

Method 1: Adding the additive to 5 quarts of oil (total = additive volume + 160 oz. oil)

For EOS

EOS	is	16 oz. / 176 oz. total sump volume	= 11:1 dilution ratio for the EOS,
Oil	is	160 oz. / 176 oz. total sump volume	= 1.1:1 dilution ratio for the oil.

EOS	P	is	6210 ppm @ 11:1 dilution	= 594 ppm
Oil	P	is	600 ppm @ 1.1:1 dilution	= 543 ppm

594 + 543 = 1,137 ppm P

EOS	Zn	is	6830 ppm @ 11:1 dilution	= 654 ppm
Oil	Zn	is	800 ppm @ 1.1:1 dilution	= 723 ppm

654 + 723 = 1,377 ppm Zn

For ZDDPlus™

ZDDPlus™	is	4 oz. / 164 oz total sump volume	= 41:1 dilution ratio for the ZDDPlus™,
Oil	is	160 oz. / 164 oz total sump volume	= 1.025:1 dilution ratio for the oil.

ZDDPlus™	P	is	51,500 ppm @ 41:1 dilution	= 1256 ppm
Oil	P	is	600 ppm @ 1.025:1 dilution	= 585 ppm

1,256 + 585 = 1841 ppm P

ZDDPlus™	Zn	is	71,800 ppm @ 41:1 dilution	= 1751 ppm
Oil	Zn	is	800 ppm @ 1.025:1 dilution	= 780 ppm

1751 + 780 = 2531 ppm Zn

Method 2: Reducing the oil by the amount of the additive (total = additive volume + (160 oz. oil – additive volume))

For EOS

EOS	is	16 oz. / 160 oz. total sump volume	= 10:1 dilution ratio for the EOS,
Oil	is	144 oz. / 160 oz. total sump volume	= 1.11:1 dilution ratio for the oil.

EOS	P	is	6210 ppm @ 10:1 dilution	= 621 ppm
Oil	P	is	600 ppm @ 1.11:1 dilution	= 540 ppm

621 + 540 = 1,161 ppm P

EOS	Zn	is	6830 ppm @ 10:1 dilution	= 683 ppm
Oil	Zn	is	800 ppm @ 1.11:1 dilution	= 720 ppm

683 + 720 = 1,403 ppm Zn

For ZDDPlus™

ZDDPlus™	is	4 oz. / 160 oz. total sump volume	= 40:1 dilution ratio for the ZDDPlus™,
Oil	is	156 oz. / 160 oz. total sump volume	= 1.026:1 dilution ratio for the oil.

ZDDPlus™	P	is	51,500 ppm @ 40:1 dilution	= 1288 ppm
Oil	P	is	600 ppm @ 1.026:1 dilution	= 585 ppm

1,288 + 585 = 1873 ppm P

ZDDPlus™	Zn	is	71,800 ppm @ 40:1 dilution	= 1795 ppm
Oil	Zn	is	800 ppm @ 1.026:1 dilution	= 780 ppm

1795 + 780 = 2575 ppm Zn

The preceding calculations for the 5-quart oil changes give typical results when used in many classic American V8 engines. The target 1800 to 2000 ppm range for phosphorus is designed to give the longest possible anti-wear agent service with no risk of overdosing. Based on the 0.94:1 ratio of phosphorus to zinc in the ZDDP molecule itself, this range of phosphorus would give a zinc level of about 1900 to 2100 ppm. As you can see from the ZDDPlus™ calculations, the zinc level when targeting the 1800-2000 ppm phosphorus mark falls in the 2400-2500 ppm range. This extra zinc is due to good over-compounding with zinc oxide during the ZDDP manufacture. This extra zinc in the form of zinc oxide helps give a high TBN (total base number) for excellent long-term acid neutralization.

For convenient reference, the following values can be used if your engine has a 4-quart oil capacity:

The resulting P and Zn values will be approximately:

11% higher P for EOS:	1221 ppm for 4 quart vs. 1100 ppm for 5 quart.
10% higher Zn for EOS:	1483 ppm for 4 quart vs. 1348 ppm for 5 quart.
15% higher P for ZDDPlus™:	2117 ppm for 4 quart vs. 1841 ppm for 5 quart.
15% higher Zn for ZDDPlus™:	2911 ppm for 4 quart vs. 2531 ppm for 5 quart.

We believe dosing a 4-quart oil change with one 4 oz bottle of ZDDPlus™ is safe. If you feel you would rather have your 4-quart oil change phosphorus or zinc concentrations closer to that shown above for 5 quarts, then merely use $\frac{3}{4}$ of a single bottle (3 oz) in an oil change. If the top is replaced snugly, ZDDPlus™ will be usable in the next change, when added to $\frac{1}{2}$ (2 oz) of a 4 oz bottle to equal the 3 oz dose.

For convenient reference, the following values can be used if your engine has a 6-quart oil capacity:

The resulting P and Zn values will be approximately:

8% lower P for EOS:	1012 ppm for 6 quart vs. 1100 ppm for 5 quart.
7% lower Zn for EOS:	1254 ppm for 6 quart vs. 1348 ppm for 5 quart.
12% lower P for ZDDPlus™:	1620 ppm for 6 quart vs. 1841 ppm for 5 quart.
12% lower Zn for ZDDPlus™:	2227 ppm for 6 quart vs. 2531 ppm for 5 quart.

The approximate 12% drop in P and Zn when using one 4 oz bottle of ZDDPlus™ in a 6-quart oil change is negligible, and will give anti-wear protection for the cam and lifters of engines with even the highest spring-pressures.

Referring to the results above using either method for a 5-quart oil fill, the addition of one 16 oz bottle of EOS would get you half way to an optimum level for a classic high-performance car, but carries with it 16 oz of oil different from the oil you add it to. However, one 4 oz bottle of ZDDPlus™ gives the proper amount with a comfortable safety margin, and you choose all but 4 oz of the oil's characteristics with your favorite oil. If you factor in normal depletion rates, then only ZDDPlus™ has the potential to maintain adequate protection for the duration of a 3000+ mile oil change.

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 # 770087,² operation of a flat-tappet engine without adequate antiwear 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 500 µm (0.020"), "subsequent wear is usually rapid and catastrophic." 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 reduced in practically all automotive engine oils, rendering them less suitable for use with older engines with non-roller lifters.

ZDDPlus™ is the ONLY antiwear component which re-establishes the ZDDP levels our classic car's 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 unspecified oil also means there is 20% less of the proper additive package. The chart below compares the amount of ZDDP in ZDDPlus™ to GM EOS, a leading additive which claims to provide ZDDP-based wear protection. The ounces of each additive given in the chart is what you would have to add to 5 quarts (160 ounces) to achieve the target phosphorus level listed in red.

Dosing Comparison of ZDDPlus™ and GM EOS

Product	Amount Used (oz)	Phosphorus (ppm)	Zinc (ppm)	P to Zn Ratio	Density (g/ml)
ZDDPlus™	4	51,500	71,800	0.717	0.990
GM EOS	16	5,300	7,100	0.746	0.908
Average SM Oil	160	600	800	0.750	0.860

Target ppm Phosphorus Concentration	Ounces of ZDDPlus™	Ounces of GM EOS
700	0.3	2.9
800	0.7	5.7
900	1.0	8.6
1000	1.3	11.4
1100	1.7	14.3
1200	2.0	17.2
1300	2.3	20.0
1400	2.7	22.9
1500	3.0	25.7
1600	3.3	28.6
1700	3.7	31.5
1800	4.0	34.3
1900	4.3	37.2
2000	4.7	40.0

— 1 bottle GM EOS

— 2 bottles GM EOS

— 1 bottle **ZDDPlus™**

² Loren G. Pless, and John J. Rodgers, "Cam and Lifter Wear as Affected by Engine Oil ZDP Concentration and Type," SAE pub 770087 (1977), 4