Engine Oils

BY **LAKE SPEED JR.**

More has changed in oil than ZDDP content in the last 10 years. The levels of detergents have also increased, and both are contributing factors in the flat-tappet camshaft problems seen in the engine building industry over the last 4 to 5 years.

The oil additive Zinc Dialkyl Dithiophosphate (commonly referred to as "Zinc" or ZDDP) provides anti-wear protection for engines — especially flat tappet camshafts.

"Zinc" works because it is a polar molecule (it has a positive charge), so the "Zinc" molecule is attracted to steel. Under heat and load, the "Zinc" molecule reacts with the steel and creates a film. The film created by the "Zinc" prevents metal to metal contact. That is how "Zinc" works to protect your engine.

Detergents are also polar molecules, and the detergent is designed to prevent build up of deposits in the engine.

As a result, both the "Zinc" and detergents compete against each other for the metal surface.

The reduction in "Zinc" in modern passenger car grade oils relates to catalytic converter life. The same coating effect that "Zinc" provides to protect your camshaft also damages your catalytic converter. To extend the life of catalytic converters, "Zinc" content has been reduced.

At the same time, detergent levels have increased to provide better engine cleanliness, longer catalytic converter life and extended oil drain intervals.

The use of Exhaust Gas Recirculation valves cleans up the emissions of an engine, but the use of EGR valves increases the need for detergents due to increased temperatures and recirculated combustion by-products.

Detergents' ability to prevent build up of deposits also helps protect catalytic converters from "Zinc", so modern passenger car oil formulas now feature increased levels of detergents. You've probably seen the TV ads that promote oils that clean your engine. Those are high detergent oils, and they are great for modern passenger car engines. They are not great for restoration and street rod engines.

The balance of "Zinc" vs. Detergents has changed in the last several years in an effort to protect catalytic converters. This shift in the balance away from "Zinc" and towards detergents has had a negative impact on flat tappet camshaft life.

Why is this important? In the old days, engine builders used SAE 30 grade, non-detergent oil to break-in an engine. The break-in period is the most critical time in the life of an engine. The non-detergent oil was effective at establishing a "Zinc" anti-wear film in the engine during break-in because the "Zinc" did not have to compete against the detergent. As a result, the engine had better access to the "Zinc" it needed when we needed it the most. Modern engines feature roller follower overhead cam designs that reduce weight and sliding friction. As a result, these valvetrains don't need higher levels of "Zinc", but a Big Block Chevy has push rods, a flat tappet camshaft and big steel valves. These older engines feature increased sliding friction and weight. These engines need increased levels of "Zinc". The oils originally developed for Big Block Chevys used less detergent and more "Zinc" than modern engine oils.

To protect a flat-tappet camshaft, you need to properly break-in the camshaft with a high "Zinc" oil and avoid high detergent oils for both break-in and service fill.

What exactly is synthetic oil?

To answer that question you have to ask another question. What is in a motor oil? Motor oil is a blend of performance additives in a base oil. The additives enhance the performance of the lubricant beyond the performance of the base oil. Typical additives are detergents, anti-wear agents, friction modifiers, viscosity modifiers and many other chemicals that help the lubricant meet the performance requirements of an application. The base oil is the other part of a motor oil, and the base oil makes up the majority of the finished motor oil. Base oils typically come from 3 sources: refined crude oil, synthetic base stocks, or vegetable oils. The vast majority of motor oils use refined crude oil as the base oil. These oils are commonly referred to as mineral oils or petroleum oils. Refined crude oils provide good lubricity at a lower cost, but refined crude oils have a strong tendency to oxidize at high temperatures (AKA breaking down). Because petroleum oils come out of the ground, they contain many imperfections. These imperfections lead to breakdown at high temperatures. When an oil "breaksdown" it can create deposits in the engine. A synthetic oil is a man made copy of petroleum oil without any of the "imperfections" that lead to "breakdown". As a result, synthetic oils can safely handle much higher operating temperatures compared to petroleum oils. Because synthetic base oils are made in a controlled environment, they are 100% pure, and that also allows synthetic oils to flow better at low temperatures. Synthetic oils can reduce Cold Start Wear by up to 70% compared to Petroleum oils. Since Hot Rods and Restoration cars spend a lot of time in the garage, synthetic oils provide

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excellent flow when the engine is started after being in the garage for a time.

Is it safe to use synthetic oil in a flat-tappet engine?
After a proper break-in period on petroleum oil, a synthetic oil with the proper balance of "Zinc" and detergents will provide greater protection than a petroleum oil.

Over the years, synthetic oils have been criticized for their performance in older style engines. The problem has been the use of oils designed for modern passenger cars in older style engines. The synthetic base oil is superior to conventional petroleum base oils, but the additive packages in modern passenger car formulations will not provide the levels of protection a flat-tappet camshaft needs. The problem is not synthetic oil. The problem is using modern oils in older style engines. You shouldn't use a racing oil in a daily driver, so why would you use a modern daily driver oil in a restoration car?

Is it safe to use synthetic oils in transmissions and rear ends?
If the oil has the proper additives for the materials, it is safe to use synthetic gear, transmission and power steering fluid in a street rod or restoration car.

What is an API rating? How is it different from an oil's viscosity rating?
The viscosity ratings of the oil describe the cold start and high temperature flow rates of the oil. A 0W-30 flows better at start up than a 10W-30. The number before the "W" is the cold start viscosity, so the lower the number, the easier it is to start the engine. The higher the number, the more power it takes to turn the motor over when you hit the ignition.

The number after the "W" is the high temperature flow rate of the oil. For example, while a 0W-30 flows better at start up than a 10W-30, both oils flow like a SAE 30 grade at high temperature (212F). The higher the number after the "W", the heavier the oil is at higher temperature. A 5W-40 is a heavier oil at high temperature than a 5W-30, so SAE viscosity ratings only tell you about the flow characteristics of an oil. The API ratings tell you about the additive package in the oil. Since 1992 when the American Petroleum Institute (API) introduced the SM – GF1 standard, the "Zinc" content in passenger car grades of motor oil has been limited. The level of "Zinc" in passenger car oils was reduced again in 1996 to 1,000 ppm under API SJ – GF2 standards. In 2001, API SL – GF3 standards restricted "Zinc" content to 850 ppm, and that is when cams started to fail. When the API went to the current standard (SM – GF4), camshaft failures skyrocketed. In addition to the reduction in "Zinc", detergent levels increased as each new API standard took effect. An API SJ rated oil contained half the amount of detergent that an API SM oil contains. The increase in detergents and reduction in "Zinc" have been a double whammy for flat tappet camshafts.

Because NASCAR forces the Sprint Cup Series teams to run flat-tappet camshafts, Joe Gibbs Racing developed high "Zinc" oils to properly break-in our flat tappet camshafts. The Joe Gibbs BR Break-In oil is the number 1 selling break-in oil in the world. The Joe Gibbs BR Break-In oil features a low detergent and high "Zinc" formula that allows the "Zinc" additive to create a protective film in your engine. Joe Gibbs also offers a Hot Rod oil that also features a high "Zinc" content with a normal detergent level just for non-emission controlled vehicles (street rods, restorations, etc...). The Joe Gibbs Hot Rod oil also features a US military grade rust and corrosion inhibitor that protects your engine while the car is in storage for the winter. Conventional oils will run down into the oil pan after extended periods of storage – leaving the engine vulnerable to rust and corrosion. The Joe Gibbs Hot Rod oil creates a tenacious oil film that will cling to the part no matter how long it sits in storage. This oil films prevents air and moisture from attacking your engine.■

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