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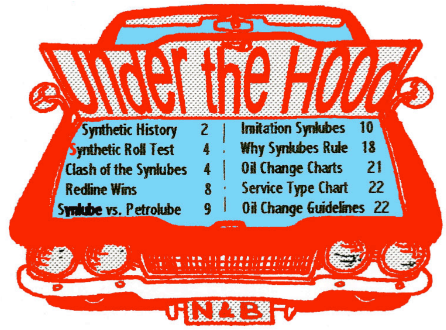


Battle Of The SynLubes

Volume IV Number 4 April 1991

The question of synthetic oil quality is on the minds of many who want the best oil available for their vehicles. When it comes to your auto investment, the higher the quality of motor oil, the better protection your engine has. The cost of motor oil is relatively small when compared to the high cost of engine replacement. If expensive motor oil significantly reduces engine wear and prolongs engine life, the benefits are justified.

Viscosity is a key factor in oil's performance. It is the thickness or "weight," appearing on the can as a number such as "10w-30." Petroleum oils lose considerable viscosity when engine temperatures and RPMs rise. In contrast, synthetics are very resistant to viscosity loss.

For example, the typical 5w-30 petroleum oil is made of a 5 weight base oil. Polymers are added so it will thicken, as it gets hotter. At zero degrees (Celsius) it behaves like a 5 weight oil. At 100o C it behaves like a 30 weight oil. The problem is, at high RPMs and temperatures it will "shear back" to the lower number, a viscosity weight of 5.

High-quality synthetic oils do not shear back. They have natural temperature-resistant qualities, achieving multi-grade viscosities without the need for unstable polymeric thickeners.

When a petroleum oil enters an area of high stress and heavy loading such as a bearing the large polymeric molecules align themselves, creating a path of least resistance. The oil follows this path instead of coating the entire surface. Viscosity quickly drops and the oil begins shearing back to the base number.

The viscosity of an oil is one of its most important qualities. If it thins out, bearing surfaces will touch (collapse), result in a in metal-to-metal contact. This causes bearing wear. Camshafts will gall while pushing on the cam followers without lubricant as a cushion. Cylinder walls also are subjected to high forces, resulting in piston and ring wear.

It is obvious that synthetic oils offer the best protection. But are all the synthetic lubricants alike? To answer this question, comparisons were made of several synthetic oil base stocks by an independent testing laboratory using several industry-standard test methods.

Not all synthetic oils are composed of the same materials. Basically, there are three principal synthetic fluids:

1. Polyalphaoleflns: Wide range of temperature stability and usually the less expensive to manufacture.

2. Diesters: Good low and high temperature stability, high film strength, good metal wetting and will easily accept additives.

3. Polyol Esters: Many of the same performance characteristics of Diesters (dibasic esters) but even greater high temperature stability. The only base fluid qualified for use in jet aircraft turbines.

You can't characterize any of today's synthetics by a single base fluid. They all use varying proportions of the above and, believe it or not, they all need petroleum to manufacture the final product.

TEST RESULTS:

The following tables represent the independent lab tests of five brands of synthetic oils. The sample oils used were the best available from each company. In the cases of Amsoil, Redline and Valvoline, racing oils were used, which are as good as, or better than, any other products sold today by these companies.

This table represents comparisons of friction coefficients using the four-ball method. In this test where four shiny steel balls are subjected to a hydraulic press and the coefficient of friction is measured. The less friction, the better. Rated from best to worst:

RED LINE 20w-50 Synthetic Racing Oil	0.068
AMSOIL 20w-50 Synthetic Racing Oil	0.071
VALVOLINE 20w-50 Synthetic Racing Oil	0.078
MOBIL-1 15w-50 Synthetic Oil	0.084
QUAKER STATE 5w-50 Synthetic Oil	0.091

This table represents the load wear index tests following the American Society of Testing and Materials (ASTM) test D-2596. It shows the ability of a lubricant to handle loads similar to those placed on bearing surfaces. The higher the number, the better.

The following table represents the Falex Wear Test, ASTM D-3233. This test utilizes a rotating shaft which is squeezed on both sides by two metal blocks, demonstrating the ability of a lubricant to prevent metal-to-metal galling. The greater the load, the better (units are in pounds).

RED LINE 20w-50 Synthetic Racing Oil	53.7
MOBIL-1 15w-50 Synthetic Oil	42.1
AMSOIL 20w-50 Synthetic Racing Oil	41.9
VALVOLINE 20w-50 Synthetic Racing Oil	35.7
QUAKER STATE 5w-50 Synthetic Oil	35.3

Not more than a decade ago, most people regarded synthetic motor oil (synlube) as mere "snake oil." This has changed significantly. Now among the staunchest advocates of synlubes are lubrication engineers, race car drivers, knowledgeable mechanics, vehicle fleet operators and millions of concerned motorists around the world.

Synthetic History

Volume V Number 4 April 1992

Long before man discovered petroleum oil, rendered animal fat, whale oil and vegetable oil were used as lubricants. These oils can be considered the first synthetic oils because they were man-made from ingredients in his environment. It wasn't until the 1860's that petroleum oil became a popular lubricant.

In the 1930's, Standard Oil of Indiana perfected the process of synthesizing high quality lubricating oil from biological compounds such as animal fat and plant seed oil. Even though this new oil was a terrific lubricant, its value was offset by its high cost. Subsequently, the formulas were shelved and began to gather dust in the archives of the U.S. patent office.

During World War II, the U. S. successfully cut off Germany from the rich oil reserves of the Arabian countries. The plan was to starve Hitler of petroleum, a most necessary ingredient for any war machine to function. Without gas and oil, Hitler's army would come to a screeching halt. Gasoline wasn't necessary, because the military tanks and hardware could be retuned to run on alcohol made from corn and other forms of biomass. But there was still a need for lubricating oils.

Using information gained from the archives of the U.S. patent office, Hitler put his best scientific minds to work to produce oils from alcohol and natural gas. Soon, the wheels of his army's machinery as well as his aircraft engines were lubricated by high-quality man-made oils. Rommel was running circles around the U.S. Army because his tanks had superior lubricants and could easily withstand the rigors of the desert heat.

When our troops overtook Hitler's army, they often found Nazi military jeeps and VW's left behind with a rock wedged against the accelerator pedal. The Germans didn't have time to destroy the vehicles and thought that the engines would blow up if left running at full throttle. But because of the incredible synthetic lubricants that were used, the engines merely ran until the fuel tank was empty and died. Our troops refueled them and continued chasing Rommel with some of his own machinery!

During this time, Both Hitler and the U.S. were developing jet propulsion. We were having a difficult time keeping jet turbines from destroying themselves because of the extreme operating conditions they had to endure. The inside of the turbine reached somewhere around 600°F while the outside had to withstand -40°. There wasn't a lubricant made that could take that kind of punishment But Hitler's highly developed synthetic oils were able to operate under those conditions and his air force had the first jets.

After the war, the U. S. military was anxious to get its hands on the German military secret oil formulations. After we captured the German scientific archives in Berlin, their top-secret formulations were turned over to the big five oil companies for further research.

A brilliant chemical engineer named Pete Peterson became America's top synlube expert, working to implement the German formulations. During this time more than two dozen small companies began producing synthetic lubricants for the military, and Peterson consulted with them to bring on the new age of synlubes.

In the late sixties, a fighter pilot named Alvin Fagan retired and started the first synthetic oil company to sell to the general public: All-Proof, of Duluth, Minn. Fagan reasoned that vehicles operating in the harsh northern winters could benefit from synlubes because of their ability to withstand extreme cold temperatures.

Fagan was not a marketing genius and his products were very slow to catch on. He employed another retired pilot, Albert Amatuzio, who had a vision of starting his own synthetic oil company. Amatuzio borrowed money from his brother, Dick, and took the formulations he learned about from Fagan and opened Amzoil across the river from All-Proof in Superior, Wis.

Amatuzio employed multi-level marketing (MLM) strategies for his synlubes similar to those used by Amway. MLM was hot and the company flourished. Meanwhile, Amatuzio's brother, Dick, still owned 40% of the company and, for unknown reasons couldn't get any money for his shares. He ultimately sued and left, leaving a scar between the two that endures today. Soon after this incident, Pennzoil sued Amzoil for copyright infringement, claiming that Amzoil's name was too similar to Pennzoil. They won the suit and Amatuzio had to change the name to Amsoil.

During the same time, John Williams, owner of Pacer Petroleum products, bought a new car for his daughter who was about to go off to college. He wanted to put an oil in the engine that would be able to last for the whole year she was away. So he filled it with new synthetic oils. She told a few friends about the wonderful oil her dad had put in the engine. Soon, the school auto shop heard the story and wanted to talk to her about this new, long-lasting lubricant.

It didn't take long for the local media to get wind of the story. Before he knew it, Williams was flooded with calls from people wanting to know more about this new oil. A man named Sol Levy saw the unique opportunity to join forces with Williams and market this new oil. In 1970 Pacer Petroleum got an SAE grade for the oil and started a division called EON Oil.

All-Proof had been using a formula containing 100% alcohol diester, one of hundreds of esters that were being sold without any wear-protecting additives. Certain diesters will dissolve the zinc coating on engine surfaces and accelerate wear. Unfortunately, Pacer was buying its synthetic oils from All-Proof, with disastrous consequences. Pacer had convinced the city of Houston to run a test on their EON brand using the city fleet of vehicles. Soon after, the engines began having camshaft failures and the city sued EON for engine damage.

A number of Pacer dealers began telling people that EON oil was "better than the big oil brand and without the double cross." They were referring to Exxon motor oil which sued them in 1975 for trademark infringement. Exxon pointed out that EON sounded too similar to Exxon. The case never went to court, but Williams received a settlement from Exxon to facilitate the name change of the company. The settlement (somewhere between 1/2 to 1 million dollars) was supposed to pay for the EON dealer's additional advertising for the name change. Williams pocketed the money, and the dealers received nothing.

Paul Baker, a large EON dealer in California, came up with a new name, mixing the letters to form NEO, and then petitioned Pacer to use the new name. Williams said Pacer Petroleum would use MLM and their synthetic oil under the Ultron name. Norman Lotz was recruited to head up the MLM effort and began undercutting former EON dealers by selling directly to their old accounts. The general idea was to cut EON dealers out of the picture.

Angry about the situation, Baker trademarked the NEO name, and started the NEO Company in California in 1976. His basic premise was to use only the finest synthetic oil ingredients available. Unfortunately, he was still dependent on Pacer for his stock and in 1981; Williams threatened to cut off his supply. Meanwhile, Williams sold the EON division to Morton Thiokol, the rocket fuel company, forcing Baker to begin sourcing his own synthetic base stocks and bottling his own oil.

NEO introduced the first 100:1 2cycle oil, the first synthetic gear lube as well as synthetic ATF. To this day, NEO utilizes the finest base stocks available for their oil. As Baker puts it, "I do not cut corners on our oil, and only use the finest stock, regardless of price."

Meanwhile, during the early seventies, a company called Blaze Oil began rebottling Amsoil and selling it under the Blaze Oil name in the south. Al Amatuzio wasn't interested in that part of the country and was happy to make a profit selling in an area where his company had very little penetration. It didn't seem like synthetic oil - a product especially suitable for cold climates - would be popular in the hot south. But soon, Blaze was selling as much oil in the southern states as Amsoil was in the north. Amatuzio later threatened to cut off the supply to Blaze and was ultimately sued for breaking his supply contract

It was about this time that Amatuzio was taken to task by the federal government for selling synthetic industrial oils with little or no synthetic base stocks. The Feds told him to either stop calling it synthetic oil or put synthetic oil in it. In the mid-eighties, Amsoil stopped using high quality diester base stocks, substituting cheap olefins instead. Even today, it is rumored that many of Amsoil's synthetic products are actually petroleum products with some synthetic added.

The rapidly rising wholesale costs of diester base stocks had synthetic lubricant prices jumping every six months. While all the other synlube companies had to raise their prices, Amsoil was lowering theirs. Amsoil sells their diesel oil to commercial accounts for less than $2 per quart! This was possible by switching to less effective Polyol alpha olefin base stocks. Amsoil dealers began seeing engines sludge up like never before and many stopped using synlubes or changed to other brands of synlubes.

During the seventies, Peter Felice and Tim Kerrigan were working with Pacer Petroleum marketing EON. They were unhappy with Pacer and experienced many problems with miss-labeling, and incomplete additive packages and quality control. They switched to All-Proof. During the demise of Pacer, Kerrigan and Felice started Red Line in California. All-Proof decided to sue them for stealing the idea and started a competing company. Red Line counter-sued and won a $700,000 judgment against All-Proof, which forced them to fold.

WHO'S GOT WHAT

Not all synthetic oils are created equal. In fact, there is a tremendous difference between Amsoil, NEO, Mobil-1, Syntec, Red Line and the other brands. The chief difference is the base stock, which comprises some 90% of the oil. The base stock is the actual lubricant, the other 10% or so is the additive package.

Petroleum oils, or petrolubes, use a complex mixture of hydrocarbon molecules derived from refining crude oil base stocks into more uniform materials. Refineries remove most of the natural contaminants. The worst for the engine, wax, is never entirely removed and is a problem because it is a poor lubricant and reacts to heat by forming damaging byproducts.

By definition, synthetic oil means that it is not made from petroleum. Petroleum oil is a mixture of hydrocarbons. The refining process, (an extraction procedure, rather than a synthesis procedure), extracts the bad and leaves the good molecules. With a synthesis procedure, chemically smaller molecules of low molecular weight are combined to build a bigger molecule. The resulting high weight molecule is an excellent lubricant.

The relative ability of an oil to lubricate is determined by the components of the base stock. There are two principal classes of base stocks used in synthetic oils: synthesized hydrocarbons and organic esters.

The base stock materials used today for most popular synlubes are made of carbon and hydrogen molecules synthesized from ethylene gas molecules into polyalphaolefin (PAO). In fact, Mobil Oil took out a patent on the name Synthetic Hydrocarbon (SHC) in 1975. This material mimics petroleum molecules, using the good features and eliminating the bad ones.

SHC's provide better viscosity characteristics than petrolubes, especially low temperature operating properties. SHC's are also more resistant to oxidation. However, there is no significant improvement in the degree of thermal stability because they are still hydrocarbon molecules which are very similar to petroleum hydrocarbon molecules.

Some of the popular brands of PAO oils include Amsoil, Mobil-1 and Castrol Syntec. PAO's are the cheapest synthetic oil base stocks. You can purchase them for as little as $3 a quart. PAO's aren't as durable as the other class of synthetic oils, the esters.

Organic esters are made by reacting certain acids with alcohols forming acid esters, diesters and Polyol esters. This process uses expensive materials and results in an oil that costs about $8 per quart. NEO claims to use alcohol diester base stocks. Amsoil started out using diesters, but changed in the mid 80's to a blend of several synthetic base stocks with PAO being the main ingredient Red Line uses Polyol ester base stocks which are modified to improve thermal stability and performance.

All synlubes use widely differing additive chemistry. Some use high-quality additives, some use cheap ones. None of the synthetic oils have problems with wax contamination because they are man made and don't come from crude oil. The esters have a big advantage because they are natural engine detergents. Right from the start, they have better sludge dispersing capability. PAO oils require detergent dispersant additives and viscosity improvers.

It is important to know that synthetic oil companies are not completely divorced from using crude oil petrochemicals. Oil wells are still necessary to produce these petrochemicals, which are used in the synthesis process. A considerable amount of energy is needed to build the synthetic materials. The amount of petrochemical needed varies with the type of base stock utilized. While PAO's are derived from 100% petrochemicals, esters are largely biological in origin and require less petrochemicals.

To lower costs, some synthetic oils contain petroleum oils in their base stocks. These oils are actually Para-synthetic or semi-synthetic oils. In Europe, some oil companies are simply adding hydrogen to petroleum oil and calling it synthetic oil. It is truly a gray area, requiring clarification, SAE standardization and truth-in-labeling

Synthetic Roll Test

Volume VII Number 6, June 1995

By now, just about everyone has heard of how good synthetic lubricants are in reducing engine wear. In 1978, I began experimenting with synlubes and have had wonderful results using them over the years. It's very heartening to see more and more people change over to synlubes, something that I have been advocating for almost two decades! The stuff really works, not only in your engine but in the entire drive train!

In my entire life, I have never owned a new car. Being a mechanic, I have always driven "clunkers." Don't get me wrong... 1 always wanted to own a new car. My dream vehicle has been a Jeep Wrangler. Well, last year Chrysler offered Jeeps at only 2.9 percent interest and I decided to consummate my life-long dream. Last April, I bought a brand new Jeep Wrangler.

As an advocate of using synlubes, I have always wanted to convert an entire vehicle over to synlubes - engine, transmission, differential, and in this case, the front differential as well as transfer case. But, before I did the conversion, I wanted to document the difference in how my vehicle acted with synthetic lubricants verses with the factory fill of petroleum lubricants. After driving the Jeep all summer to allow for it to properly break in, I began conducting the test in August.

Right near my home is a steep hill that flattens out into a straight stretch or road. I chose this as a place to conduct a "roll-test" of synlube vs. petrolube. At the top of the hill was a road sign that I used as the starting point. I would pull up next to it and align it with the "B" pillar of the Jeep. I would then release the brake and allow the Jeep to roll down the hill in neutral until it would go no further.

When my Jeep stopped rolling, I would get out and make a paint mark on the edge of the road corresponding to where the front tire stopped. To establish a base line, I conducted the roll-test ten times with the factory fill of petroleum lubricants. I did the test on different days to overcome any differences in wind, temperature or fuel in the tank. Each time I conducted the test with myself as a solo passenger on my way home from work, after driving about 20 miles.

Using a spray can of silver paint; I marked the road edge for each of the ten trials. I then changed the entire drive train, including the engine, over to Redline synthetic lubricants. I installed Redline MTL in the gearbox and transfer case and Redline 75W-90 in the two differentials. The engine was refilled with Redline IOW-30. Even though this would have no effect on the rolling of the vehicle, I wanted the extra protection of the world’s finest synlube in my engine!

I conducted the test series again for the synlubes, this time marking the ground using a spray can of white paint. As I conducted the second phase of the test, it immediately became apparent that I was rolling further than before! After gathering the data, I added and averaged the results for each test run, petrolube and synlube. The average total distance the Jeep rolled with petrolubes was 877.43 feet. The average total distance the Jeep rolled with synlubes was 887.65 feet. The Jeep rolled an average often feet further with synlubes installed! Here was no-nonsense proof that synthetic lubricants actually are slipperier and decrease rolling friction. This means better gasoline mileage and less wear and tear.

Note: this test was conducted using Redline synlubes, which use expensive Polyol ester base stocks. All of the other synlubes on the market use cheap polyalpha olefin base stocks and will not produce results like I achieved.

Clash Of The Synlubes

Volume VIII Number 4 April 1995

What's Up in Synlubes, Doc? One of the most asked questions I get has to do with lubricants. "Which should I use? Which weight is best? Is there a difference in brands? Is synthetic better? Which synthetic brand is best?"

Ever since I discovered synthetic lubricants (synlubes) in 1978, I have been doing experiments and research for answers to these questions. After conducting my own testing and reviewing the evidence published by SAE, thee is no doubt synlubes are far superior to petroleum oils when it comes to lubrication. "Are synlubes worth the extra cost? Are semi synthetics or Para-synthetic lubricants okay to use? Are all synlube brands equal in their ability to protect engines?"

"Is the cost justifiable" Almost always the answer is yes. Synlubes produce longer-lasting engines, offer better starting, better fuel mileage, cleaner engines and combustion chambers. However, a vehicle is a bad candidate for synlubes when it leaks or bums a great deal of oil. In this case it is not cost effective. Also, if you are not going to keep the vehicle much longer, the long-term benefits will not be enjoyed by you. Unless you are passing the vehicle on to a relative or friend, your investment will be lost.

"Are semi-synthetic lubricants okay to use?" Semi-synthetic lubricants are only as good as the manufacturer makes them. Unfortunately, there are no guidelines as to how much synthetic oil has been added to the container. The company can add just one drop of synthetic oil to the bottle and get away with calling the product semi-synthetic. For this reason, I do not recommend using blended or semi synthetic oils. If you want a blend, do it yourself. Just add one quart of the best synthetic oil you can buy to your regular oil change. You will reap even better benefits if you were to buy a semi synthetic oil -- and the total cost will be much less.

"Are all synlube brands equal in their ability to protect engines?" No, all brands of synthetic oils are not the same. In general, there are two distinct types of synthetic oils on the market today. The most popular type is made from poly-alpha olefins and is marketed by Mobil, Valvoline, Castrol, and Quaker State. Olefins are easy to manufacture and relatively inexpensive. They can be made from natural gas products, biomass and fat waste products or even petroleum oil. This class of synlube sells for $3-5 per quart. Olefins provide much better protection than petroleum oils because they are made up of molecules that are more uniform in size then petroleum molecules. On the downside, olefins are not as durable as higher quality synthetic oils and do not hold up to the rigorous duty of jet engines.

"Which synthetic brand is best?" When used in cars and trucks, olefins offer better protection than petroleum, but not the best protection possible. The alcohol diester and Polyol ester synthetic oils are much better lubricants. However, esters are much harder to manufacture and are relatively expensive. They are made from reacting an alcohol with an acid. Unlike the olefin, all the ester molecules are exactly the same, with no variation in size.

For this reason, esters will outperform olefins every time. Every big time racecar engine now uses ester-based lubricants and esters are the only thing good enough to lubricate jet aircraft. They are not found on store shelves and must be ordered from racing oil companies or individual distributors. The most popular brand on the market is made by the Red Line Synthetic Oil Company. Their oil sells for about $8 per quart.

In a the world of lubrication, there is another class of synlubes that are silicone based and are not compatible with any other lubricant For this reason, using silicone lubes will cause severe engine problems because it will react with any petroleum oil left in the engine and him it into mud. Its uses are limited to special industrial applications and will not be discussed here.

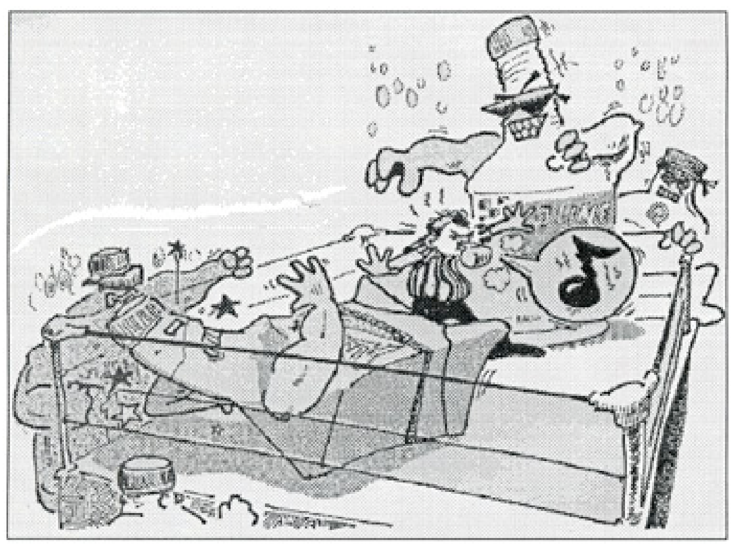
Which weight is best?

When it comes to choosing a weight, it is a good idea to stay within the manufacturer's guidelines. 5w30 must be used when the temperature dips below freezing. 10w-30 is good for all other temperatures. If the vehicle maker calls for 20w-50 (like my Harley Davidson), you should use that weight Even though synlubes resist thickening at lower temperatures, the oil in my Harley became very thick on a frosty day. If your vehicle tends to consume a little oil, you should consider using a thicker grade to cut down on consumption. If, for example, you have been using 5w-30 or l0w-30, try a l0w-40 or maybe a 20w-40.

"Is any synthetic oil better? Which is the best?" Yes, there are major differences between brands. All the brands on the store shelves are olefins. If you want an inexpensive synthetic oil, I recommend Castrol Syntec. However, for a little more money, you can purchase Amsoil, a blend of base stocks. Amsoil won't divulge their ingredients, but I'm told they use several types of olefins mixed with a little ester. If you really care about your vehicle, I recommend using an ester oil. The only one readily available is Red Line.

Mirror, Mirror, On the Wall.
Which Synlube is the Best of Them All?

This brings me to the discussion of which oil is really better. The best test of how well a lubricant performs is in racecar engines. The rigors of one race put an engine through the equivalent of years of street use. However, racing oils do not contain the same additive package that street use oil contains, because it is only used for one race. In racing, there are no problems with startup, warm-up, and cool down, moisture contamination, poor fuel quality, air temperature changes or excessive idling (to name a few). Racing oils are blended to provide lubrication and protection under full load and little else.

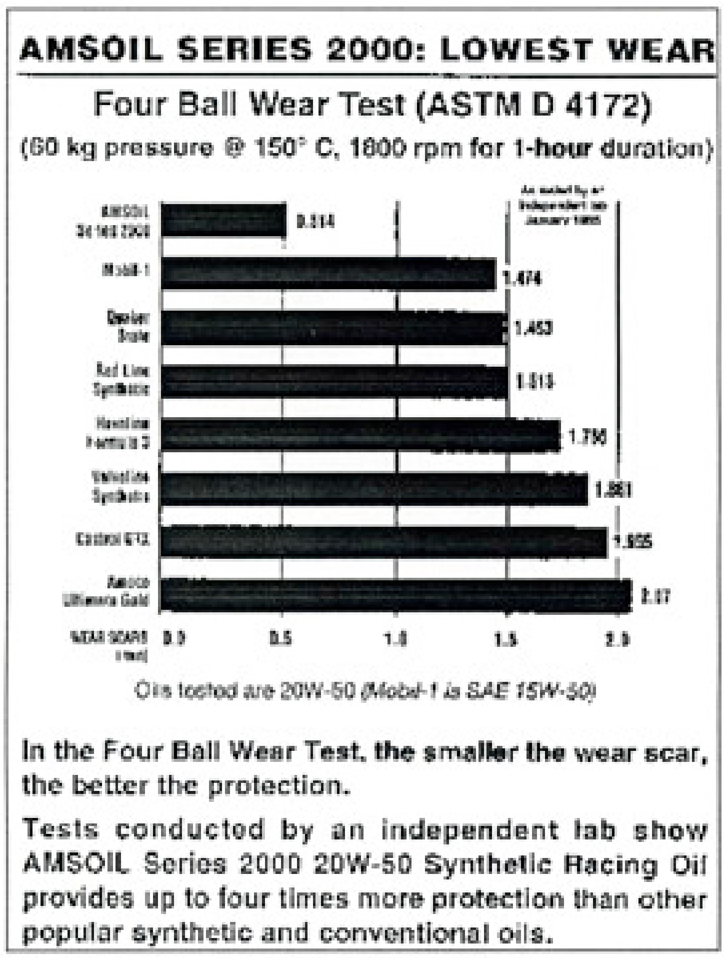


However, racing does a pretty good job of showing which oil holds up best and provides less friction, which means more horsepower. The lubricant that wins races will also provide better lubrication and fuel mileage when blended for street use. If you talk with people in the race car circuit, their favorite has been Red Line. Unless they are sponsored by a big-name oil company, most independent race car operators use Red Line. And, if the car is sponsored, you can bet the big-name oil company is providing a totally different motor oil than one you can buy on store shelves. I'm told they are all using ester base stocks in their oil. For example, the race car may say "Valvoline," but you can bet that the Valvoline they are using is a specially formulated ester.

In the past, Amsoil Racing Oil has produced really disappointing results when put to the test in actual race cars. Recently, Amsoil announced their Series 200 20w-50 Racing Oil was the best oil on the market. Amsoil has launched a very aggressive advertising campaign, comparing their oil with the other industry synlube and petroleum leaders. Their claim reads:

"Amsoil Series 2000 provided up to four times more wear protection than other popular synthetic and conventional oils." They also claim the oil change interval can be extended "up to three times the length of the oil service life interval recommended by the vehicle manufacturer." The chart [next page] published by Amsoil showed their test data when comparing their Series 2000 oil to the others. The chart, along with Amsoil hype, has been printed on every container of this new oil. The test sequence used was said to be the ASTM (American Society of Testing Materials) four-ball wear test (D4172) conducted at 150 degrees centigrade.

This test has four metal balls, about the size of grapes, put under pressure and rotated against each other. They are bathed in the lubricant to be tested and put under about 130 pounds of pressure for an hour while the balls are rotating. The purpose of the test is to measure the scar created by the balls moving against one another. The bigger the scar, the poorer the lubricating ability of the test oil. Some people claim the ASTh4 test is able to imitate the metal to-metal contact that takes place inside an engine. The D-4172 test procedure, set forth by ASTM, call for oil temperatures of 90 degrees C I was curious as to why 150 degrees C. was used by Amsoil to conduct their testing.



I discussed this question with a lubricant engineer (a tribologist who asked to remain unnamed because he has worked for many large oil companies, as well as for the world's largest seller of chemical oil additives. He said the reason for choosing a higher temperature was because this temperature would make Amsoil's oil additive package perform better than other brands of oil. Certain additives will "beef-up' film strength when heated up. These same additives may not necessarily provide added protection when run at lower temperatures.

If the D-4172 procedure is meant to mimic the conditions inside an engine, normal engine oil temperatures should be chosen. It would seem that running the test sequence at any other temperature would produce bogus results that are, for the most part, meaningless. Putting it bluntly, it appears to me Amsoil rigged the ASTM test to make their oil look better than everyone else. They must have known their additive package would shine at the extreme temperature of 150 degrees Celsius and the others wouldn't.

Even worse, Amsoil is also guilty of comparing apples to oranges. They pitted their 20w-50 racing oil against the other oils, which were not racing oils. How can you compare a racing oil to a street use oil? For that matter, how can you compare a 20w-50 to a 5w-30 oil? If you study Figure 1, you will notice that the competition oils used in Amsoil's test sequence have no viscosity identification. I am left wondering which Quaker State oil was tested, their synthetic or their petroleum oil.

I decided to call Red line, Castrol and Mobil Oil to find out how they felt about the claims being made about how terrible their oil is compared to Amsoil 2000. The consumer relation's department of Mobil Oil basically said they had not heard of Amsoil and couldn't care less about any claims being made against them by some unknown company. Castrol, on the other hand took issue with the test. Castrol representative, Alice Fisher, responded with a letter that said:

"In answer to your [questions} about Amsoil's testing results on Amsoil's 2000 Synthetic l0w-50 vs. Castro! GTX conventional non-synthetic oil, we would like to point out several factors:

1. The ASTM procedure (D4172) is a method used primarily in testing industrial lubricants, not automotive engine lubricants.
2. The ASTM procedure (D1472), used in Amsoil's comparison, is not a part of API SH or automotive manufacturers specified performance testing methods. This should not be considered a basis for wear protection claims in the absence of relative field performance in automotive engines and test precision documentation. This is not a recognized testing method for automotive engine lubricants and may not represent the conditions found in your vehicle.
3. API SH performance determines the appropriate wear characteristics of passenger car automotive engine lubricants.

Based on the above information, we have no plans to test Castrol SYNTEC or Castrol GTX under these test conditions (Different D4172 test temperature noted).

Apples To Oranges

When I spoke with Roy Howe at Red Line, he said the "apples to oranges" fallacy was truly correct. When Redlines's 40w racing oil was compared to Amsoil 2000, they both performed the same and produced basically the same results. Additionally, Howe was completely in agreement with Castrol in that the ASTM test is not recognized and may not be an accurate indicator of real-world performance. Howe said that Red Line could use additional friction modifiers and anti wear additives in their oil, but they prefer not to. Rather then concoct an oil package with additives that only make the oil look good when tested as a new oil, Red Line's stance is to produce an oil that has long-term protection. This kind of protection is designed for an operating engine, not for a 4-ball tester.

Howe explained that the additive package chosen by Amsoil for their Series 2000 oil aggressively reacts with the steel balls in the tester. The additives combine with the steel causing it to temporarily change its metallurgy. How explained that these additives, when exposed to actual operating conditions inside the engine, are rapidly deactivated. "Engine oils are designed to lubricate operating engines. We perform a lot of testing with anti wear additives, friction reducers and synthetic base oils. We [Red Line] know there are many components which we could add to our oils to perform better in these ASTM tests on our [new] unused oils, but projection in an operating engine is the real goal -- not simply obtaining good numbers with unused oil."

How then does Red Line stand up against Amsoil when tested in an actual engine? This would be more consistent with the type of testing Castrol said is needed to judge the merits of an oil. A Ford 4.0 liter engine was filled with Amsoil's Series 2000 20w-50 oil. Samples were taken for analysis at 338 miles and again at 919 miles. For sake of comparison, Red Line 20w-50 was tested in a turbocharged 2.0-liter engine and samples were drawn at 2252 miles and again at 20.342 miles. A Corvette filled with Red Line 40w Racing Oil was raced for about 1300 miles and a sample was drawn. To be consistent with Amsoil's test comparison the ASTM test was conducted at 150 degrees C. The results of these tests are shown in Figure 2. [Editors note: This table cannot be found]

As expected, the Amsoil 2000 Racing Oil performed better than Red Line's street oil, but produced about the same results when compared to Red Line's Racing Oil. These were brand-new oils right out of the container. The big differences are seen with used oils. As expected, Amsoil Series 2000 oil deteriorated rapidly after as little as 338 miles. Using this ASTM test, the additives in the Red Line products showed an improvement in the ASTM wear test, while Amsoil deteriorated. Red Line's oil looked better after 20,342 miles than Amsoil did after just 338 miles. Howe said, "We find it very curious that Amsoil chose not to compare their Series 2000 Race Oil with Red

Line Race Oil. Red Line Race Oil right out of the bottle provides significantly better results than even the unused Amsoil... and what is unique with the Red Line is the results improve with engine operation instead of rapidly degrading as with the Amsoil product."

"Is there such a thing as an oil that improves with age?" According to Howe, there is. "This is not surprising because part of the synthetic package and base oil chemistry actually reacts with the [engines'] blow by gasses to create a more effective anti wear chemistry. The polyolesters and unique anti wear chemistry in Red Line are designed to improve the wear characteristics after a period of engine operation." This explains why the performance of the Red Line shows a small wear diameter after some use.

Another use of the ASTM 4-ball test is to measure a lubricant's ability to reduce friction between the moving ball bearings. This is called the coefficient of friction. While it is not a recognized test by Castrol, it serves as a way to make comparison between lubricants. The same oil samples used in the previous comparison were used to measure the coefficient of friction. I find this test very interesting in that it clearly shows which lubricant is more slippery and produces less friction between surfaces. Obviously, this is a good illustration of what effects a lubricant has when subjected to high-performance applications.

Since the low coefficient of friction means better performance, faster engine response and improved fuel mileage, it is probably a superior indicator of oil performance than the wear-scar diameter test.

And, on the test, both Amisoil Series 2000 and Red Line new street oils produced similar results. This makes me wonder why Amsoil didn't use this type of test in their comparisons between oils. The answer is obvious when you look at the data. Table 3 shows how Amsoil's coefficient of friction after 919 miles is much higher than Red Line after 20,342 miles. Remember, the greater the friction, the poorer the oil. When you compare apples to apples, Red Line's Race Oil is so far superior to Amsoil Racing Oil that there is no contest.

No, the story doesn't end here, folks. To try and set the record straight, Red Line decided to send all Amsoil dealers a copy of the results I just discussed. This brought an angry response letter from Amsoil headquarters. Here is the context of the letter, which I edited a little for the sake of brevity:

"...In response to the Red Line article... [it was] totally ridiculous... [and this letter] is not intended for publication. We are not in business to promote Red Line. They are a small company that has resorted to low-road marketing tactics, and they don't deserve any additional exposure. Our statement is intended merely as a response to the outrageous claims they have made. Use this statement as necessary to set the record straight for any concerned down line Dealers or customers you may have. Then, we'll put this foolishness behind us.

We've wasted enough time on Red Line... [the Red Line] article is flawed in both its marketing approach and scientific methodology... Amsoil 20w-50 provided nearly three times better wear protection than Red Line 20w-50... ASTM tests, as any informed entity in the lubricants industry knows, are designed for use with new (unused) lubricants, not used oil... Testing used oil poses two problems... the [testing] conditions are not controllable... variable including fuel and glycol (antifreeze) dilution, contaminant levels, filtration, driving conditions, sampling techniques... are [not controlled]... Amisoil tried to replicate Red Line's findings [and found] the results were inconsistent... [which] failed to meet the repeatability requirement of the ASTM D4172 test...

The letter goes on to blame Red Line for performing poorly on the Noac Volatility and Cleveland Open Cup Flash Test. Then, suddenly, in midstream, the letter jumps to a totally different topic about using supplemental additives with motor oil and how the use of molybdenum disulfide reduces the coefficient of friction but decomposes in high temperatures. The letter sums it up by saying, "Of course, Amsoil Dealers are much too educated on the technical aspects of lubricants and on the principles of ethical salesmanship to be swayed by unscientific and unprofessional marketing tactics." The letter then boasts about how Amsoil motor oils can achieve 100,000-mile drain intervals.

Who's right? Who do you believe? For one thing, I reviewed the ASTM test procedures, and could not find any specification in the procedure for the use of NEW oil. The ASTM procedure could be, and is used, for the testing of lubricants in all levels of age -- from new oils to depleted oils. I found no problem with scientific methodology here. As for the replicate-ability of the tests, how could Amsoil replicate the tests if they didn't have a sample of the oil that was used? Forgive me, I got lost here.

Red Line's Roy Howe is confident of the data he collected. He says that he is so confident of Red Line's performance in real world situations that he challenges you or anyone to perform you own test on any engine you choose. He suggests taking oil samples at 1,000 miles, 5,000 miles, 10,000 miles or whatever you consider as appropriate. He doesn't want you to rely on Red Line or Amsoil's data.

Lab Testing

The ASTM tests cost $45 and all you need is 3 ounces of oil. The exact test specified is the ASTM D4l72 (60 kg, 1800 rpm, 150 degrees C, 1 hour). You can use any testing lab you choose. It is advisable that you keep an extra sample of each test you run so you can retest if you have doubts about the results.

Here are the addresses of two testing labs. The first is the less expensive of the two.

Petro-lubricant Test Labs, 170 N. Main St., Bld. 2, Wharton NJ 07885 (201) 366-3797
Falax Corp. 2088 Comprehensive Dr. Aurora, IL. 60505

I would like to hear from you and see the results you obtain with your own testing. We want to find out what your experiences have been, both in real-world experiences and data you gather from oil sample ASTM analysis. I'll keep you posted on what I find right here in the Newsletter. Stay tuned.

Redline Wins

Vol. 4, Number IX, April 1997

NOTE: Castrol Syntec changed their formula the following year after this was printed. All references to their lab tests must be disregarded.

Just as everyone leads a different life, everyone's driving habits are also quite different. To make things more complex, we all drive different types of vehicles, fuel up with various brands of gasoline, and lubricate our engines with a variety of oils. We operate our vehicle in different climates. And if that isn't enough variation, we all change our oil at different time intervals!

Some of these variables can't be controlled, while others can. We can choose when to change our oil. We can pick the grade of oil and viscosity that is supposed to be the best for the conditions under which we operate our engines. One oil can't possibly be suitable for everyone. That's why there are so many different types. But this makes it a real challenge for consumers to choose which oil is best for them.

Traditionally, consumers have made their decision about which oil to buy based on the recommendations in their owner's manual, by their mechanic, or the size of their pocketbook. In some cases, climate and driving conditions play a part in the decision process. Unfortunately, there's been no unbiased, independent information source providing date for comparison sake.

All engine oils aren't the same. They're composed of blends made from different types of base stocks. Petroleum oils use mineral oil base stocks, while synthetics use either an ester or olefin base stock. The oil company then adds their own additive package to produce the final product that you buy.

Properties of a given brand of oil may change from time to time as the oil company starts using newer additives in their oil. However, in some cases, competitive pricing causes an oil company to cut back on the additives, or use cheaper ones, resulting in a degeneration of the quality of your usual brand. Add to this problems caused by inconsistencies in the blending process, shipping and packaging. The result is a quagmire that can leave you in the dark.

I obtained engine oil reports on Mobil-1, Castrol and Redline synthetic oils from a company called Institute of Materials. They publish analysis reports on oils. I wanted to see how different the properties of a PAO base stock synthetic oil were in comparison to a POE base stock synthetic oil.

Poly Alfa Olefins (PAO) are inexpensive synthetic base stocks and are used in all of the synlubes found on store shelves On the other hand, Polyol esters (POE) are the highest quality base stocks and are the only lubricants good enough to be used in jet aircraft. (Would you want to fly in a jet using anything but the best lubricants?) Redline is the only manufacturer producing a POE base stock that is available nationally. It's only sold by Redline dealers.

I ordered reports on Mobil-1 Advanced Formula, Castrol Syntec FSX and Redline Synthetic Oil. All of these oils are SAE 10w-30 grade oils. Mobil-1 had API designations SG,SH,CC,CD,GFI; Castrol has SH, CD; Redline had SF, SG, SH, CC, CD, CE.

The resulting data turned up major differences in several important areas. In fact, I was surprised that both Mobil-1 and Castrol failed in key areas--not providing protection in major critical domains. First I'll define the key areas and then explain what the differences between these oils mean.

ACID RESISTANCE

This is the most important common measure of how an oil protects against the ravages of corrosion inside the engine. Acid resistance is just what it says: how well an oil is able to neutralize harmful acids inside an engine. Why acids? Because one of the main byproducts produced when gasoline is burned is water. In fact, every gallon of gas produces 1/2 gallon of water. In addition to this, gasoline contains sulfur. The resulting mix produces sulfuric acid inside the engine. As an oil oxidizes, it also forms acids. Unless this acid is neutralized, it will damage the soft metal used in engine bearings.

An oil's level of resistance to acids can be measured by mixing more and more acid solution with the oil until the base material gets used up. This gives the lab the ability to calculate the amount of base components present in the oil and is expressed in milligrams of base material per gram of oil (mg/g). This number is called the Total Base Number (TBN) of the oil.

There are no particular specifications for TBN. The higher an oil's TBN, the more protection it provides--up to a point If the TBN is too high, the extra base material will form excessive ash during the combustion process. Too much ash can cause cylinder wall scoring and piston wear. Too little TBN and the bearings will quickly erode, causing catastrophic engine failure.

In general, the average range for TBN in gasoline engine oils ranges from 6 to 12 mg/g. As an oil gets older, the TBN number drops. This makes TBN a hand measure of an oil's useful life. Accordingly, oils with TBN numbers below 6 require more frequent oil changes, while oils with numbers in the 1-12 range provide for extended drain intervals.

The TBN of the old oil is one of the main items to check when conducting a lube oil analysis. When a sample of the old oil is analyzed, the TBN number tells if the oil was changed prematurely, or if it was already past is useful life. This is an important factor for those who manage huge fleets of vehicles, or for trucking companies that must deal with very expensive oil changes. Remember, truck engines typically hold 25 times as much oil as your car.

The TBN results are as follows:

Mobile-1	12.65 mg/g
Castrol Syntec	5.88
Redline	12.63

Interpreting the results, it becomes obvious that Syntec cannot support extended drain intervals, as I had previously believed. Only Mobil- 1 and Redline have high enough TBN numbers to afford the owner to extend their drain-interval-something that is important when using expensive synlubes. By extending the drain interval, the expense of the oil can be justified.

The figures in the report showed a change in the TBN range on the Mobil- I oil. I interpret this as an indication of poor quality control. Some of the samples varied as much as 15 percent from the best score. This means that the amount of base material used by Mobil is not a constant.

OPERATING VISCOSITY

The actual viscosity of an oil during real-world operating conditions is by far the most important aspect of an oil. This aspect of the oil has a direct effect on the engines longevity and durability. It also directly impacts the fuel economy an engine gets. Operating viscosity is the measurement of an oils ability to lubricate the critical areas of you engine. Remember, one key function of a lubricant is to provide an oil film between moving parts.

When oil gets hot, it becomes thinner. Temperatures in excess of 300 degrees F. are commonly found in critical areas of the engine, such as cam bearings. Pistons and piston ring lands experience temperatures many times higher, as high as 2000 degrees F. Parts inside an engine can really cook!

A good oil provides a high enough viscosity to protect engine parts from touching each other and causing damage. A poor oil will thin out from the heat, allowing critical parts to scrape and grind against one another. On the other hand, if the oil is too viscous, it will cause unnecessary drag and rob fuel mileage.

To properly measure an oil's ability to take the heat, the oil is heated to just over 300 degrees F. (150C.). A cylinder is placed inside a cup filled with the hot oil, with only 3.5 microns distance (1/20 the thickness of a human hair) between the cup and cylinder. The amount of force needed to rotate the cylinder at 3600 RPM is measured. This force is then translated into units of centipoises (cP), a measure of the oil's viscosity.

The results are as follows

Mobil-1	3.27 cP
Castrol Syntec	3.48
Redline	3.54

While the actual numbers in terms of centipoises are difficult to interpret, it appears to me that Mobil-1 doesn't offer the same protection as Syntec and Redline. When it comes to Operating Viscosity, it clearly seems that Redline is the winner.

OXIDATION RESISTANCE

Sludge is a big enemy of modern engines. Sludge clogs up oil passages causing oil starvation. If it gets bad, it will clog up the oil pump strainer and completely choke off the oil pump--resulting in a catastrophic loss of oil pressure and instant engine devastation. Sludge is what happens when oil oxidizes.

When oil oxidizes, it turns acidic and its viscosity can increase. It turns into varnish and thickens--forming deposits. A poor quality oil can get in the crankcase, becoming too thick to pump. Usually, oxidized oil causes the piston rings to stick to the pistons, resulting in scored cylinder walls. By the time the compression loss is detected, the engine is scrap metal.

Oxidation resistance is the ability of an oil to resist the direct and indirect attack of oxygen during operation. The very nature of the oil lends to its ability to resist oxidation. Here, additives help the oil resist the ravages of oxidation. As soon as the antioxidant additive is exhausted, strong oxidation begins to occur. The type and amount of oxidation in the oil will determine how long it can resist the effects of oxidation.

To measure oxidation, the oil is subjected to oxygen under pressure. The time it takes for the oxidation inhibitors to wear out is measured. Once they are gone, the oxygen chemically attacks the oil and forms oxidation products as the oil begins to rapidly oxidize. When this takes place, the sudden drop in the oxygen pressure is called the "break point". The time it takes for the break point to occur is recorded in minutes. The longer an oil takes to reach the break point reflects its ability to resist oxidation.

The results are as follows:

Mobil-1	396 mm.
Castrol Syntec	1000
Redline	1000

It seems to me that Mobil-1 has a big problem with oxidation resistance. It took only 396 minutes for Mobil-1's oxidation resistance additive package to fail. Interpreting the numbers, it appeared that Mobil-1 can't be trusted to protect against sludge formation as well as most other oils on the market On the other hand, both Syntec and Redline seem to offer superior oxidation resistance.

CONCLUSION

In conclusion, both Mobil-1 and Castrol Syntec appear to have major weaknesses in their formulas. I believe this is mainly due to the way that the base stock performs and the additives used in their products. Comparing a PAO (olefin) to a POE (ester) is like comparing a synthetic to mineral oil. Just as the synthetic will always be superior to petroleum, an ester will always outperform on olefin. I have always said that I will only recommend the best oil money can buy. Redline continues to prove themselves as the very best oil.

Synlube VS Petrolube

Vol. 4, Number IX, April 1997

For almost two decades I've been reading reports concerning the wonders of using synthetic oil. I became a supporter of synlubes back in 1978, when I discovered how well it worked in my own vehicles. Today, the auto repair and service literature is brimming with articles touting the virtues of synthetic oils. Just above every oil company in the world has begun to produce their won brand of synlube, except one; Shell.

I figure that Shell must be heavily invested in petroleum refining, and not want to diversify or change their direction. Maybe they want the world to stick with petroleum (mineral) lubricants because it puts more money in their pockets. I really don't know. But I was totally taken by surprise when I came across an advertisement in the trucking magazine, Overdrive. The ad is a blatant attempt to convince truckers that using synthetic oil is a waste of time.

Titled, "Do synthetic motor oils outperform straight mineral oils?" the ad is formatted in an answer column manner, with the picture of the writer, Bob Juett, appearing next to the text. Mr. Juett may be a really nice guy but someone should give him some tops on how not to look like a sneering used-car salesman. And the layout guy shouldn't chop off his head when centering the photo, it really makes Juett look brainless. Her are some excerpts from the ad:

"...A synthetic oil's extreme temperature performance is due to its man-made consistency. Every molecule looks the same. But his chemical property also means that the synthetic oil doesn't do as good a job of "solubilizing" (holding stuff in solution) as a mineral oil. Additives aren't solubilized as well, nor are combustion products.

If additives aren't kept in suspension, they can't do their job. And if combustion by-products aren't kept suspended in the oil, they wind up as engine deposits. With some synthetics--especially in diesel engine applications--we've seen combustion by-products that "plate out" or accumulate as deposits in the hotter areas of the engine; the piston crown lands and top grooves... Deposit formations like this can cause loss of oil consumption control, and lead to more frequent engine overhauls...

Then there's the matter of cost. For the manufacturer, the raw material cost of synthetic oil can be up to FOUR TIMES what it is for mineral oil... You have to ask yourself: What am I getting for my money? Unless you're spending most of your time in the nastier climates of places like Canada or Alaska, the diesel engine performance of a top-flight mineral oil can easily exceed that of a synthetic. And cost you a lot less."

Imagine my surprise to read that a synthetic oil has less detergent deposit control than a mineral (petroleum) oil. That's the job of the detergent additive package, not the base oil. Blaming synlubes on the failure of a particular additive package to hold combustion byproducts in suspension is like saying an engine is poorly made because it won't run on watered-down gasoline. It's not the engine's fault.

Sure, there are cheap synthetic oils on the market. Some are downright garbage. Those synlubes have to cut corners somewhere in order to try and undercut the price of the competition. Those companies leave out the necessary amounts of additives--like detergents and dispersants--to cut costs. But that's not a damnation of synlubes.

Juett would also lead you to believe that synlubes by nature can't "solubilize" as well as mineral oil. This claim flies in the face of every bit of synlube research done in the past three decades. If nothing else, synlubes o a much better job of keeping engines clean (especially piston ring lands and walls) than any mineral oil.

Ironically, the same issue of Overdrive had a great article on the virtues of synlubes. It even has a caption that directly contradicts Mr. Juett:

"New piston designs place the rings much closer to the top of the pistons, making them more difficult to lubricate. Synthetics help solve the problem, but they are more expensive."

Here are some of the highlights of the article "Synthetics."

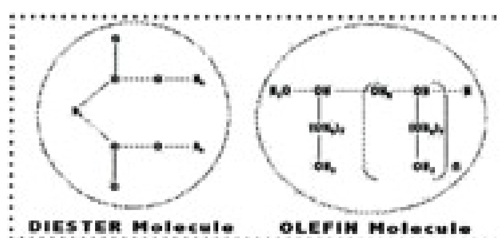
- They have much lower volatility compared to conventional (mineral motor oils and don't boil away.
- Synthetic motor oils form as little as one-quarter of the deposits on very hot engine parts, compared to conventional motor oils. (Formation of deposits can lead to abrasion and engine wear.)
- Synthetic motor oils flow much better at low temperatures, for better protection and cold starts.
- For Ryder Systems, synthetics in transmissions and differentials have offered the following benefits:
- extended component life
- improved cold weather flow
- reduced component temperature by up to 50 degrees
- more resistance to oxidation
- reduced warranty claims
- increased fuel economy by up to 2%
- reduced maintenance

Rick Muth, Eaton General Service Manager, feels that a zero-maintenance goal for wheel-end systems is readily obtainable with synthetic grease:

- extended seal and bearing life
- guaranteed bearing and seal lubrication
- longer wheel-end system life
- reduced downtime caused by wheel seal failure
- A side benefit is that synthetics [grease] exhibit higher thermal stability than petroleum.

Imitation Synlubes

This article (February 1999) explores the history leading up to the current debacle over what is truly a synthetic lubricant, and the proliferation of *the new imitation synthetics. The different types of synthetic base stocks will be explained, as well as a primer on additive packages. We'll also expose the imitation synthetics and tell you how they scam consumers.*



HISTORY

The first recorded attempt to produce a totally man-made lubricant in was in 1877, it wasn't until the 1896's that petroleum oil was used as a commercial lubricant Before petroleum lubricants; rendered animal fat; whale oil and vegetable oil were used.

Since these oils were man-made from the environment, they could actually be considered as the first synlubes. In 1929 Standard Oil of Indiana polymerized different olefins from biological compounds such as animal fat and plant seed oil.

Union Carbide was also working on another synlube, Polyalkylene Glycol (PAG). Later Union Carbide, Carbon Coip and Linde Air Products furthered the development of PAG oils, which eventually proved ideal air conditioner compressor lubricants. These synthetic lubricants were able to flow at extremely cold temperatures, had high viscosity properties and solvency as well as the lack of carbon formation. But because of their high cost, they weren't recognized for their value until many years later. Even worse, PAG oils attracted moisture which caused metal parts to rust in the presence of high humidity. But that didn't daunt the Germans, who needed a lubricant capable of operating in the desert.

During World War II, the U.S. successfully cut off Germany from the rich oil reserves of the Arabian countries. But, Hitler's spies got enough information from the archives of U. S. Patent Office to enable them to synthesize oils from alcohol and natural gas. That was 1939. Based on coal gasification, their synlubes produced about 10% of their lubricant needs.

German military tanks and hardware were made to run on alcohol, made from corn and other forms of biomass. Their military machines ran in the desert on synlubes. And because it withstood the rigors of the heat, Rommel's tanks ran circles around the U.S. Army. In their hasty retreat, the Germans sometimes didn't have time to destroy their vehicles. Thinking the engines would blow up if left running at full throttle, they would wedge a rock against the accelerator pedal. However, because of the incredible synlubes, the engines revved until the fuel ran out. When our troops found these vehicles, they refueled them and began chasing the Germans with their own war machines!

Both Hitler and the U. S. were developing jet propulsion. The inside of the jet turbine reached somewhere around 600°F, while the outside had to withstand -40°. Because of the extreme operating conditions the jet turbines kept destroying themselves. Our scientists weren't aware of a lubricant that could take that kind of punishment But Hitler's had synthetic oils, and his air force had the first jet aircraft.

After the war, the U.S. military wanted German military's oil formulations. After we captured the German scientific archives in Berlin, their top-secret formulations were turned over to the big five oil companies for further research. A brilliant chemical engineer named Pete Peterson worked to implement the German formulations and became America's top synlube expert

Because of military operations in Alaska, our army was having problems getting engines to operate in the extreme cold. The current subzero petroleum oils had to be thin enough to keep from turning solid, but at the same time, were was too thin to operate in the Detroit diesel engines. As soon as they reached operating temperature, these 2-stroke engines would begin consuming this high volatility oil, causing them to run away and self destruct

Three different synthetic base stocks were formulated for artic use, an alkylated aromaticoligomer, a diester and an olefin. These oils lead way to the military spec. internal combustion engine artic oil, MIL-L-46167. As news of this artic lubricant got out, and it's use spread into the private sector in Alaska and Canada, trucks and machinery could now operate there.

Soon more than two dozen small companies began producing synthetic lubricants for the military, and Pete Peterson consulted with them to bring on the new age of synlubes. In the late sixties, a fighter pilot named Alvin Fagan saw how synlubes would work with vehicles operating in the harsh northern U. S. winters. He retired from the military and started the first U. S. synthetic oil company, All-Proof, of Duluth, Minn. But Fagan wasn't good at marketing and his company did poorly. During that time, Fagan employed another retired pilot, Albeit Amatuzio.

With money borrowed from his brother, Dick, and formulations from Fagan, and a marketing plan copied from Amway Amatuzio started Amzoil right across the river in Superior, Wisconsin. While the company flourished, Amatuzio lost lawsuits brought against him by his brother, Dick and Pennzoil. His brother sued to get back his investment (he still owned 40% of the company) and Pennzoil sued for copyright infringement (Amzoil's name was too similar). This left a family riff, and Amzoil changed to Amsoil.

When John Williams, bought a new car for his daughter, he wanted to put oil in the engine that would last for the whole year while she was away at college. So Williams, owner of Pacer Petroleum products, filled it with a synthetic oil. She told a few college friends about the wonderful oil her dad had put in the engine and the school auto shop teacher soon heard the story and wanted to know about this new, long-lasting lubricant

It didn't take long for the local media to get wind of the story, which was occurring at the same time as the Arab Oil embargo. In an effort to thumb their noses at the Arabs, everyone was looking for other sources of oil. Driven by the possibility of extended drain intervals, Williams was soon flooded with calls. Seeing this as a unique opportunity a man named Sol Levy joined with Pacer Petroleum to form EON oil.

Originally, All-Proof had been using a formula containing 100% alcohol diester. This is one of many different esters. The bad news was they were sold to unsuspecting consumers without the benefit of any wear-protecting additives. Some types of diesters are so aggressive, that they'll dissolve the zinc coating on engine bearing surfaces! Pacer had convinced the city of Houston to run a test on their EON brand using the city fleet of vehicles. Soon after, the engines began having camshaft failures, and the city sued EON for damages.

Even worse, Pacer oil dealers were saying EON oil was "better than the big oil brand without the double cross." They were referring to *Exxon* motor oil. In 1975, Exxon sued for trademark infringement, claiming that EON sounded too similar to Exxon. Paul Baker, a California EON dealer came up with a new name, mixing the letters to form NEO.

Baker petitioned Pacer to use the new name, and Pacer Petroleum would market theirs under the name Ultron. Norman Lotz was hired to run the marketing, and began undercutting former EON dealers by selling directly to their old accounts. The general idea was to cut EON dealers out of the picture.

Angry about the situation, Baker started NEO Inc in California in 1976. His basic premise was to use only the finest synthetic oil ingredients available. NEO introduced the first 100:1 2-cycle oil, the first synthetic gear lube as well as synthetic ATF. Unfortunately, he was still dependent on Pacer for his base stocks. In 1981, Williams threatened to cut off his supply. Meanwhile, Williams sold the EON division to Morton Thiokol, the rocket fuel company, forcing NEO to find their own base stocks and bottling their own oil.

During the early seventies, a southern company called Blaze Oil began rebottling Amsoil and selling it under the name Blaze Oil. Because their product was especially suitable for cold climates, Aruzoil wasn't interested in selling in the south. Then Blaze Oil became popular in the southern states and Amsoil threatened to cut off the supply. Blaze sued Amzoil for breaking their supply contract.

It was about this time that Amsoil was taken to task by the Federal Trade Commission for selling synthetic industrial oils with little or no synthetic base stocks. The FTC requested they either put synthetic oil in it or stop calling it synthetic. In the mid-eighties, Amsoil stopped using high-quality diester base stocks and began using cheap olefins (PAO). Users began seeing engines sludge up like never before and many stopped using synlubes or changed to other brands.

During the seventies, Peter Felice and Tim Kerrigan were working with Pacer Petroleum marketing EON. Because of problems with mislabeling, incomplete additive packages and quality control, they were unhappy with Pacer and joined All-Proof. During the subsequent demise of Pacer, Kerrigan and Felice started *RedLine* Oil in California Redline now sells the world’s finest (and only) ester-based synlubes.

The age of synthetic lubricants began booming both here in the U.S. and in Europe. Mobil began marketing their synlubes touting that Mobil-1 was used exclusively to construct the Alaska pipeline. However, while it continued to grow in Europe, eventually reaching a 38% market penetration, it began to wane in the U.S. This was partially because the oil embargo was over and the price of gas dropped again.

Also, car companies took issue to the claims that synlubes provided extended oil drain intervals-or would never need to be changed. They added warnings in their owner's manuals forbidding the use of synlubes or requiring frequent change intervals-or else the engine warranty would be voided. People became scared about extending their drain intervals or using non-factory authorized oils.

Then the car companies did an about face and started selling their own versions of synlubes. Now the store shelves are replete with different brands of synlubes. But which is best?

THE PLAYERS

Most consumers don't realize that synthetic oils have different base stocks, which comprise some 90% of the oil. The base stock is the actual lubricant The other 10% or so is the additive package. The relative ability of oils to lubricate is determined by the components of the base stock. There are two principal classes of base stocks used in synthetic oils: synthesized hydrocarbons (PAOs) and organic esters. Then there are the hydro wax lubricants.

Early on it became apparent to the synthetic engine oil formulators that petroleum oil additives wouldn't work with synthetic base stocks. Synlubes were incompatible with engine oil seals and filters. The seals would either shrink or swell-and leak. Synlubes dissolved the glue that held oil filter paper together, causing them to fail. While Olefin (PAO) synlubes caused a slight shrinking of oil seals, diesters caused a slight swelling. So, one way to solve the oil consumption problem was by adding some ester to the PAO base stocks. And the oil filter problem was cured with improvements in construction and binding agents.

PAOs

The base stock materials used today many popular synlubes are made of carbon and hydrogen molecules. These are synthesized from ethylene gas molecules into PolyAlphaOleflns (PAO). Mobil's trademarked name for PA0 is Synthetic Hydrocarbon (SHC) and almost all the synlubes sold in the stores are made with PAO base stocks.

PAOs provide better viscosity characteristics, are more resistant to oxidation and have much better low operating properties than petrolubes. Because PAOs are still made from hydrocarbons-which are similar to petroleum molecules-they aren't significantly better with thermal stability. PAU molecules will still react with moisture and sulfur to form sludge and acids, and when PAOs bum, they produce ash-an oil contaminant PAOs are cheap synthetic oil base stocks, and aren't as durable as the ester class of synthetic oils.

ESTERS

Organic esters are made by reacting certain acids with alcohols, forming acid esters. There are alcohol diesters and Polyol esters. This process uses expensive materials and results in lubricants that cost many times more than PAOs. Only esters are durable enough to withstand the rigors of jet engine operation, and races are being won around the world with ester based tubes. RedLine offers poiyol ester base stocks which are modified to improve thermal stability and performance. Their products have gained world-wide popularity in both racing circles and domestic uses.

HYDROWAXES

Petroleum oils, or petrolubes, use a complex mixture of hydrocarbon molecules derived from refining crude oil base stocks into more uniform materials. Because of their long chains of hydrocarbons, these molecules act like microscopic ball bearings inside the engine. The process of refining removes most of the natural contaminants. However, one horrific contaminant, wax, isn't removed entirely. Wax is a poor lubricant, and it forms damaging byproducts-mainly sludge, inside the engine. Until recently it was considered a byproduct Not any more.

At an Esso plant in Great Britain, Exxon began making lubricants from a byproduct of commercial refining. Called Exxsyn, it's similar in some ways to PAOs. The byproduct, slack-wax, is given a hydro treatment to remove sulfur, nitrogen and catalyst poisons. It goes through a two-stage hydroisomerizalion process to convert the N-paraffin's into isoparaffins, a vacuum stripper removes aromatics, olefins or intermediate and volatile products (vacuum stripping gets rid of lighter conversion products to be used in lighter fuels or specialty products), a solvent de-waxer gets rid of excess unwanted wax until it reaches the desired pour point-with the residual wax being recycled back into the isomerization unit Got that?

In the mid 90's, Shell and Mobil began selling hydro wax lubricants in Europe. In 1997, Castrol stopped using PAO in Syntec and became the first company to market it here. Hydrowaxs are very cheap to produce, even cheaper than olefins, making them the cheapest of all the synthetics. They have come to be known as Group-Ill lubricants.

Many in this country say that calling them synthetics is a farce. I call them imitation synthetics. They are a rip-off that no one has told the consumer public about Meanwhile, one oil company is selling Group-rn oils and getting away with calling it synthetic. In the next installment, Nutz *and Boltz will* expose them *and* tell you how they are getting away with this hoax.

Imitation Synlubes II March, 2000

ADDITIVES

All popular synlubes use widely differing additive chemistry. Some use high quality additives, some use cheap ones. For petroleum oils, additives are the most expensive ingredient in the container.

For synlubes, the additives make a difference between a so-so lubricant, and a really great lubricant. If the additive package is formulated with the correct amounts of the right ingredients it also becomes possible to extend the drain intervals.

Some synlubes (mainly esters) don't need thickeners or detergent additives. This leaves more room in the container for the lubricant. Remember, it's the base stock that does the lubrication, not the additives. The more additives needed, the less lubricant! That's one of the big advantages of Polyol ester synlubes.

DETERGENTS

Because PAOs are created from petroleum products (mainly natural gas) they tend to lack resistance to sludge formation, and need a detergent-dispersant.

This additive is usually a high-molecular weight nitrogen compound. When sludge precursors begin to accumulate in the engine, mainly combustion blow by by-products, the nitrogen encircles the by-products, keeping them from interacting and in suspension until the oil is changed. If they combine, they'll form long chains of molecules that become sludge deposits.

However, heat and thermal cycling depletes the detergents, then the sludge will begin to coat the inside of the engine, plug oil passages and cause catastrophic engine damage. This is an important consideration when extending oil drain intervals. PAO base stocks may last 7,500 miles, but should not be trusted past that point. Esters, on the other hand, are naturally detergent in nature and don't require nitrogen additives. Esters don't turn into sludge and can last up to 18,000 miles (under ideal conditions).

Because Group-HI lubes are made from a wax, they require additional detergent dispersants to control sludge. In addition to their tendency to form sludge, Group Ill also produce ash and react with sulfur. For these reasons, it's not possible to extend the change interval, even a little.

VISCOSITY IMPROVERS

The viscosity of oils is a most important quality, a key factor in performance. If it thins out, bearing surfaces will touch (collapse), resulting in metal-to-metal contact. This causes catastrophic bearing wear. Without the lubricant to act as a cushion, bearings and camshafts will gall. Cylinder walls also are subjected to high forces, and will suffer from piston and ring wear.

Viscosity is the thickness or "weight" (w) of an oil. It is represented as a number such as "10w-30." Polymeric thickeners (aka viscosity improvers or VI's) are added so the oil will thicken as it gets hotter. A typical 5w-30 petroleum oil is made of 5-weight base oil. At zero degrees (Celsius) it behaves like 5-weight oil. Because of VI's, it will behave like a 30weight oil at 1000 C.

Some places in the piston have a normal operating temperature of at least 600°, and turbochargers get even hotter than that. This causes thermal degradation. The problem occurs during high RPM and temperatures. Oils "shear back" to the lower number-just when it is needed to be thicker. A 5w-30 turns into a 5-weight oil.

Petroleum-based lubricants contain very large molecules, and especially suffer from thermal degradation when exposed to high engine temperatures. When this happens, they also form varnish deposits, which stick rings to the pistons and plug up turbo oil passages. Once a petrolube-based oil reaches 475°, it breaks down, turns into tar and varnish, then forms hard deposits that block the oil flow. Petroleum oils also lose considerable viscosity at high engine temperatures and RPM. When petroleum oil enters an area of high stress and heavy loading, such as a bearing, the large molecules align themselves creating a path of least resistance. The rest of the petroleum oil follows this path, instead of coating the entire surface. The oil viscosity quickly drops, and the oil begins shearing back to the base number.

Probably the greatest advantage of ester base stocks is their ability to resist the ravages of heat. This is especially important in turbo bearings and in the upper ring area of pistons. Because ester lubricants don't shear back when hot and have natural temperature-resistant qualities, they exhibit natural mufti-grade viscosities without the need for additional VI's.

Of all the synlubes, Redline's ester base stocks offer the best thermal stability, providing continued lubrication at temperatures as high as 700°. Some PAOs don't need Vls. But Group-Ill oils do. Remember, adding VIs to the oil takes up space in the container.

ACID NEUTRALIZERS

As the engine operates, combustion gasses acidic by-products from the sulfur in the fuel. The acids combine with moisture (every gallon of gasoline produces 1/2 gallon of moisture) which dissolve bearing surfaces.

All modem motor oils contain sodium hydroxide (NaOH) to combat the acid build up in the oil. As the oil becomes contaminated and turns acid, the NaOH gets used up. Preventing acid buildup is the primary reason for changing motor oil.

Because everyone's driving habits are different, everyone's oil gets contaminated at a different rate. And since various oils contain different amounts of NaOH, the only real way to tell if your oil change interval is correct is by having it analyzed. We recommend taking a sample during your oil change and having the Total Base Number (TBN) measured.

The TBN represents the number of grams of NaOH per kilogram of oil. New oil comes with a TBN number ranging from 5 to 12, depending on the quality of the oil. Store bought oils have a TBN of 6. High-quality synthetics (Redline) have a TBN as high as 12. When the TBN drops to the below 2, it's time to change it.

Imitation Synlubes III April 2000

SYNLUBE DIFFERENCES

The question of synthetic oil quality is on the minds of many who want the best oil available for their vehicles. When it comes to your auto investment, the higher the quality of motor oil, the better protection your engine has. The cost of motor oil is relatively small when compared to the high cost of engine replacement An expensive motor oil may cost more, but if it significantly reduces engine wear and prolongs engine life, the extra cost is justified. Basically, there are now three types of oils that are being labeled as synthetic. The real synthetics and the petroleum-based synthetics. The true synthetics can be distinguished by the fact that they are entirely man-made.

ESTERS

These true synthetic lubricants, the Polyol esters and diesters, are also known as POEs, or esters for short They provide the best engine protection available right now, and are the only class of lubricants used in jet aircraft engines (who would want cheap lubricants in a jet?!). The esters...

- aren't derived from anything else-from petroleum or natural gas-are made entirely from other chemicals.
- have better high-temperature stability, with excellent metal-wetting abilities especially with very hot engine temps, continuing to lubricate hot cylinder walls, camshafts, and valve stems up to +600° F.
- don't have a tendency to sheer back to less stable compounds, which don't lubricate well.
- provide high speed film strength keeping the metal parts separated from each other, eliminating rubbing types of wear, especially at high engine speeds.
- have natural viscosity stability, making it unnecessary to add viscosity improvers (VIs) to keep them from thinning out at high temps and thickening at low temps.
- don't hydrolyze, combining with moisture to form longer chains of molecules which eventually coat the engine with sludge.
- don't react with the water and sulfur byproducts of combustion which forms destructive acids.
- don't thicken when very cold, still pouring at -40°f.
- don't attack seals causing them to shrink, and actually have some seal-swelling tendencies.
- accept additives readily and work well with additive packages making them more stable.
- don't use a non-renewable resource, but are expensive to manufacture as a major drawback.
- Last two to live times as long as petrolubes, allowing for extended drain intervals. This factor alone more than makes up for the increased cost of these lubricants.
- use some olefins in the additive package to improve compatibility of engine seals with the ester base stocks.
- aren't sold to the public in stores, where the petroleum companies rule the store shelves.

OLEFINS

The second class of synlubes are the Poly Alpha Olefins, also called PAOs or Olefins for short They...

- are derived mainly from natural gas, and for that reason aren't true synlubes.
- are less expensive to manufacture than esters, but more expensive than Group Ill oils.
- are made from a non-renewable resource, natural gas.

• are superior to petrolubes enough to provide extension of maintenance guidelines which are written for petrolubes. Inmost cases the 3 month/3, 000 mile oil change interval can be doubled.
• have better high and low temp stability than petroleum oils, and slightly better than Group Ill oils,
• tend to sheer back to less stable compounds, but not as bad as Group Ill or petrolubes.
• have better viscosity when very cold or hot, but many still require VIs to perform properly.
• react to moisture and sulfur compounds, resulting in sludge and acid byproducts.
• have a tendency to cause seal shrinkage, but not as bad as petroleum oils.
• must be carefully formulated to work properly with the additive package.
• use some esters in their additive package to improve the performance of the olefin base stocks.
• compromise the base stock of all the store brand synlubes, which are made by oil companies.

GROUP III

The third class of synlubes are hydroisom- base oils, called the Group Ill lube- Group Ill lubricants...

- are really an imitation rather than a true synthetic oil, because they lit the exact definition of a mineral oil: *"An oil manufactured from* crude oil by a *series of refinery processes."*
- are derived mainly from slack-wax--a byproduct of petroleum refining. Technically, it consists of isomerization of a linear paraffin into a branched-chain **paraffin.** The hydroisomenzation process produces a motor oil more pure than conventional petroleum (mineral) oil.
- are cheap to manufacture, maybe even cheaper than petroleum oil.
- are made from a limited natural resource.
- are still called synthetics and are more likely to become the only synlubes offered to the consumer public by the oil companies-who are driven more by prices than anything else.
- were first marketed in the US by Castrol, who uses it exclusively in Syntec synthetic oil. Mobil and Shell are the leading marketers in Europe, and haven't turned their attention here-yet
- could be used in any other store-bought synlubes. No one is telling the consumer if their synlubes contains olefins or cheaper Group-Ill stocks.
- production creates no increase in the size of the molecule, unlike PAOs.
- have better high and low temperature stability than petrolubes, but not as good as olefins.
- act the same as petroleum in many ways, including high-speed sheer, metal wetting high-heat problems, thickening when cold, hydrolysis, sludge and acid formation, and seal shrinking.
- Have better viscosity characteristics, requiring less additive of viscosity improvers than petrolubes.
- Require the use of seal conditioning additives to prevent engine seal degradation.
- Usually are sold with a poor quality additive package.

Imitation Synlubes IV MAY, 2000

PAO vs POE

As the years passed by, the synthetic oil companies gathered into two groups. Those who used Poly Alpha Olefin base stocks and those who used Poly Oil Ester base stocks. The players were easy to spot. All the oil companies followed Mobil1 in using Olefins. Their marketing placed a large importance on price point. The price-per-quart costs were cut even more for industrial needs by making Olefins available in large quantities. For fleet and industrial operations, lubricant costs are a big issue.

If a company with a fleet of trucks is able to save downtime and labor costs by switching over to synlubes, they'll jump at a chance to save money. And that is exactly what many trucking firms did when they saw the value of synlubes. But remember, truck engines use many gallons of lubricating oil, not quarts. And price is a big issue for fleet operators who buy their lubricants in 55-gallon drums. Sales to trucking and industrial became one hot market area for the synlube companies.

Then the do-it-yourselfer (DIYer) market that sells off the store shelves, is yet another juicy target for the synlube companies. The issue of competition and price at store shelves is probably the biggest thing affecting consumer choices-whether it's industrial or DIYer's.

I believe that's was why Amsoil switched over from Ester base stocks to Olefins in 1986. In order to compete with the other players, you had to fill your bottles with a base stock that was price competitive. And you can't compete by selling a product that costs twice as much to formulate. This is true because of the high price of Esters. Remember, Olefins are cheap when compared to Esters.

As time marched along, the battle lines were drawn. The main contenders were Mobil-1 and Amsoil. Mobil-1 become the oldest and most revered synlube company, ruling the US market. Amsoil sold through dealers. But remember! To compete, you not only need price point, but you also must have availability. And in order to compete with Mobil-1, Amsoil had to sell in stores. Then along came all the other synlubes. One by one they showed up on store shelves, all vying for the consumer's dollar.

With a huge advertising blitz, Castrol launched their synlube, Syntec. In order to capture the consumer market away from Mobil-1, Castrol had to convince consumers that Syntec was as good as Mobil-l. Once that was accomplished, all they had to do in order to pull the rug out from under the synlube market was sell their product for less. And that's just what Castrol did. Castrol grabbed the synlube market selling for less. And you can bet that Mobil wasn't happy about it.

Meanwhile, Redline Oil Company took another direction. Rather than compromise their product by using cheaper Olefins, they decided to create the finest lubricants using Ester base stocks. The difference between Olefins and Ester base stocks became readily apparent to those into racing. Again and again Redline's Ester stocks outperformed the others. More horsepower, better protection, less wear all very important considerations to those who live at the cutting edge of performance-the racing industry.

But racing engines aren't the only engines that benefit from Ester base stocks. Mercedes-Benz and BMW owners quickly realized their expensive cars would also benefit. Redline became the lubricant of choice for hip yuppies, who saw the big picture. Sure, it was expensive. But so is an engine. And why compromise? It just doesn't make sense. Especially when your engine alone costs more than most people spend on a whole brand new car!

PAO vs Group III

And as time marched on into the nineties, there became two groups of synlube consumers. The first group bought only the best, and Redline Oil sales have taken off with the world market snapping up more than a third of their production. This small California start-up company went from a few rented warehouse stalls to building their own blending plant. And it's running at full production, and still can't keep up with the demand.

Then there's the other group of synlube users. I call them the K-Mart shoppers, the shopper who always grabs the cheapest one from the shelf. And here's where the consumer battle is being fought. And here is where the story gets really interesting.

A Castrol commercial called "Test 4E: Test on Race Track" ran on national TV in 1997. It showed all the oil being drained from a car, being replaced with only a capful of Castrol Syntec. The car was then shown going over 100 MPH for an extended period of time while an announcer said, "Castrol Syntec protects in ways other oils can't." And, "Syntec has unique molecular structure that bonds to engine parts." Then, the following words appeared on the TV screen:

"CASTROL SYNTEC'S UNIQUE MOLECULAR STRUCTURE"

The announcer says, "Castrol Syntec protects in ways other oils can't."

In 1998 there were three more TV commercials, Aerial Dogfight, Spiderman, and Air Force. All of them played on the lie that "Castrol Syntec's patented stabilizers seek out and neutralize harmful particles in ways that other oils can't." All the commercials pushed the claim that Castrol Syntec Motor Oil contained some kind of patented ingredient which made it protect engines better than any other motor oil on the market.

Then there were the pamphlets that contained outrageous claims:

[Syntec] "contains exclusive chemical esters that actually bond to engine surfaces." [syntec] "leaves a layer of protection far stronger than conventional and synthetic blend motor oils." [Syntec] "is the best protection available." "Together, the [Syntec] bonding and additive technology provide the best protection you can buy." "Nothing protects better than Castrol SYNTEC FULL SYNTHETIC." "Don't settle for the second best! Use Castrol SYNTEC Full Synthetic Motor Oil."

Then there was the labeling on Syntec containers that contained the shocking claim:

UNIQUE MOLECULAR BONDING.
Castrol Syntec FULL SYNTHETIC PROTECTS IN WAYS OTHER OILS
CAN'T. FULL SYNTHETIC MOTOR OIL. SAE IOW-30.

With the debut of the TV commercials and pamphlet campaign, Castrol took on the rest of the synthetic oil industry. By making the claim that their product was superior, Castrol opened themselves to the attack of the rest of the industry. The commercials were outrageous. **They contain three big fat lies**.

The first lie claims Syntec was the best lubricant because "Syntec's unique molecular structure allows it to bond to engine parts." There is no doubt that the use of an Olefin base stock is superior to mineral oil (paraffin, Group II or petrolube) base stocks. Synlubes have been clearly and consistently documented as offering far superior lubrication than their petroleum counterparts. This is because of the molecular structure of synlubes gives them an ionic attraction to metal.

By far, the Esters exhibit the best engine protection. But they're expensive. Olefins are cheaper and offer good protection. While Olefin protection isn't as good as the esters, it still offers a better choice than petrolubes. And for the off-the-shelf K-Mart customer, the only difference in the different store brands of synlubes was their additive packages. As those of us who have studied lubricants know, the main difference in the price of store shelf motor oils (whether it be petro or synlube) is the quality of the additive packages. And Castrol made claims they now had a special ingredient that worked better than any of the other store-shelf synlubes.

Note: Redline isn't included here because it isn't available in the stores. The debacle has to do with Olefins, not Esters like Redline. At issue is Castrol's claim that their product outperformed the other Olefin base stock lubricants. Redline and its ester base stock is well known to be far superior to the others. Olefins are another class of lubricant than Esters and that has been clearly demonstrated. Castrol was claiming their "exclusive" base stocks and their "exclusive" additives made Syntec superior to the other Olefin-based motor oils. Castrol claimed that Syntec had a *unique ingredient*. An ingredient that worked so well that you could run your engine for extended periods without any oil with just a capful of Syntec. This was the second lie.

This immediately raised the question about how they measured the difference in their oil and the others? Were their tests run at room temp? At very hot or very cold temps? Was it a standardized (industry recognized) test sequence? Was there a neutral or control group also tested? (More about "The Test" later on).

And just what did it contain? There's an important point, here. So pay attention. While the TV commercials were running, Castrol was quietly switching their base stock from an Olefin to Group-Ill base stocks (slack wax isomers). Castrol switched to using lubricants that were not made from synthetic ingredients. Syntec was now being made entirely from petroleum slack wax. Syntec was no longer a synthetic oil.

And that was the biggest insult to injury of all. The third great lie. Syntec had quietly switched to hydroisomerized (Group Ill) base stocks. They were the first company to market Group Ill lubricants in the US. And Syntec wasn't any longer a synlube. But Castrol claimed it was. And the other synlube companies didn't like it one bit. They didn't like Castrol claiming they had pulled some kind of magic ingredient or additive that made it have superior detergent/dispersant qualities (neutralizes harmful particles) to their products. They didn't like Castrol claims that Syntec's base stocks provided superior lubrication (especially since Castrol was now using Group ill) to their products. And they didn't like Castrol selling Group III lubricants as synthetics.

They especially didn't like it because of the bottom line that Castrol could now easily beat them on price point. Compared to Olefins, Group Ill lubricants are cheap to produce. Castrol was not only undercutting their store prices, but they were doing it at a *very large profit margin.* They wouldn't be able to compete with Group Ill lubricants and would soon lose their market share.

And now you know why all the other synlube companies went ballistic. Their cause was justified. Castrol had stepped over the line and needed to be put in place. And the others decided to do something about it.

Imitation Synlubes V ***June, 2000***

THE INDUSTRY CRIES OUT

Castrol's claims that their reformulated Syntec offered "Superior engine protection" and "Unique molecular bonding" caused many in the oil industry to cry "foul." This followed with an intense debate over the term "synthetic oil". Mobil oil spearheaded an effort to define synthetic oil, and to put an end to Castrol's marketing claims that hydroisomerized (hydro processed) petroleum oil is synthetic. But lest we forget, there was a similar flap back in the seventies between Mobil and the other synlube companies.

Alcohol and Polyol esters were the first synlubes. Then Mobil started marketing synthesized hydrocarbons, which were made from natural gas. Mobil called it SHC, even though it was based on Olefins. The other companies objected, saying it was not man-made, but rather made by re-refining natural gas. But Mobil got away with it and soon other petrochemical companies joined in and started marketing their own versions of Olefins.

Mobil decided to attack Castrol for doing exactly the same thing as they did two decades earlier, only this time the base material wasn't natural gas. It was slack wax-a byproduct of petroleum refining. Was this a case of Mobil calling the pot black, and did Castrol have the right to call their product synthetic oil? The answer lay in the hands of the NARC.

The NARC

Three leading advertising associations and the Council of Better Business Bureaus, Inc. joined together in 1971 to form the National Advertising Review Council (NARC). Their mission was to foster truth and accuracy in national advertising though voluntary self-regulation. NARC began focusing on challenges brought forth by other advertisers as well as from self- monitoring of traditional and new media, including the Internet. NARC has set forth and established procedures and policies for three other inter-related agencies, Council of Better Business Bureau National Advertising Division (NAD), Children's Advertising Review Unit (CARU), and National Advertising Review Board (NARB).

Mobil Oil submitted a petition to NARC regarding the truthfulness of Castrol's claims that Syntec provided superior engine protection to all other motor oils (both synthetic and conventional), that Syntec's esters provide "unique molecular bonding and that reformulated Syntec could be called a synthetic oil. The NARC ruling would set a precedent for a broad definition of the term "synthetic."

SYNTHETIC DEFINED

Mobil's complaint to the NARC contended that true synthetics had to be formulated from small molecules subject to a chemical reaction, not built from natural petroleum. The process of isomerization, reformulating, hydro treating, and hydro cracking are processes that produce better compounds from crude oil, but do not represent synthetic products. Mobil argued that hydroisomerization doesn't create synthetic material because it doesn't create or build molecules. It merely rearranges the same molecules that were present in the original petroleum base.

Mobil also contended that Castrol's definition of synthetic was contrary to the EPA definition, "the term 'synthetic' material., means material produced by the reaction of a specific purified chemical feedstock, as opposed to the traditional base fluid such as diesel and mineral oil, which are derived from crude oil solely through physical separation processes."

Further, Mobil argued that Castrol clearly defined Syntec on their own website by saying a mineral oil is "oil that is manufactured from crude by a series of refinery processes." Isn't that what hydro processed oil is? Refined? Further, Castrol defines "synthetic lubricants are manufactured chemicals... created in the laboratory by combining molecules.. . a lubricant produced by *synthesis rather than by extraction and refinement."*

The Society of Tribologists and Lubrication Engineers (STLE) describes synthetics as man-made compounds, not naturally occurring, and that combining low molecular weight materials via chemical reaction into higher molecular weight structures creates synthetic materials. The American Society for Testing and Materials defines synthetic as originating from the chemical synthesis of relatively pure organic compounds from one or more of a wide variety of raw materials.

And on and on it went. Do you think that rerefining a petroleum oil or byproduct into a purer product qualifies to be called synthetic? Is Castrol justified in making their claims of superiority to all other oils?

NOTE By Lee: The following letter would not scan at all so I have recreated it here as best as I can.

Mobil Technology Company

December 21, 1999

Mr. David Solomon
NUTZ & BOLTZ,
INC
P.O. Box 123

Dear Mr. Solomon

Please be advised that comments in the Mr. Know-It-All column of "NUTZ & BOLTZ" (Volume XI, Number 11) which state that "Mobile 1 now uses hydrogenated paraffin base stocks" are <u>completely false.</u>

For the record, Mobil 1 has always and continues to be fully synthetic, using a combination of poly-alpha-olefin and Group V synthetic stocks.

We request that you immediately notify your readers of this correction, and inform me of the specific steps you plan to take in order to remedy this situation.

We would be happy to discuss Mobil 1 and its fully synthetic properties with you further. Please contact W. L. (Bill) Maxwell at 856-224-3220 should you have any questions or require additional information.

Very truly yours,

W. H. Buck, Manager
Passenger Vehicle & Aviation Lubes

Imitation Synlubes VI July 2000

THE NARC RULING

Despite the debate about the definition of synthetic oils, and all the scientists that said a rerefined petroleum product would not qualify as being synthetic, the National Advertising Review Council (NARC) decided in favor of Castro!! But they did rule against Castro! in their false advertising claims. Castro! agreed to stop making such claims as "superior engine protection", "Protects in ways other oils can't" "Nothing protects better than Castro! Syntec..." ". . .provide the best protection you can buy" and "Unique molecular bonding".

Many industry experts were appalled by the NARC decision, saying that they were not in a position to make such a ruling being only businessmen and not technical experts. Others bemoaned the fact that the term "Synthetic Oil" will now become practically meaningless. But the bottom line is this, the consumer will ultimately be the victim because consumers shop based on price. And when Mobil-1 costs more significantly than Castrol, and they both claim to be fully synthetic oils, which will the consumer buy?

Castrol has basically wooed the synlube market away from them by making false claims for their inferior product, Syntec, and then selling it at a cheaper price. The consumer doesn't know those claims were false. No one has forced Castrol to recant their false claims, and anyone who read or saw them on TV still thinks the claims are true. And now that Castrol has grabbed the synlube market away from Mobil, what's Mobil going to do?

Funny, there's an irony going on here with this whole debacle. Mobil and Castro! Launched a similar protest a decade ago against Shell and BP for making similar claims. What goes around comes around, right?

RUMORS ABOUND

About the same time as the NAD ruling was released, Mobil began selling their new TriSynthetic formula. Rumors began to fly that Mobil had begun using Group III in their formula in order to remain price competitive.

My insider source in the industry said that it was true, that the trisynthetic formula contained all three: Esters, olefins and hydrogenated paraffin base stocks. I indicated it in the *Mr. Know It A//* column last November. Well, I was wrong, and Mobil promptly let me know. They sent the letter shown below.

I called them and asked what was in their formula They said the formula contains an ester, an olefin and alkylated naphthalene. I asked if there was *any* hydrogenated paraffin base stock in the formula and was told there was not. At least there isn't at this time. I asked if they could say if there ever would be a switch to hydrogenated paraffin base stocks. I was told that they couldn't predict what might be done to their formula in the future.

But, Mobil will lose market share to Castrol if they can't compete on price point And price point is what the cheaper Group III lubricants have as an advantage. Olefins cost too much to be competitive in a synlube war on price. Will this force Mobil to change their formula?

I don't believe there's any question that they will. In addition, Mobil just happens to be one of the world's biggest supplier of Group III lubricants! The question is not will, but *when.*

And thanks for the NARC riding, consumers will never know if and when they switch because they can get away with it Surely, all the other oil companies will soon follow suit And it doesn't matter that when compared to olefins, Group Ill clearly exhibit deficiencies such as cold- and very high-temp performance, soot handling capabilities, just to name a few. But the consumer will never know that a change was made, at least not by what is being labeled on the store shelves.

THE CONCLUSION

Which brings me to the final point. Who can you trust? Certainly not the petroleum companies, who have proven they don't care about the consumer or his engine. It is clear that the battle of the synlubes is not being waged on engine dynos or at the race thick. How well a lubricant protects your engine is not the key issue. The issue is who can sell their carbon-based product for less. And because of that issue, future store-shelf synlubes will be Group III.

Meanwhile, people who really care about their engines are unwilling to accept sacrifices for price or quality. People who spend many thousands of dollars for their racecar engines, or their fine BMWs or MBZs. People who want the best protection that money can buy will accept no compromises. And that is why Redline remains on the top of my list of recommended products. Redline only uses the finest Polyol ester base stocks, with the best additive packages man has ever made.

What you use is up to you. You can take your chances with your engine and what you buy on the store shelves. It's up to you. As for me and my machinery, I want only the best And clearly the best lubricant is an ester-not an olefin and certainly not hydro processed isomers or Group III! Until someone comes along with a better lubricant, I'll continue to recommend only the best As I have said all along, if I find a better lubricant on the market, I will be the first to say so. And you can bet that I'll let you know.

Why Synlubes Rule August 1999

There's no realistic way to make a comparison between the benefits of using synthetic lubricants in your vehicle. Cost factors have so many components, it would take a very sophisticated computer program to be able to predict actual dollar savings. So, when it comes to the bottom line, it's really up to you to factor the many variables into the equation for your own vehicle. Then, you can estimate your own savings.

Typically, the benefits of proper oil changes aren't noticeable until a vehicle has reached 50,000 to 60,000 miles. So, if you don't keep your vehicle longer than that time period, the use of synlubes or frequent oil changes will only benefit the person you sell the vehicle to. But, synlubes can offer benefits in terms of increased fuel mileage as well as extended change intervals.

If you're in the habit of keeping a vehicle more than 5 years or driving it more than 150k miles, the reduced wear benefits alone are worth the extra expense of using a synlube. Main unit component replacements, engines, transmissions, and transaxles, are very expensive. Improving the lubrication of these main units alone is worth the price of admission. Of course, there's no easy way to measure the engine wear differences between synlubes and petrolubes.

But there are many other benefits available from synlube use, and each should be weighed for its relative value in your own particular operation conditions. In order to help you reach your own conclusions about the pros and cons of using a synlube in the operation of your vehicles, we will list the benefits and drawbacks. Judging on the basis of your own operating situation, you can pick and choose which type of oil and maintenance schedule best fits your needs.

SEVERE or NOT Too SEVERE SERVICE

Quite often you hear the term "severe service" used when defining the oil change intervals. The definition seems to differ from carmaker to carmaker. Since nobody has properly defined the terminology. Exactly what is severe service? Since they haven't, Nutz and Boltz will try.

All carmakers distinguish between service types. There are the *severe* and *normal* service intervals. Because manufacturers assume that most drivers operate under normal driving conditions, it's important for you to determine the service schedule that realistically applies to your type of driving. A survey of driving practices found that over 75 percent of car owners are severe service drivers. The study suggests that severe service is the norm for many drivers.

However, auto manufacturers write their owners manuals considering the opposite-that most people operate under normal conditions. Short average trip-length is by far the most important reason why you need to change motor oil more often. Short trip cycles cause engines to repeatedly warm and cool, which is responsible for most engine wear.

Because the maintenance schedules of a fleet operator and a little old lady are so drastically different, it’s important to judge each and every situation individually. This is where owner’s manuals go so far astray from describing proper maintenance service intervals.

And, let's not forget, car companies are adamant about their vehicle maintenance expense bottom line dollar figure. The oil change schedules listed are unrealistic. Most people don't drive under those operating conditions. Yet, they list change schedules that are too idealistic for most people's vehicle operating conditions. In reality, most people operate under what would be considered as severe service conditions.

If operating expenses were compared from one make of vehicle to another using severe service guidelines, operating expenses would be far more realistic. But the automotive industry must beat the almighty dollar-or lose to a competitor. And as long as this is so, maintenance schedules-especially oil changes and tune-ups-will continue to be drastically oversimplified and too infrequent.

In order to paint a more fair and realistic picture of how often oil change intervals should be carried out, we've listed what we consider as appropriate oil change intervals for most real-world operating conditions. Hopefully, with this information, you will be able to more accurately determine your exact operating conditions and will change your oil accordingly.

FIGURE YOUR SERVICE CLASSIFICATION

In order to know your service classification, you must first determine your average trip-length. Note your odometer mileage reading at the beginning and end of a predetermined driving time period. During that time period, keep track of how many times you start your engine and how many miles you drove. Here's the formula:

$$\frac{\text{Total Miles}}{\text{\# of Startups}} = \text{Average Trip}$$

For example, you drove 900 miles during the time period. During that 900-miles, you counted up 45 times you started the car. Calculate your average trip-length by dividing 900 by 45. In this case, your average trip-length is 20 miles.

Twenty miles average trip length is normal service. If you find that your average trip-length is less than 10 miles, you should follow the severe service recommendations listed. Severe service means you must engage in more frequent oil change intervals.

SEVERE SERVICE DEFINED

SEVERE SERVICE-def.[adj/noun] 1) Repeated short distance driving. 2) Driving less than 10 miles per trip, per direction (as in "I only drive five miles to work"). 3) Driving on highways that are covered with dust or where road salt or other corrosives (such as ash) have been applied. 4) Driving on rough or excessively muddy road surfaces. 5) Driving where the brakes are used a great deal. 6) Operating the vehicle at low speeds. 7) Operating the vehicle with excessive periods of idling. 8) Operating the vehicle at freezing or below freezing temperatures. 9) Operating the vehicle at temps above 90° F. 10) Operating the vehicle in very humid climates. 11) Operating the vehicle at continued high speeds. 12) Operating the vehicle in steep mountainous conditions. 13) Operating with towing or carrying heavy loads, especially over 2,000 pounds. 14) Living at the end of a long, dusty, unpaved road.

If you are operating the engine under any of the above conditions, you'll need to follow the *severe service* oil change frequencies. The more items listed above fit your type of driving, the more frequent your oil changes should be. If there is any doubt about the condition of the oil, draw a sample for oil analysis. This will document the need for more frequent changes. Oil analysis will provide a multitude of interesting facts about your engine, including problems with sand, gas, and glycol contamination.

New Car Owner Note. If your vehicle is under a special warranty where you are treated to free oil changes by the dealership, look out! The change intervals offered are for "normal service." Since this doesn't hold for of all operating conditions, you may want to change it more frequently. Or, armed with a lube oil analysis that shows the oil was past due when it was changed, you might be treated to more frequent oil changes.

Oil change general rule-of-thumb: For synthetic oil (Olefins and Esters) users, you can safely double the oil change frequency. The use of lube oil analysis will help determine your proper change interval-which in reality may be much longer. For petroleum oils (including Group III), change the oil every 3 months or 3,000 miles, whichever comes first.

VISCOSITY INDEX IMPROVEMENT

One of the chief engine concerns is our oil pressure. Using synthetic lubricants has a direct effect on the oil pressure. Typically, synlubes produce higher oil pressure for the same viscosity grade oil. For example, if you were comparing a IOW-40 synthetic to a IOW-40 petroleum oil, the synthetic will typically produce a higher oil pressure. Why? Two reasons: 1) Because synthetics have higher sheer stability. 2) Synlubes don't lose viscosity (the primary determinant in oil pressure). Not like petroleum oil. It's because of "Viscosity Index Improvers."

To make an oil into a multigrade lubricant, it's treated using a polymeric plastic thickener called a Viscosity Index Improvers (VII). STP is an excellent example of a pure VII. Just pour a can of STP "Motor Honey" and it's apparent what VII thickeners look like, and how they act. VII's are what makes a IOW oil into a IOW-30. For winter operation this oil will flow like a 10-weight oil when cold, but act like a 30-weight oil when hot. Improving the viscosity makes a 10-weight oil into a thin oil capable of still flowing at zero degrees. Yet it's still able to thicken enough to act like a 30-weight when hot. VII's gives it high temperature stability.

One big problem with VII's has to do with how the high temperature testing is done. Lab test methods are used that don't equate to real-world use. The testing is carried out by measuring the relative viscosity in a small tube at very low rpm's. This isn't representative of general engine operation.

The conditions found in a modem engine cause a big problem with *sheer-back.* At higher engine rpm's, multigrade petroleum oils shear back A multigrade becomes more like a 10-weight at higher rpm's, not a 30-weight-like it's supposed to. Likewise, a 5W-30 will shear back to a 5weight. That's why carmakers tell you not to use 5W-30 for sustained high-speed operation.

The sheer back phenomena, where the VII is actually "chopped" into smaller sections due to high shear environments. When this happens, it loses its ability to act as a viscosity index improver. This can happen on both temporarily and permanently. In other words, the VII can go away only at high speeds, or can break down and go away altogether causing a permanent loss of engine protection.

By loss of protection, this happens when the oil thins out, it allows critical metal-to metal parts to touch. That means wear and in some cases catastrophic wear. For example, when the connecting rod bearings are no longer protected because of oil sheer back, the film that separates the bearing surface from the crankshaft collapses. When this happens, the bearing "kisses" the crank and the bearing surface begins to come off. That's bad news.

Similarly, when sheer-back allows the piston to scuff the cylinder wall, more bad news happens. Most important and essential are the upper piston rings-the hottest part of the engine. When sheer back causes the oil lubricating the cylinder wall to loose its fun strength, the piston rings "kiss" the cylinder walls and wear. This eventually results in a loss of compression, blow by, and oil consumption.

If the VII sheer-back happens only at high speeds, it isn't a concern for a little old lady. But for a performance enthusiast, or a driver who likes to push it a bit, this is a problem. The long-term loss of VII's comes about when the additive package breaks down as an oil ages. The results show up on the analysis report showing the change in base stock viscosity, changes reflecting the joining of the long hydrocarbon chains into even longer ones.

What makes petroleum oils shear back? When an oil enters a high shear-stress area such as a bearing, the large polymer molecules will align themselves to create a path of less resistance. This causes the apparent viscosity to be much less than the viscosity listed on the container. For example, a typical 20W-50 will actually behave similar to a SAE 30-weight in the bearing saddles.

WHY SYNLUBES DON'T NEED VIIs

Synthetic oils don't thicken very much when exposed to cold. Nor do synlubes thin out under heat. Synthetic base stocks have a natural multigrade properties, so they don't need VI's. Because of synlubes' inherent temperature stability, a high quality 10w-30 synlube can provide high shear protection viscosity stability that is superior to a 20W-50 petrolube.

This is especially important for certain important parts of the engine, like the bearings, lifters, and camshafts. Because of synlubes lack VI's, and offer a lower coefficient of friction, synlubes exhibit a much lower viscosity than petrolubes on the cylinder walls-where it counts which results in more power and better fuel economy.

One really big advantage of not using VI's is what happens to the oil at high rpm's and temps. A synthetic oil rating IOW-30 can actually produce a thicker oil film strength than a straight 30-weight petrolube. Petrolubes and some Group III oils must use a large amount of VI's (as much as 10% of the oil) to make the multigrade status. Higher quality synlubes (especially ester blends) don't need VI's to make them capable of achieving multigrade status.

However, you must be careful here. Some cheaper synlubes (including the Group III hydrowaxes and PAO blends being sold as synlubes) still contain VI's to achieve their winter status. Even worse, many SynLubes can contain as much as 20% non-synthetic petroleum oil mixed with the Vi additive package. Consumers are actually buying a semi-synthetic oil thinking it's 100% synthetic. TIP: Look for a disclaimer* somewhere on the container: *excluding additive carrier oil.

The chart on the top of page 22 tells change intervals based on the API base stock classification system shown in the chart at the bottom of page 22.

Why Synlubes Rule II **September 2000**

SYNLUBE BENEFITS OVERALL

The number of benefits available to you from the use of synlubes is weighed by your own particular operation conditions. To reach your own conclusions about monetary value of using a synlube in the operation of your vehicles, you will need to make a list of the benefits you will incur for your driving environment.

Go through the following list and check off which ones are of benefit to you. After you've finished, weigh the costs and compare the benefits tailored to your individual needs.

PROS

***Low temps & cold engine operation -** Reduced oil resistance to movement.
*__Cold starter operation__ - Reduced resistance to turn and longer starter life.
*__High temps & hot engine operation__ - Increased heat-dissipating ability.
*__Wear reduction__ - High film strength reduces metal-to-metal contact.
*__Viscosity__ - Reduced resistance to flow at very low temps, no VI Is needed.
* **Fuel mileage** - Reduction in overall heat and frictional loss increases mileage.
* **lncreased power** Reduction in overall heat and frictional losses increases power.
* **Longer change intervals** - Reduction in intervals save service labor costs. Under best conditions, esters will provide up to 18,000 miles of protection.
* **Short trips** - Reduction in severe service-related wear caused by short trip driving.

CONS

*__Expensive__ - Costs range from 3-6 times the cost of conventional motor oils.
*__Not readily available__ - Not all brands can be purchased from store shelves.
*__Doesn't comply with OEM__ - Some brands may not be recognized by the manufacturers as meeting their requirements. But remember, those requirements were established so the lubricant will comply with industry standards set forth by various commissions, including OEM's own commissions and of course, the EPA!

***Doesn't comply with industry** - Many synlubes are formulated for performance, not how they perform on a particular set of lab tests. Specifically, performance lubricants don't pass lab tests for metal contamination that cause degradation of the oxygen sensor or catalyst.
***Oil burners** - Because of their formulas, synlubes contain metals that contaminate the 02 sensor. If your engine uses oil and has an oxygen sensor, it will shorten sensor life depending on the amount of oil that is being burned.
***Oil Leakers** - Because of the high costs associated with synlubes, an engine that leaks may wind up costing more than the benefits, depending on how much it leaks.
***Older Models Oil seals** - especially valve stem seals, have changed drastically since the days of rope seals. While modern compounds are oil resistant, older formulations may react unfavorably. Consideration of the age of the engine when seals were installed (new or rebuilt later on), the engine may not be a good candidate for synlubes.

CHOOSING OIL GRADES

When choosing a petroleum oil, use the lowest viscosity possible that still provides a decent amount of separation of the metal parts in the engine. The idea is to use the thinnest oil possible without sacrificing film strength. Using to thick an oil will rob power from the engine caused by the extra drag. Oil that's too thick will also slow down cranking speed, which can become a problem during cold startups.

Choosing a synthetic oil viscosity is a bit different than choosing a petroleum oil. Because of sheer stress at high speeds, a 5W-30 petroleum oil will actually behave more like a SAE 10-weight oil in the engine bearing saddles. Conversely, an ester will behave like a 30weight This is what gives it superior film strength and viscosity protection.

MIXING SYNS & SYNS & PETROs

Union Carbide began the development of a glycol-ether oil as a synthetic motor oil sometime in the 1930's. They ran extensive field trials during WWII, from 1942 to 1945. They test marketed a "Prestone Engine Oil" in several Eastern states during 1946.

While glycol-ether oils were superior lubricants, field trial results and overall expense made the effort fail. In addition, glycol-ether oils were totally incompatible with petroleum oils. But, people didn't know any better. As soon as they added a quart of petroleum oil to an engine containing glycol-ether oil, the engine oil turned to jelly and the engine seized. This started the myth that synlubes weren't any good, or that they are incompatible with petrolubes. Today, all popular oils are more or less compatible with one another. It's their additive chemistry that conflicts. For this reason, it's still not a good idea to mix petro- and synlubes. For that matter, it's not a good idea to mix different brands of petrolubes.

From a chemical engineer's point of view, it's preferable to have a known chemistry of lubricant additives working inside the engine. In order to not have to worry about any possible negative interaction additives of one product might have with some of the other, use the same brand of lubricant when mixing. That way you know the lubricant is going to do what it is designed to do. For example, mixing Brand X l0w30 with Brand X 5w-30 is okay. But don't mix Brand X l0w-30 with Brand Y l0w30. Bad idea.

Still, many people have reported benefits by mixing one quart of Redline 100% synthetic to three or four quarts petroleum. Maybe it's Redline's high-quality additive package that makes it so compatible. Maybe it's the nature of ester-based lubricants. The best recommendation is to use only one type of lubricant in your crankcase

Why Synlubes Rule III **October 2000**

SYNLUBES AND DRIVETRAINS

People who systematically change their entire drive train over to synthetic lubricants find that changing the differential to synlubes shows a bigger effect in performance and fuel economy than any other component. People with four-wheel-drive vehicles having two differentials and a transfer case report as much as a 25% improvement in fuel economy. Motor oils, many gear lubes, and ATF all have slipperiness additives. While these additives serve a purpose, they also prevent the gear synchronizers from working properly. Synchronizers need friction to do their job. Friction is the method that transmission synchronizers use to transfer the energy. But there is no correlation between wear and coefficient of friction. These are different regimes of a lubricant-making it difficult to provide a gear oil that reduces friction and protects the synchronizers.

Incredibly, Redline formulations are capable of reducing wear and gear friction, while improving synchronizer friction action at the same time. Redline "Manual Transmission Lubricant (MTL) is classified as a GL-4 gear oil. This means it has good anti-wear and extreme pressure qualities for gear train protection. It provides excellent drive train wear protection as well as synchronizer anti-wear properties. Note: GL-5 gear oils are designed for differentials.

Redline MTL is classified as an 80-weight gear oil. But if you were to classify it using a motor oil classification system, it would be called a 30-weight Why? Because when SAE oil classification procedures were developed during the turn of the last century, they predicted that engine oils were going to run closer to 200° F. and gearboxes were going to run at 150°. Today's gearboxes run closer to 2000. Because the viscosities were rated using obsolete temperature ranges, it's not really applicable today.

Synlubes like MTL also have a significant advantage over petro-gear lubes because of their excellent low temperature fluidity. Synlubes provide the same protection as 80-weight oil, but will flow like a 10weight oil when cold. In the winter, they improve cold weather shift-ability tremendously. Specifically, because of its coefficient of friction, MTL isn't an extremely slippery lubricant It is able to improve gear synchronization in both cold and hot temperatures.

While friction reduction is an advantage in differentials, a certain amount of friction is needed for transmission synchronizers to work properly. Using ATF or motor oil in a manual transmission may be what is called for in the owner’s manual. But in reality, it's not a good idea. Detergents are needed for ATF and motor oil to operate in their assigned working environments inside engines and transmissions. But those detergents compete with the friction reducers that are needed to protect the metal surfaces of the synchronizer cones. MTL also has the advantage of no detergents needed. Hence, there's more lubricating oil in the container.

CALLING THE FINAL DRIVES

For rear-end (differential) lubricants, probably the best all-around choice is 75W-90 weight oil. The American Petroleum Institute calls for the use of a GL-5 class of lubricants. This classification specifies special lubricants for use with hypoid differential gears that experience high shock loading and heavy-duty applications. Here is another place where synthetic gear oils offer very low friction performance. Synlube chemistry also results in a big reduction in the temperature inside the differential.

This is especially important for friction reduction, improvement in power, and fuel economy. But, some final drives call for ATF. In most cases MTL is the product of choice for these applications. But be sure to check first, before you specify it for your particular application. Ditto for transfer cases.

CALL IN Synthetic ATF

Ever since whale oil was banned as an ATF additive, tribologists have been trying to create a better additive that both enhances friction yet allows the base stock oil to lubricate. Both GM and Ford created their own formulas. GM's registered trade name for these fluids became known as "Dexron" and Ford "Mercon." And because Ford transmission systems had different shifting mechanisms than GM, both fluids had markedly different frictional. GM required a smooth, versus hard lock-up for Ford. Dexron had less frictional qualities than Mercon.

Since then, many changes in transmissions have occurred. The downsizing of vehicles and increases in engine horsepower has required more and more rigorous ATF formulations. Transmissions joined up with the differential and are now part of a single unit as rear-wheel drive has changed to front And, vehicles operate on a much higher average speed, making sheer-back rear its ugly head in the driveline.

There are now many advanced Dexron formulations for better low temperature fluidity and cold shifting. Chrysler and Honda also have special specs for their And Many Do-It-yourselfers have found out, using the wrong type of ATF can result in catastrophic failure at worst, and slipping or banging into gears at best.

As many motorists have found out, having the transmission serviced by the wrong person-who installs the wrong fluid cause’s catastrophic breakdown. CJ just had the transaxle in her Nissan Maxima self-destruct at 63K miles because the local mechanic used cheap ATF that didn't hold up.

Beware. Operating your driveline with a non-OEM recommended lubricant (or the synlube equivalent) can be a big mistake. The problem is with the lower viscosity base oil that the lube is built upon. Since it's able to reach a low viscosity, it winds up sacrificing fluid volatility. Under higher temperatures, it also will exhibit more evaporation, frothing and foaming. And worst of all, during high-temperature operation it tends to oxidize which causes acid build-up in the transmission.

Acids reduce the coefficient of friction, which causes increased wear of the friction material inside the transmission. These problems have caused many transmission failures in racing and heavy-duty applications. Synthetic ATF provides the answer. It doesn't need low-volatility base oils. By nature, synthetic base stocks have much lower volatility for the same viscosity. This allows synthetics to use low viscosity base oil in a ATF formulation that exhibits much less volatility and foaming. Synthetic ATF is also more resistant to oxidation, preventing acid buildup.

For these reasons, synlubes in your drive train add up to cost savings in two ways. Better protection form wear and reduced driveline drag. And because of the major loss of driveline resistance, driveline synlube changeovers produce a more noticeable improvement in performance than engine changeovers. Likewise, a larger drop in fuel consumption is exhibited when switching the driveline to synlubes than the engine.

With heavy-duty diesel trucks, synlubes in the driveline also offers increased change intervals. While synlubes are more expensive to purchase, they offer substantial savings in fuel mileage, which more than makes up for the difference in cost. Then there's the savings in extended drain intervals-another bonus.

Note From Lee:

This Report was scanned and recognized by Omni page Pro. I have taken the liberty of converting it from magazine 3 column format to full page and enlarging the text. It’s just easier to read that way.

I have done my best to error check for spelling and obvious screw-ups by the OCR. If anybody catches something let me know and I will correct it and replace the posted document. Some of the images in the copy from Nutz and Boltz were just crap. I have cleaned them up as much as possible. Those that did not scan were recreated as accurately as I could read them. The last two are scanned Jpegs. It would have been a nightmare to recreate them. But they are readable.

I cannot be held responsible for any technical information in this article. The article is available in word format. If you want it that way contact me via PM.

Thanks to Fred for providing this document for the Forum.

Nutz & Boltz Oil Change Recommendations By Oil Types

Oil Type	Group I		Group II		Group III		Group IV		Group V	
Service	Normal	Severe	Normal	Severe	Normal	Severe	Normal	Severe	Normal	Severe
Change Monthly		✓								
3 month/ 3k miles	✓			✓		✓				
6 month/ 6k miles			✓					✓		
6 month/ 7.5k miles					✓		✓			✓
1 year/ 10k mi.*									✓*	

* OIL ANALYSIS RECOMMENDED

THE API BASE STOCK CLASSIFICATION SYSTEM

These groupings were set forth by the American Petroleum Institute in January 1999. The system classifies automotive engine oil base stocks into five different categories or groups. These groups were established so they are independent of the source of crude base stock oil as well as the refining process. The groups are based on physical characteristics of each base stock, and are then related to the performance of the engine oil formula.

GROUP I

Common motor oil, commonly referred to as conventional motor oils. Made from petroleum (mineral oil) solvent refined base stocks. Example: Bulk motor oil.

- contains less than 90% saturates and/or greater than 0.03% sulfur
- has a viscosity index (VI) greater than or equal to 80 and less than 120.

GROUP II

Premium grades of motor oils, commonly referred to as severely hydrotreated and/or hydrocracked base stocks. Modern top-grade ultra-refined, high quality 100% petroleum oils. Example: Valvoline MaxLife motor oil.

- contains greater than or equal to 90% saturates and less than or equal to 0.03% sulfur
- have a viscosity index greater than or equal to 80 and less than 120.

GROUP III

Hydrowaxes, commonly referred to as very high viscosity index (VHVI) or extra high viscosity index (XHVI) base stocks. Also known as hydrowax or hydroisomerized oils. Also called synthetic oil. Example: Castrol Syntec.

- contains greater than or equal to 90% saturates and less than or equal to 0.03% sulfur
- have a viscosity index greater than or equal to 120.

GROUP IV

Polyalphaolefins, also known as Olefins and PAOs. Made from natural gas, and still has many of the drawbacks of petrolubes. Called synthesized hydrocarbons (SHC), full synthetic oil. Example: Mobil-1 (present formula, which is a olefin base stock with ester in the additive package). Note: The formula is subject to change at any time.

GROUP V

Polyol esters, alcohol diesters and other esters, also called esters and POEs. Completely built from hydrocarbon molecules involved in chemical reactions. Includes all other base stocks not included in Group I, II, III or IV. Example: Redline oils (which are made from polyol ester base stocks with olefin in the additive package).

Bio for David "Dré" Solomon

After working as an automotive technician for thirty-seven years and being involved in many aspects of the repair industry, David Solomon is known as one of the most respected automotive technical authorities. He's been certified by the National Institute of Automobile Service Excellence (ASE) as a Master Automobile, Master Heavy Duty Truck, Master Paint & Auto Body, and Advanced Engine Performance Technician. Known by his nickname, *Dré*, he has been a teacher of high-tech automotive computer diagnostics and data analysis coast-to-coast since 1986, a participant in the National Train the Trainer Program for the US EPA, and is a Certified Fluke Scopemeter trainer. Dré is a contributing editor for numerous periodicals including *"Trailer Life," First For Women, Import Service, Emissions Monthly, Bottom Line Personal, Boardroom Reports* and *Moneysworth*." He has authored a book on Bosch Fuel Injection, chapters in Beat the System by Rodale Press, Hints and Tips to Make Life Easier by Readers Digest and for over a decade has been publisher of the *Nutz and Boltz Newsletter*. Dré holds a Master of Arts Degree in Psychology with a minor in Rehabilitative Counseling. He has been inducted by the Society of Automotive Engineers as a full SAE member and belongs to the North Atlantic Council of Automotive Instructors. And for all of his accomplishments, Solomon's name is listed as a *World Class Automobile Technician* in the Automotive Hall of Fame.

Nutz & Boltz Oil Change Recommendations

Specialty Vehicle Service by Oil Type (Group)

Vehicle type	Recreational Vehicle				SUV driven Off Road				Show Car, Antique			
Type of oil used	Gp. II	Gp. III	Gp. IV	Gp. V	Gp. II	Gp. III	Gp. IV	Gp. V	Gp. II	Gp. III	Gp. IV	Gp. V
Oil Change Intervals												
Change monthly					✓	✓						
3 month /3k miles	✓						✓		✓			
6 month /6k miles		✓						✓		✓		
6 month /7500 mi			✓									
1 year /3k mi.											✓	
1 year /10k mi.*				✓								✓*

OIL ANALYSIS RECCOMMENDED

General Oil Change Guidelines

- **Temperature operating range**. The lower the ambient temps, the thinner the oil. If the temperature of the ambient air being drawn into the engine is 100° F, or above, 10W-30 or greater must be used. If the temperature of the air drops below freezing, a 5W-30 oil or synlubes are preferred. For very low temps a synthetic oil is a must.
- **Age of the engine** (in miles of operation, not calendar years). A new engine has much smaller bearing clearances and requires a thinner oil. As the engine ages, the oil viscosity should be increased to help make up the extra gap and improve pressure. For example, use 20w-50 in a high mileage engine that's operated in hot weather. Engines with a lot of miles on them, or with low oil pressure can also benefit from using 20W-50 synthetic oil.
- **Piston, bearing, and oil passage clearances**. Some engines are designed with small internal oil passages, especially those leading to the camshaft and lifters. One engine application now requires a 0w-30 synthetic to rectify a lifter oil supply problem. Conversely, using too thick of an oil results in "lifter pump-up" which causes high speed misfire and burned valves. However, some older engine lifters need a thicker weight oil to quiet them down.
- **Engine size**. Smaller engines turn faster and require higher viscosity oils to help reduce high-speed sheer-back. For example, use 20w-50 in a high revving engine that's operated in hot weather.
- **Type of service,** as in *light-duty*, *moderate* or *severe*. A 5w-30 oil provides more benefits and protection for light-duty operation, but won't hold up under most moderate and severe operation. While a heavier oil provides more protection, a synlube provides the best protection for all three conditions.
- For nearly all **modern engines**, you are told to use a 5W-30 oil. This is because the carmaker used that grade for the EPA fuel mileage tests. Hence, in order to put the window sticker with the EPA mileage test on it, that same grade of oil must be recommended. Using a thicker grade, for example, a 10w-30, will result in lower fuel mileage.
- If you do a lot of **towing**, you are operating under severe service. Use a 10W-40 or 20w-50, and it would be nest if you used synthetics.
- If the engine is **turbocharged**, turbo lag will be less noticeable with 5W-30 synthetic. Turbos especially love synlubes because they run so hot.
- **Supercharged** engines benefit from the added bottom end protection, because supercharged engines produce more low-end torque.
- If the engine is **high revving**, air cooled or is used for extremely severe service, a 20W-50 is preferred during warm temperature operation.