

ZDDPlus™ is not a typical oil additive. By adding a small 4 ounce bottle of ZDDPlus at every oil change, an adequate amount of Zinc and Phosphorus will continue to protect your classic engine.

Why do we need ZDDPlus™?

As part of an effort to reduce vehicle emissions, the U.S. EPA offers vehicle manufacturers “credits” for early implementation as well as penalties for violation of emission reduction standards. The EPA’s program called for 100,000-mile catalytic converter life by 2004, 120,000 miles by 2007, and 150,000 miles by 2009. To achieve these goals, automotive manufacturers have pressured their oil suppliers to remove substances from motor oils that would shorten the service life, including the proven EP (extreme pressure) additive ZDDP (zinc dialkyldithiophosphate). Zinc and phosphorus from the ZDDP can be present in small amounts in the exhaust gas of an engine depending on the amount of oil which is consumed in combustion. These elements can coat the catalyst reducing the amount of catalyst exposed to the exhaust gases, ultimately increasing emissions at the tailpipe. As a result of the EPA mandate, the ZDDP level in engine oils has been declining since the mid-1990s, roughly coinciding with the implementation of OBDII.

ZDDP has been an important additive to engine oils for over 70 years, and has an excellent track record at protecting the sliding metal-to-metal cam lifter interface. Historically, ZDDP has been added to oils in amounts resulting in approximately 0.15% phosphorus, and 0.18% zinc. ZDDP protects by creating a film on cams and flat lifter contact points in response to the extreme pressure and heat at the contact point. The film of zinc and phosphorus compounds provides a sacrificial wear surface protecting the base metal of the cam and lifter from wear. In the course of normal service, this conversion of ZDDP to zinc and phosphorus compounds depletes the ZDDP level in the oil. Studies show that depending on the specific engine and severity of duty, after 2000-4000 miles of operation, the level of ZDDP can drop below that considered adequate to provide wear protection to the cam and lifters.

According to the SAE Tech Bulletin # 770087 [1] , operation of a flat tappet engine without adequate EP additives such as ZDDP quickly leads to lifter foot scuffing and cam lobe wear. Camshafts are typically only surface hardened leaving the core ductile for strength. According to the SAE Bulletin, once cam lobe wear reaches 0.0002, “subsequent wear is usually rapid and catastrophic.” Two ten-thousandths of an inch is one fifth the thickness of an average human hair.

In order to make engines last in the absence of ZDDP, virtually all IC (internal combustion) engines designed in the last ten years utilize roller lifters. Today, ZDDP has been removed from practically all automotive engine oils, rendering them unsuitable for use with older engines with non-roller lifters.

5 Quart Oil ZDDP Dosing

Product	bottle size	zinc % by weight	phosphorus % by weight	P:Zn ratio
ZDDPlus™	4 oz	6.35	5.09	0.802
GM EOS	16 oz	0.71	0.53	0.746

Target Zinc Concentration	Ounces of ZDDPlus™	Ounces of GM EOS	
0.07	1.55	13.54	
0.08	1.77	15.47	----- 1 bottle GM EOS
0.09	1.99	17.41	
0.10	2.21	19.34	
0.11	2.44	21.27	
0.12	2.66	23.21	
0.13	2.88	25.14	
0.14	3.10	27.07	
0.15	3.32	29.01	
0.16	3.54	30.94	
0.17	3.76	32.88	----- 2 bottles GM EOS
0.18	3.99	34.81	----- 1 bottle ZDDPlus™
0.19	4.21	36.74	
0.20	4.43	38.68	

Why is it being removed? Because contemporary engines with roller bearings no longer require the additional protection of Zinc and Phosphorus. Not true for classic cars, tractors, muscle cars, etc. Also removing the Zinc and Phosphorus from motor oil increases the life of the catalytic converter. But classic cars, tractors, etc., don't have cats! Also, as part of its ongoing effort to reduce vehicle emissions, the EPA has mandated that emission systems must have a service life exceeding 120,000 miles. To achieve this, automotive manufacturers have required oil suppliers to remove additive packages from motor oils that could reduce emissions compliance. ZDDPlus™ is the ONLY EP (Extreme Pressure) component which re-establishes the ZDDP levels that our classic car engines were designed for, while allowing the car owner to use the base oil of their choice. While some off-the-shelf additives may have some ZDDP, the amount per bottle is small, and when enough is used to get the proper concentration of ZDDP, there is a quart or more of unspecified oil that comes along with it. This dilution of 20% of your oil with an unspecified oil also means that there is 20% less of the proper additive package. The chart below compares the amount of ZDDP in ZDDPlus™ to GM EOS, an additive which claims to provide ZDDP based wear protection.

What's In Our Oil ?As lubrication technology improves, so does the base oil used in the manufacture of engine oils. Oils are also changed and updated in response to advancements in engine technology. Modern engine oil is a precise mix of a base oil with additives totaling almost 10% of the oil by volume. Pound for pound these additives are each more expensive than the base oil, and oil companies are in business to make a profit. Common sense says that these additives are there with Modern engine oil is a multi-purpose fluid in an engine, carrying the heat away from hot spots and releasing it in the sump as well as providing lubrication to critical areas which need protection against wear.

ZDDPlus™ contains the proper amount of ZDDP to give at least 0.18% zinc and 0.13% phosphorus level when a single 4 oz. bottle is added to a normal 5-quart oil change. This level of zinc and phosphorus is the level designed into pre-OBDII oils. Using ZDDPlus™ affords you total control over the characteristics of the oil in the engine by allowing you to use the full 5 quarts of a high-grade automotive oil of your choice.

Different additives are put in the oil in order to address the needs of each specific engine system that is supplied with oil:

- The crankshaft and connecting rod bearings discharge oil into the spinning reciprocating assembly, and an anti-foaming additive keeps the oil from turning into foam.
- The heat developed on high-pressure contact areas can exceed the breakdown temperature rating of the base stock, so heat stabilizers are added in order to fight viscosity breakdown and ashing.
- In a multi-viscosity oil, the multi-viscosity characteristic is established by an additive.
- Acids and byproducts of combustion are neutralized by another additive.
- A dispersant additive helps keep combustion

particulates from clumping.

- Detergents are added to lower the surface tension to a specific value to help keep contaminants in suspension and off of the metal engine parts. Some detergents also interact with the EP additive to gain an additional level of wear protection.
- The sliding cam-to-cam-follower interface in a non-roller lifter engine requires a special EP additive, which has historically been the ZDDP that is now reduced in all API rated automotive oils.

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Laboratory Test Results

Product tested	Method Zn/P	Result Zn/P	P : Zn Ratio
Pure ZDDP	AA / D-4951	10.30 / 8.25	.801
<i>ZDDPlus</i> +	AA / D-4951	6.50 / 5.21	.801
EOS	AA / D-4951	0.71 / 0.53	.746
STP	AA / D-4951	0.65 / 0.10	.154
Comp Cams Break In Lube	AA / D-4951	0.02 / 1.30	.65.0
Castrol Tecton 15w-40	AA / D-4951	0.05 / 0.32 [1]	.640
ZMax	AA / D-4951	<0.01 / 0.14	na
Marvel Mystery Oil	AA / D-4951	< 0.01 / 0.07	na
Power Up	AA / D-4951	<0.01 / 0.34	na
Crane Cams Break-In Lube	AA / D-4951	11.64 / 6.04	.519

[1] Includes 5 quarts of oil.

AutoSound 2000

What about off-the-shelf additives and supplements? API oils have always been more than adequate for the engines designed when the oil was current. The use of current API grade oils has always been adequate to satisfy car manufacturer's requirements and warranty demands. Historically, with few exceptions, newer API grades have superseded the performance of their predecessors. The removal of ZDDP has resulted in a clear change to that philosophy. It has never been necessary or desirable to include additives or supplements to any API rated oil to meet car manufacturer's specifications or warranty requirements. In virtually all cases, off-the-shelf additives amount to little more than automotive snake oil. Current additive technology has yet to develop an EP anti-wear agent as effective as ZDDP. Consequently, if these additives actually had adequate levels of ZDDP, they would be incompatible with modern engines and void manufacturer's warranties. Due to this unprecedented turn of events in emissions requirements, ZDDPlus™ should not be confused with an off-the-shelf additives. ZDDPlus™ should be considered a replacement for a missing oil component critical for older cars.

Why Can't We Use Diesel CI/CJ-4 Rated Oils? There are some diesel engine rated oils on the market which may still have some ZDDP in them. There are problems associated with using these oils in a normal gasoline engine which can become severe in a high-performance gasoline engine. One issue is the high amount of detergent additive, and another is the high viscosity. High detergent oil has a lower surface tension and lower shear pressure rating which can cause higher bearing wear in gas engines. A diesel engine needs oil with very high detergent capabilities in order to hold the large amount of combustion byproducts in suspension, but it is not optimized for a gasoline engine. The bearing journal size-to-displacement ratio on a gasoline engine is designed around the use of a lower detergent oil and relies on a high-shear rating to the oil.

The other problem with high detergent oil is that it actually reduces the friction reduction that the ZDDP affords, especially in a high-performance, high valve spring pressure engine.

The viscosity rating of most diesel rated oils is higher than optimum for our higher revving gasoline engines, and can cause oil starvation in bearings at high rpms.

Why Can't We Use Racing Oils?

There are some racing oils which maintain a level of ZDDP. Racing oils are optimized for short term severe duty, in contrast to an oil that has been designed for day in, day out street operation. The additive package in a racing oil does not have the same detergent characteristics which are designed into extended service oils. As a result, racing oils may not have the capability of neutralizing acids and keeping contaminants in suspension. Also, the breadth of choice of viscosity, so important to correct street engine operation over a broad temperature range, is not available in racing oils.

By using ZDDPlus™ in addition to a modern high-quality oil of the proper viscosity for your gasoline engine, the correct EP lubrication level is established, and the oil characteristics remain optimized for your engine.