

Which Oils??

Should I worry?

What should I do?

Question:

Has Zinc Been Removed from Motor Oils?

I am having thrust bearing failure in a 4.6 modified performance engine. This is a street/strip engine. Many of my friends are having the same problem. I think it is the result of the removal of zinc from the oil. I was told by two separate racing engine builders that the EPA ordered the removal of the zinc from over-the-counter motor oil. I use Mobil 1 5W-20. Is this true and do you think a zinc additive might help?

-- Randy Lovejoy, Americas, GA

Answer:

The active ingredient that you are talking about is phosphorus which is added through a component called ZDDP. For products that meet the new ILSAC GF-5 specification the phosphorus levels for the oil must be less than 800 ppm phosphorus. The ILSAC level for phosphorus has been reduced to protect the catalytic converter and other emission protection equipment. The engine manufacturers are confident that this level of phosphorus will protect both new and older engines. However, there are Mobil 1 synthetic oils which have a higher level of phosphorus (phos) and can be used in engines in racing or high performance applications; see the attached [table](#).

Answer updated April 2012

CRANE FLAT TAPPET CAMSHAFT RECOMMENDED BREAK-IN PROCEDURE

Due to the EPA's mandate for zinc removal from most motor oils, proper flat tappet camshaft break-in procedure is more critical than ever before. This is true for both hydraulic and mechanical flat tappet Camshafts. As a point of interest, the most critical time in the life of a flat tappet camshaft is the first 20 minutes of "break-in" during which the bottoms of the tappets "mate-in" with the cam lobes.

There are some oils with additive packages that are better for camshaft "break-in". These include, but are not limited to: **(Brad Penn or Joe Gibbs racing)** or a "race only" petroleum-based oil and include **Crane Cams Part # 99003-1 Super Lube** additive. **Do not use API rated "SL" or "SM" oil.**

Experts say that the reasons behind the changes in engine oil are numerous, but one of the main reasons is that the American Petroleum Institute (API) has regulated the amount of zinc levels to .08 percent, down from .15 of a few years ago (and even higher levels before that) due to its harmful effects on catalytic converters and emissions systems.

The latest API formulations are aimed at extending the life of catalytic converters not racing engines. Around 1996 most of the OEMs had already started manufacturing OHC engines with roller followers, that in turn, allowed them to use lower zinc-phosphorous anti-wear additives.

So while performance engines of the early 1990's could share the same oil as production engines without consequence, today, the use of API approved street oils in many performance applications will likely lead to trouble, especially during flat tappet cam break-in periods.

According to Lake Speed, Jr. of Joe Gibbs Driven Racing Oil, one of the important differences between racing oil and API oil is the limited amount of phosphorous in API blends. The EPA limits the amount of phosphorous and zinc, specifically it's the phosphorous, not the zinc that is limited. Phosphorous is a component of Zinc dialkyl dithio phosphate (ZDDP, or ZDP) is a family of zinc salts of dithio organophosphates. And they easily dissolve in mineral and synthetic oils that are used as lubricants.

Zinc phosphate is mainly for anti-wear. The zinc and phosphate go hand and hand. So when you limit phosphate you limit zinc as well.

“You can put zinc in the oil but it won't act as an anti-wear agent until you add the phosphorous,” says Speed. “When you have a limit on the amount of zinc-phosphorous you limit the anti-wear agents. The combination of zinc and phosphorous is limited to a maximum of 800 parts per million in API/SM classification, which is the latest classification that came out in 2004.

Is the lack of zinc and phosphorus as big a problem as it appears to be? No! Emphatically, no! So many of the on-line chat rooms are talking about the new oils being harmful or even dangerous to our older engines. Look at the source. Everyone "knows someone, who knows someone" whose engine was supposedly destroyed by modern oils. I question that. If all of these new urban legends were true, there would, be a mountain of destroyed engines to rival Mount Everest. It only takes one person to yell "fire!" with conviction and the entire theater empties out. Well, someone yelled "fire" about engine oils and started a stampede for the exit. The new oils have been tested, and passed more stringent testing than our engines are going to receive. Granted, after the fact, ZDDP, zinc and phosphorus have been touted as the only things between our engines and total disaster. Zinc and phosphorus were excellent antiwear additives, and they are still available in diesel oils. But they have been replaced by other additives in SM oils. They have been tested in independent laboratories and the results analyzed. **The new additives provide adequate anti-wear protection.**

Then there is the question of mixing high zinc/phosphorus content oils with SM to give "necessary" protection. There is no guarantee that a quart or two of 'older' oils, SJ or SL or even a specially formulated high ZDDP-content oil, will homogenize with SM oils to produce the correct or desired level of zinc/phosphorus for older engines. Finally, there is the question of additives. Reading the labels on oil additives in a local auto parts store yielded only one which specifically mentioned zinc. We cannot guarantee that it will properly blend with your SM motor oil, nor can we guarantee that it won't settle out of solution and just lie at the bottom of your oil pan. This would be even worse than knowing you are not properly protected; it would give you a false sense of security in thinking that you've covered all bases. It might not be so. The testing required for engine oil does not include testing with aftermarket additives or miracle-fixes.

If you still have reservations about using SM oils in older engines, there is a pretty safe alternative for you: diesel oil. At the present time, diesel oils do not have the same restrictions on zinc or phosphorus as gasoline engine oils. Take a careful look at diesel oils at your local auto parts or chain store. The API donut will specify the type of service that the diesel oil is designed to handle. Many diesel oils are "cross-over" oils - they carry a dual designation on the donut (for example, "API Service CI-4/SL). The "C 1-4" is the diesel rating, but the "SL" is the gasoline-engine rating. They have incorporated all of the additives to make their oils compliant with gasoline engines without sacrificing proper lubrication in a diesel engine.

If there is one drawback in using a cross-over diesel oil in a gasoline engine, it is that the ash content will possibly be higher than a gasoline-engine only oil. In a well-maintained, tight gasoline engine it shouldn't present too much of a problem.



A 'cross-over' diesel oil, formulated for both diesel engines (CI-4) and gasoline engines (SL).

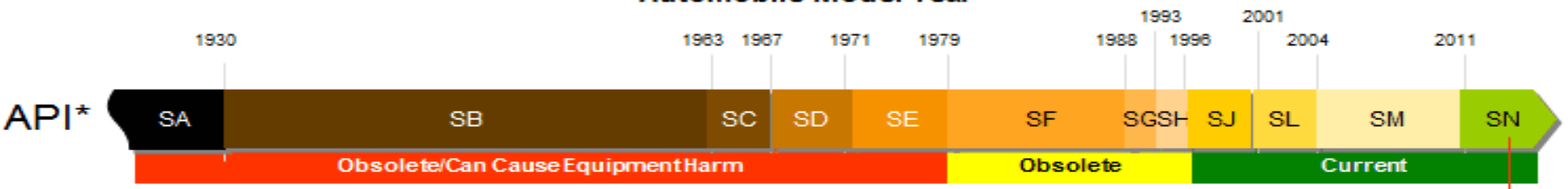
In the API (American Petroleum Institute) classification system, "S" and "C" are the two basic application categories of oil. "S" is intended for gasoline use and "C" is intended for diesel use.

"A" was the first grade in each category and resulted in "SA" and "CA" grade oils. Each designation progressed farther up the alphabet as new grades of oil were introduced. The newest grades are "SM" and "CJ" respectively. "SF" was for 1988 and older engines.

API SERVICE CLASSIFICATION FOR PASSENGER CAR ENGINE OIL



Automobile Model Year



Look for the "API Donut" and the two letter Code on the back of the bottle. If the label says API SERVICE "SA," it's engine oil made for use in cars built prior to 1930. API SA through SH motor oils are classified by the API as "OBSOLETE" and the API says their "Use in more modern engines may cause unsatisfactory performance or equipment harm." API SF through SH are also OBSOLETE.

Read the Label! →



Look for the API* "Donut" on the Label

I talked with the OEMs in Detroit. The API SM ILSAC GF-4 engine oils should be suitable for older engines with flat tappets. The specification testing for oils with this performance category includes two engine wear tests (Seq. IIG and Seq. IV) which use engines with flat tappets. Both the Seq. IIG (GM engine) and Seq. IV (Nissan engine) are flat tappet engine tests measuring wear. For an oil to meet the specification these wear and scuffing tests must be passed. You will remember that API SM/GF-4 engine oils have a phosphorus limit of 0.06% min. and 0.08% max. It is also important to use the recommended viscosity grade (e.g. SAE 10W-30, SAE 10W-40).

An alternate suggestion is for those who are not convinced they may wish to use oils meeting the new API CJ-4. Although designed for diesel engines it has lower ash levels. Phosphorus levels are as much as 0.12%. API CJ-4 engine oils should be showing up in stores shortly. It may be possible to find these oils in SAE 10W-30 as well as the [other grades].

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.

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



Shell ROTELLA®
Energized Protection™



SHELL ROTELLA® T TRIPLE
TRIPLE ACTION HELPS CONTROL • WEAR



Joe Gibbs Driven Racing Oil

In 2003 and 2004 Joe Gibbs Racing only produced enough oil for its own racing operations. The oil was produced in small batches several times a year, but that became a costly endeavor. JGD's Lake Speed, Jr. says, "We wanted to have the very best possible product and we knew we couldn't cut any corners to make it more economical for our teams, so the choice became clear that we would have to our oil to other racing teams. It kind of went from there.

"Anywhere there's a pushrod V8 engine, our oil works very well for these applications; that's what it's designed for."

Speed says that JGD offers several different formulations of its oil, but the JGR organization only uses three of the formulations.

Brad Penn

Brad Penn offers several racing oil formulations including break-in oil for flat tappet cam applications.

Dick Glady of Brad Penn says that they have been receiving rave reviews from engine builders who have use their break in oil. “We have a strong detergent dispersant package with the base oil formulation. Which basically allows the metal that flakes off during the break-in to be pulled away from the metal parts.”

Glady adds that the detergent additive suspends the particles and gets them out of the engine quickly.

Glady points out that Brad Penn is the only US refinery of motor oil and it processes 100 percent pure Pennsylvania Grade crude oil. “We process it so we get a very unique cut off our fractionation tower. We blend this cut into our racing oil and it has a tremendous affinity for metal surfaces. It goes after the metal surfaces and stays there. So, not only have we not cut our zinc levels, which are typically 1,500 ppm, and our phosphorous at 1,400 ppm, the whole story isn’t just the zinc, it’s the combination of that and the properties of our unique base oil.”

Brad Penn also offers other racing oils in mineral-base and partial synthetic including SAE 0W-30, 10W-30, 20W-50, SAE 40, SAE 50 and “Nitro” 70 Racing Oil.

enginebuildermag.com

Amzoil

Ed Newman of Amzoil says that its racing oil was designed specifically with protection and performance characteristics in mind.

Newman says that Amzoil was the first to offer synthetic oil back in 1972 and today they offer a number of performance oils including those that are acceptable for flat-tappet camshaft engines.

“We offer a full line oil that contains an additive package with a proven history,” says Newman. “Products like our 10W-40 and 20W-50 high performance engine oils contain higher ZDDP levels, and are perfectly suitable for flat-tappet camshafts.

“I always tell people to measure the oil not by what’s on the label but by standard ASTM tests. There are all kinds of qualities an oil has to have for performance applications besides just the base stock,” Newman concludes.

Mobil 1 Engine Oils

Additional product information, including Product Data Sheets and this chart, is available at MobilOil.com

10/17/2011

Brand	Viscosity	Nominal Phosphorus Level, PPM	Nominal Zinc Level, PPM	Product Description	Recommended Consumer Applications	API, ILSAC, and Other Industry Approvals***	ACEA Approvals	GM Service Fill Approval	Ford Service Fill Approval	MB Approval	BMW Approval	VW Approval
Mobil 1 Extended Performance	5W-20	800	900	Boosted, advanced full synthetic formula designed for today's longer oil change intervals in Hondas, Chryslers and newer Toyotas	Vehicles that require 5W-20	GF-5,SN	A1/B1-08 A1/B1-10		X			
Mobil 1 Extended Performance	5W-30	800	900	Boosted, advanced full synthetic formula designed for today's longer oil change intervals in many domestic, including GM, and imported vehicles.	Vehicles that require 5W-30 or 10W-30.	GF-5,SN Honda HTO-06	A1/B1-08, A5/B5-08, A1/B1-10, A5/B5-10	dexos1	X			
Mobil 1 Extended Performance	10W-30	800	900	Boosted, advanced full synthetic formula designed for today's longer oil change intervals in many domestics and imports.	Vehicles that require 5W-30 or 10W-30.	GF-5,SN	A1/B1-08, A5/B5-08, A1/B1-10, A5/B5-10					
Mobil 1	0W-20 Advanced Fuel Economy	650	750	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance.	Most vehicles that specify 0W-20 (newer Toyotas and Hondas), 5W-20 and certain hybrids.	GF-5,SN	A1/B1-08, A1/B1-10		X			
Mobil 1	0W-30 Advanced Fuel Economy	650	750	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance.	Most vehicles that specify 5W-30 or 10W-30.	GF-5,SN	A1/B1-10, A5/B5-10		X			
Mobil 1	0W-40	1000	1100	Advanced full synthetic formulation designed to meet the requirements of many European vehicles.	Porsche A40. Many European vehicles. HT/HS applications.	Chrysler MS10850, Nissan GT-R SN,SM,SL,SJ	A3/B3-08, A3/B4-08			229.3/ 229.5	Longlife 01	502.00 / 505.00
Mobil 1	5W-20	800	900	Advanced full synthetic formulation designed to meet the requirements of many newer vehicles including Hondas, Fords, Chryslers and newer Toyotas.	Vehicles that require 5W-20.	GF-5,SN	A1/B1-08, A1/B1-10,		X			
Mobil 1	5W-30	800	900	Advanced full synthetic formulation designed to meet the requirements of many domestic, including GM, and imported vehicles.	Vehicles that require 5W-30. Corvette approved.	GF-5,SN Honda HTO-06	A1/B1-08, A5/B5-08, A1/B1-10, A5/B5-10	dexos1	X			
Mobil 1	5W-50	1000	1100	Higher viscosity, advanced full synthetic formula designed for performance vehicles	Porsche. HT/HS applications.	SN/SM	A3/B3-08, A3/B4-08			229.1 /229.3		501.01, 505.00
Mobil 1	10W-30	800	900	Advanced full synthetic formula designed for domestics and imports	Vehicles that require 5W-30 or 10W-30.	GF-5,SN	A1/B1-08, A5/B5-08, A1/B1-10, A5/B5-10					1
Mobil 1	15W-50	1200	1300	Boosted, higher viscosity, advanced full synthetic formula designed for performance vehicles.	HT/HS applications. Racing and Fiat tappet applications.	SN/SM	A3/B3-08, A3/B4-08, A3/B3-10					
Mobil 1 Turbo Diesel Truck	5W-40	1100	1200	Advanced full synthetic formula designed for diesel powered pickups and trucks.	Most diesel applications. Including engines with diesel particulate filters.	CJ-4, CI-4, CI-4 Plus, SM, SL	E7					

Brand	Viscosity	Nominal Phosphorus Level, PPM	Nominal Zinc Level, PPM	Product Description	Recommended Consumer Applications	API, ILSAC, and Other Industry Approvals***	ACEA Approvals	GM Service Fill Approval	Ford Service Fill Approval	MB Approval	BMW Approval	VW Approval
Mobil 1 High Mileage	5W-30	1000	1100	Boosted, advanced full synthetic formula designed for higher mileage vehicles.	Vehicles that require 5W-30 or 10W-30.	SL/SJ	A1/B1-08, A5/B5-10, A1/B1-10, A5/B5-10					
Mobil 1 High Mileage	10W-30	1000	1100	Boosted, advanced full synthetic formula designed for higher mileage vehicles.	Vehicles that require 5W-30 or 10W-30.	SL/SJ	A3/B3-08, A3/B4-08, A3/B3-10					
Mobil 1 High Mileage	10W-40	1000	1100	Boosted, advanced full synthetic formula designed for higher mileage vehicles.	Higher viscosity applications.	SN/SM/SL/SJ	A3/B3-08, A3/B4-08, A3/B3-10					
Mobil 1 ESP Formula M	5W-40	800	900	Advanced full synthetic formulas designed specifically for passenger car diesels that have particulate filters.	Low SAPS. Available at most MB dealers.	None				229.31, 229.51		
Mobil 1 ESP Formula	5W-30	800	900	Advanced full synthetic formulas designed specifically for passenger car diesels that have particulate filters.	Low SAPS. Available at many Chrysler dealers.	Porsche C30, Chrysler MG-11106	C3-08, C2-08			229.31, 229.51	Longlife-04	504/507
Mobil 1 Racing 4T	10W-40	1200	1300	Advanced full synthetic formulas designed specifically for motorcycles where clutch lubrication is also important.	All motorcycles where 10W-40 is specified	SN/SM/SJ/SH, JASO MA1 2006						
Mobil 1 V-Twin	20W-50	1600	1700	Advanced full synthetic formulas designed specifically for motorcycles where clutch lubrication is also important.	All motorcycles where 20W-50 is specified, especially V-Twin engines	SJ						
Mobil 1 Racing	0W-30	1750	1850	Advanced full synthetic formula specifically designed to maximize horsepower under race conditions.	Race engines. Not recommended for street use.							
Mobil 1 Racing	0W-50	1750	1850	Advanced full synthetic formula specifically designed to maximize engine protection under race conditions.	Race engines. Not recommended for street use.							

** API SH and API SG are no longer licensable.

***For a full list of industry and original equipment manufacturer approvals by product and viscosity, see the Product Data Sheets which are available online at www.mobiloil.com.

Mobil 1 Engine Oils

Additional product information, including Product Data Sheets and this chart, is available at MobilOil.com
10/17/2011

Brand	Viscosity	Nominal Phosphorus Level, PPM	Nominal Zinc Level, PPM	Product Description	Recommended Consumer Applications	API, ILSAC, and Other Industry Approvals***	ACEA Approvals	GM Service Fill Approval	Ford Service Fill Approval	MB Approval	BMW Approval	VW Approval
-------	-----------	-------------------------------	-------------------------	---------------------	-----------------------------------	---	----------------	--------------------------	----------------------------	-------------	--------------	-------------

Mobil 1	15W-50	1200	1300	Boosted, higher viscosity, advanced full synthetic formula designed for performance vehicles.	HT/HS applications. Racing and Flat tappet applications.	SN/SM	A3/B3-08, A3/B4-08, A3/B3-10					
Mobil 1 Turbo Diesel Truck	5W-40	1100	1200	Advanced full synthetic formula designed for diesel powered pickups and trucks.	Most diesel applications. Including engines with diesel particulate filters.	CJ-4, CI-4, CI-4 Plus, SM, SL	E7					

Mobil 1 Racing 4T	10W-40	1200	1300	Advanced full synthetic formulas designed specifically for motorcycles where clutch lubrication is also important.	All motorcycles where 10W-40 is specified	SN/SM/SJ/SH, JASO MA1 2005						
Mobil 1 V-Twin	20W-50	1600	1700	Advanced full synthetic formulas designed specifically for motorcycles where clutch lubrication is also important.	All motorcycles where 20W-50 is specified, especially V-Twin engines	SJ						
Mobil 1 Racing	0W-30	1750	1850	Advanced full synthetic formula specifically designed to maximize horsepower under race conditions.	Race engines. Not recommended for street use.							
Mobil 1 Racing	0W-50	1750	1850	Advanced full synthetic formula specifically designed to maximize engine protection under race conditions.	Race engines. Not recommended for street use.							



Checkout the
ZDDP Certified Lab Test Results

Place a 4 ounce bottle
of ZDDPlus™ into a typical
5 quart (160 ounce) oil tank.

Use ZDDP with confidence!

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.



Engine Oil Supplement with Zinc Treatment

Part Number: 4401

Dosage: See Product Description

Size: 32 fl. oz. (946mL)

Restores ZDDP Zinc & Phosphorus levels to prevent camshaft, valve-train and other engine damage.

For component:



Engine

What it does:



Lubricates