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## COMMENTARY ON MOTOR OILS FREQUENTLY ASKED QUESTIONS

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The purpose of proper lubrication is to provide a physical barrier (oil film) that separates moving parts reducing wear and friction. Oil also supplies cooling to critical engine components, such as bearings. Detergent oils contain dispersants, friction modifiers, anti-foam, anti-corrosion, and anti-wear additives. These detergents carry away contaminants such as wear particulates and neutralize acids that are formed by combustion byproducts and the natural breakdown of oil. Likewise, the viscosity of the motor oil throughout the operating range of the engine is very important to the “hydro-dynamic bearing” layer (oil film that forms on and between moving engine parts). Boundary Lubrication occurs when insufficient film to prevent surface contact and where the primary anti-wear additive ZDDP plays its role in protecting your engine.

Not all motor oils are created equally when it comes to the levels of additives and detergents used. In an SAE whitepaper on the development of the API SL standard, Shell’s own lubrication engineers stated that ‘the introduction of ash-less and zinc free oils are on the horizon making choosing an oil that much more difficult for older engines.’ The focus of this study is on the levels of zinc and phosphorus found in motor oils, more exactly, the zinc (Zn) and phosphorus (P) that makes up the anti-wear additive ZDDP, zinc dialkyl dithiophosphate. Oils for modern engines have different formulation constraints than those for older engines and just because oils are “modern” or synthetic does not mean they will provide adequate protection for your engine. Shopping for oil by brand, previous reputation, or by manufacturer approvals alone does not guarantee the best oil for your engine.

What general characteristics make motor oils specifically well suited to an aircooled engine? Aside from recommendations issued by Porsche, what makes for a good motor oil? These oils must be thermally stable, having a very high flashpoint, and must “maintain proper lubrication and protect vital engine components under the extreme pressure and the high temperature conditions” found in aircooled Porsches. Porsche recommends and uses Mobil 1 0w40 as a factory fill and Mobil 1 15w50 is a popular choice used by many for their aircooled boxer engines year round in a wide range of climates.

It is worth noting that Mobil offers its own line of racing oils for track use and Porsche even now offers its own line of classic oils for protecting older aircooled engines, so oil selection is more important now than ever. Understanding what changes have happened and why is important in selecting the right lubricant.

Oil companies have been cutting back on the use of Zn and P as anti-wear additives. This reduction of phosphorus content is a mandate issued by API, American Petroleum Institute, who is in charge of developing standing standards for motor oils. Zn and P have been found to be bad for catalytic converters. In 1996, API introduced the API SJ classification to reduce these levels to a maximum of 0.10% for viscosities of 10w30 and lighter. The 15w40 and 20w50 viscosities commonly used in Porsche engines did not have a maximum phosphorus limit. The API SL standard maintained this higher limit but with reduced limits for high temperature deposits. With the API SM, phosphorus content less than 0.08% was mandated to reduce sulfur, carbon monoxide, and hydrocarbon emissions. The biggest difference between the API SM and SN standard is that with the subsequent SN standard now mandated a max phosphorus content of 0.08% for all motor oil viscosities, not just the 10w30 and lighter oils the previous API standard limited, and limits for high temperature deposits are reduced, requiring added detergency for increased engine cleanliness allowing for longer drain intervals. Most modern oils are not backwards compatible with older engines for these reasons.

It is worth noting that prior to this movement to reduce Zn and P levels, the oils recommended for use in an aircooled boxer engine typically had 0.14% Zn and 0.14% P content with less detergency, than current street car formulations. In comparison, an API SE-rated virgin oil sample of Kendal GT-1 motor oil from the 70’s, pre-dating today’s limited Zn and P mandates, contained 0.14% Zn and 0.12% P and significantly reduced detergency with the relatively short drain intervals then recommended by auto manufacturers. Oils with later API SH and SJ standards with no limit for phosphorus were developed, tested, and used in aircooled engines through the end of production of the Porsche 993 with aircooled Mezger engine. With this knowledge, it can be concluded that any given motor oil should have a minimum of 0.14% zinc and 0.12% phosphorus for aircooled engines.

To offset the reduction of zinc and phosphorus levels required by the EPA, boron as well as molybdenum disulfide, among other friction modifiers, has been added to modern oils. The addition of boron, when in the presence of ZDDP, does boost the anti-wear properties and although considered an anti-wear additive, the use of “moly” has been truly limited only to increasing fuel economy requirements of the CAFE (Corporate Average Fuel Economy, enacted by Congress in 1975). These additions do not completely address wear issues of older vehicles that require higher levels of Zn and P.

However, it is worth noting that updated API guidelines do not apply to “racing,” “severe duty,” or any motor oils that do not carry an API “starburst” seal or clearly state for off-road-use only, except those oils carrying an API SN rating, which should all be avoided. Motor oils meeting “Energy Conserving I or II” standards, that provide emission system protection, or extended drain intervals should be avoided. Conventional 10w40 and 5w50 grades, because of their lack of shear-stability and relatively high amount of viscosity improvers, should also be avoided.

Compared to conventional oils, synthetics have superior shear stability leading to improved resistance to thinning and evaporation at high temperatures. Synthetics also have superior cold flow characteristics, reducing start-up wear significantly. Although most modern synthetics incorporate seal swelling agents, for those concerned with formation of new leaks or worsening of existing leaks, an acceptable compromise is the use of conventional, semi-synthetic, or group III synthetic (as compared to group IV and V synthetics), which is formulated from very highly refined "hydro-cracked" petroleum base with synthetic additives. Regardless of your choice to use conventional or synthetic lubricants, the formulation is just as important as whether it is a non-synthetic or synthetic oil. Lastly, other than cost, there is no reason not to use a synthetic oil in your Porsche or any other aircooled engine.

Coupled with reduced oil viscosities, modern engine oils are designed to maximize fuel economy, extend catalytic converter life, and reduce tailpipe emissions. It is more important now than ever to select the right engine oil. Failure to use the right oil, use proper filtration, or observe proper changing intervals can affect the performance of even the best motor oil. With this knowledge in hand, using a quality motor oil with proper filtration and reduced drain intervals, as recommended by your Porsche mechanic, is the best thing to do for your engine and to protect your investment.

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Want to learn more? Read up on the API standards by reading the API's Engine Oil Licensing and Certification System:

<http://www.api.org/~media/Files/Certification/Engine-Oil-Diesel/Publications/150917thAddendum1-032515.pdf>

### **WHAT NON-DETERGENT OIL CAN I USE WHEN BREAKING IN A NEW ENGINE?**

Just because non-detergent oil is cheap, it doesn't mean you should use a cheap non-detergent oil. Always use a proper break-in oil in a new engine and never use a synthetic oil for break-in!

### **HOW SHOULD I BREAK IN MY ENGINE?**

If you have questions on how you should break in an engine and proper break in procedure, we recommend reading the following articles about the subject:

[http://www.mototuneusa.com/break\\_in\\_secrets.htm](http://www.mototuneusa.com/break_in_secrets.htm)  
<http://www.aircooled.net/vw-engine-break-in-procedure/>

### **WHEN CAN I SWITCH TO A SYNTHETIC OIL?**

After initial break in, we recommend a minimum of 500 miles with a maximum of 1,000 miles on break in oil, followed by the use of an intermediate conventional oil for 3,000 to 5,000 miles. At that point, you can continue with use of a conventional oil or switch to a semi or full-synthetic oil.

The exception is for a race car that you don't have the luxury of breaking in on the street. When breaking the engine in on the dyno, be sure to monitor oil temperature and keep below 220F and monitor your oil pressure. Before going to the track, switch to a conventional or semi-synthetic race oil.

### **CAN I BOOST THE LEVEL OF ZN AND P IN MY OIL?**

Never use oil additives to boost ZDDP in your engine oil. Just use the right oil.

### **SHOULD I DO USED OIL ANALYSIS?**

It is best to choose a motor oil and stick with that oil to determine a baseline for your engine's oil performance through sampling and testing throughout your engine's life. That way you can determine appropriate drain intervals for your driving habits and monitor the condition of your engine's internals to determine if your motor oil is doing the best job possible at protecting your investment. The key is regular testing – trending is required to identify problems.

### **WHEN SHOULD I USE A RACE OIL?**

Street oils typically protect only to 240F, even full synthetics. Anytime you do a high performance driving event, even if it's your first time taking your car on track, you should use a true race oil. These oils typically have added anti-wear additives, reduced deter-

gency, and improved anti-foaming additives, coupled with better base stocks that resist thinning at high temperatures. These oils are designed to protect your engine best under the stress of going on track. Remember, most race oils are good only for about 500 miles, so we recommend changing your oil immediately after a track day so you store your race car with clean oil. For street cars, that becomes a bit more complicated, requiring you to run change to a street oil between events and run the race oil only for track use. Remember, oil is cheap, engines are expensive!

### **WHAT SHOULD I DO IF I HAVE AN OLDER, HIGHER MILEAGE ENGINE AND WANT TO USE A SYNTHETIC MOTOR OIL?**

Those oils formulated from a group III base stock (hydrocracked petroleum product) are less prone to cause leaks or make existing leaks worse. Most synthetic oils are now formulated with seal swelling agents to minimize leaks, so take this with a grain of salt. Additionally, older engines may require thicker viscosities and may have higher oil consumption, but you must take into consideration that Porsche allowed for as much as one (1) quart of oil consumption per 600mi, so check your oil level often and don't overfill!

### **SHOULD I USE A NON, PARTIAL –SYNTHETIC, OR FULL-SYNTHETIC MOTOR OIL, OR PERHAPS A MOTORCYCLE OR DIESEL OIL?**

Formulation is more important than whether you use a non-, partial-, or full-synthetic motor oil.

As far as a full synthetic goes, I personally recommend their use, even if the engine ends up leaking a little – I'd rather have the added protection. At the end of the day, the additional cost is a small expense to pay for the added protection of a full synthetic. Many years ago, diesel oils were an acceptable alternative to street car oils. Unfortunately, this ended with any diesel oils with the introduction of the API CJ-4 standard.

In a pinch, motorcycle oils for high performance aircooled motorcycle engines typically provide exceptional shear stability, oxidation and acid control, and high-temperature protection, over that of conventional or synthetic motor oils approved for use in modern engines made for an API SN or Energy Conserving motor oil.

### **WHAT VISCOSITY MOTOR OIL SHOULD I USE?**

You should always refer to your owner's manual for the recommended grade and viscosity of oil to be used in any engine. That said, for most Porsche owners, Mobil 1 0w40 provides the widest range of protection year-round and for vehicles with sufficient oil cooling capacity. Some owners may find that 15w50 is better suited to their engine if it runs hotter or doesn't have extra oil cooling like a late model Porsche 964 or 993, but remember that below 15F you probably should have something with a lighter cold viscosity for cold start protection.

## WHAT MAKES MODERN MOTOR OILS NOT THE BEST CHOICE FOR AIRCOOLED OR VINTAGE ENGINES?

Porsche recommends 15,000 mi intervals on their newest water-cooled engines, as does most every German auto manufacturer. Modern motor oils are governed by requirements dictated by auto manufacturers and API standards (among other standard bodies). A rampant problem is sludge formation. Most encompass the need for a very high TBN or total base number for long drain intervals, among other wear factors.

Another consideration is that modern oils are for the most part designed with increasing the longevity of emissions control devices. A good example is Mobil 1 ESP 5-30, formulated to meet the requirements of European manufacturers like Mercedes Benz, BMW, and Volkswagen. These modern oils are deficient in some respect to the oils previously available, making choosing an oil even more difficult and precarious for your older engine.

Lastly, fuel economy is the primary motivator for development of new API standards for motor oils. CAFÉ, or corporate average fuel economy, will be mandated to meet 60 MPG by 2025, pushing for thinner and thinner oils and the addition of more friction modifiers, all of which trade off fuel economy increases for decrease in longevity. Lighter viscosity oils lend themselves to increased oil consumption which requires less anti-wear additives and more detergents to meet current engine cleanliness requirements. Most importantly, these requirements mean modern oils are most certain death for older engines for which these oils were never designed or tested for use in.

## SHOULD I USE AN ENGINE OIL FLUSH IN MY ENGINE?

If you have an engine that is dirty or has sludge buildup, never use an oil flush product. We have seen many engine failures following the use of an engine flush product. Additives to clear up noisy or stuck lifters or engine flush products will dislodge deposits and plug oil passages, among other things.

The best way to clean a dirty engine is to pull the sump (if removable) to clean deposits. Then put the engine on a sequence of regular, short oil changes, no more than 500-1000 miles. Repeat 5-10 times with a fresh oil filter at every change. This will slowly clean the engine. However, if the engine is beyond the point of no return with heavy sludge formation, an engine rebuild is your only recourse for corrective action.

## HOW OFTEN SHOULD I CHANGE MY OIL?

For most street driven Porsche models, we recommend an oil change interval of 6 months or 5,000 miles.

Older aircooled models should be limited to 3 months or 3,000 miles due to reduced oil system volume. Same goes for older aircooled VW models.

## HOW OFTEN SHOULD I CHANGE MY OIL? - CONTINUED

Dedicated track cars should have their oil changed after every event. Mixed street/track use cars should run race oil for the track event and change immediately after to a street oil.

Vehicles stored for winter should have their oil changed prior to storage. Addition of a product like Driven Storage Defender for fuel system and oil system should be added. Do not start up and let your engine idle during storage. It is best to let it sit dormant until you take the car out of storage and have the opportunity to drive the car for an extended period and get the oil to full operating temperature.

## WHAT OIL FILTER SHOULD I USE?

Just like with motor oils, people have their favorite oil filters. We have purchased and cut apart dozens of brands of filters, all leading us to one conclusion. Other than using a Genuine Porsche oil filter, the only aftermarket filters we use and recommend are Napa Gold/Platinum filters (both are manufactured by Wix).

## WHAT FUEL SYSTEM CLEANER, LEAD ADDITIVE, OR OCTANE BOOSTER SHOULD I USE?

Fuel system cleaners are widely available from dozens of companies, all promising everything from helping you to pass emissions testing to increasing octane. Many do little more than put a drain on your wallet. In most cases, using a quality pump premium formulation is the best thing you can do for your engine, regardless of octane requirements.

Most modern engines and fuel management systems can adjust for the increased octane and provide improved fuel economy and horsepower, so even though the octane requirement may be 87 or 91 octane, it can benefit from 93 octane. Most importantly, always use a Top Tier fuel. Shell V-Power is what we use and recommend.

Where ethanol-free fuels are not available, only use E10 fuels. Ethanol content higher than 10% will cause fuel system damage to fuel systems and engines not designed for higher ethanol contact fuels.

For fuel systems that have not been serviced properly or for which you do not have a service history, the use of Lubro-Moly Jectron will vastly improve fuel system and engine performance. If you continue to have symptoms associated with bad injectors, the only solution will be to send the injector for cleaning or replace with new injectors.

## WHAT FUEL SYSTEM CLEANER, LEAD ADDITIVE, OR OCTANE BOOSTER SHOULD I USE? - CONTINUED

If you want to use a fuel system cleaner regularly, use one that meets OEM requirements and is actually used by OEMs. Redline makes a fuel system cleaner that is good for both fuel injected and carbureted engines, called SI-1. They also make a lead substitute, called just that, Lead Substitute, that also cleans your fuel system and is safe for injectors and catalytic converters. These products do not however provide protection from the damage of ethanol or are good for stabilizing fuels for storage.

We use and recommend Driven's fuel system products. Carb defender should be used at every fill up on cars with older carbureted engines or fuel systems not compatible for modern ethanol fuels to protect against the damage caused by modern ethanol fuels.

Stay away from aviation (AV) gas. If you need to boost your octane, use race gas, a product like Driven Fuel System Cleaner with Octane Booster, or a race gas concentrate.

Lastly, modern E10 fuels have a very short shelf life. Fuel not used within 4 weeks of being pumped will need to be stabilized. Use of Driven Carb Defender, Storage Defender, or any other Driven fuel system products will stabilize these ethanol fuels.