, jacket and WHY do you buy INSURANCE? In case of an accident! Right!! If within the first fifty (50) miles after an oil change, a rock hits your radiator or the thermostat sticks, the water pump stops pumping or whatever causes a major heat problem in your cooling system, what would you rather have in your engine? A mineral oil that acts like butter, that burns up and evaporates very quickly and also carbonizes OR an oil that can handle high RUNNING temps like synthetics (325°f to 367°f).

High quality oils are INSURANCE not only maintenance. The same is true about brake fluids and gear oils.

THE API CONTROLS THE STANDARDS FOR AUTOMOTIVE ENGINE OILS. SJ, SL AND NOW SM MAY NOT BE AS GOOD FOR HIGH PERFORMANCE RACING ENGINES AS THE OLDER SG/SH RATING.

Many SJ/SL/SM rated oils, especially the thinner type are intended for modern engines that use O2 sensors and Catalytic converters. The reason for the newer SJ/SL rating is that with 0w30 and 10w30 oils, you run the risk of more consumption in higher mileage engines. So the ZINC and Phosphorus levels were reduced. If consumption was an issue, the smog emissions components may be damaged from very high levels of these additives.

These (EP) Extreme Pressure additives play a big role in preventing wear in performance engines. HIGH LIFT CAMS, STIFFER SPRINGS, HIGH COMPRESSION PISTONS AND RINGS, HIGER RPM, All require the maximum EP additives.

Careful attention must be placed when designing a new performance SJ/SL oil because other EP additives must be used to their most effective level. Our newest type EP additives have been developed and tested by our racing division in equipment that demand the razors edge in performance. Our new SJ/SL and European factory approved performance oils are the best there is for all around protection and horsepower for modern type STREET engines.

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