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## **ZDDPlus™ Tech Brief #5**

### **Racing Oil as a Replacement for SM Oil**

The EP agent of choice in high-performance engine oil has been ZDDP for over 50 years. With modern SM oils now being formulated with reduced amounts of phosphorus in the form of ZDDP, it is logical to look elsewhere for an oil which still contains sufficient ZDDP for a classic or high-performance street car. There are some racing oils that have an amount of ZDDP which, at first glance, would make them look suitable for classic and high-performance street engine use. When you look more closely at exactly how and why racing oil is formulated differently from oil designed for street use, you will begin to see that may not be so.

The choice of base stock and additive characteristics give oil its suitability to a particular use. When oil is formulated, the most important properties for the intended purpose are given the highest priority, and the less important characteristics are taken into account only as they do not interfere with the primary goal. In this way, the science of formulating engine oil is an excellent example of compromise in engineering. No one oil can be optimized for ALL uses. The primary objective in formulating racing oil is to keep power-robbing oil pumping loss minimized, while providing the highest possible hydrodynamic film strength to allow rotating parts to remain separated at high load and rpm. This means a reduction of detergents which would reduce the shear strength of the oil film. It also means the actual amount of EP agent in a racing oil is less important than that in an engine with extended oil change intervals. Many racing oils have a ZDDP level which gives a phosphorus level of 1000 ppm. This is lower than the level for which many classic high-performance engines were designed.

Racing oils are optimized for short-term severe duty as well as reduced oil drain intervals, in contrast to street-use oil that has been designed for day in, day out street operation with extended drain intervals. Especially in the case of vehicles which see extended periods of storage, it is important to remember that acids and contaminants in the oil are at work even when the car is in storage! In addition to very short oil change intervals, a drag racing engine may have a total life measured in mere thousands of actual crankshaft revolutions between rebuilds. In contrast, a street engine may spin a many as 150 million times in 60,000 miles at 2500 rpm, or 7.5 million times per 3000-mile oil change at 2500 rpm! Obviously, the need for long-term protection of all components which rely on the engine oil is much more important in designing a lubricant for street use than it is for racing use.

If you examine the requirements for oil optimized for racing use and contrast it against oil optimized for street use, you will see some major differences:

1) Oil formulated for street use will typically have 2500 to 3000 ppm or more total detergents added. Many racing oils test at 1200 to 1000 ppm total detergent, with some testing at half that much. Detergents and dispersants which are incorporated into street oils, can reduce the ultimate oil film shear strength.<sup>1</sup> The need for optimum hydrodynamic film strength is a strong incentive for formulators of racing oil to minimize the detergent and dispersant additive package, one brand claiming: "Helps increase horsepower through advanced friction modifiers balanced with reduced detergent levels."<sup>2</sup> As a result, some racing oils may not have the capability of keeping contaminants in suspension over an extended drain interval, so the interval must be shortened accordingly,

<sup>1</sup> P.A. Willermet, Ford Motor Co., 36123 Roycroft, Livonia, MI 48154, USA, "Some engine oil additives and their effects on antiwear film Formation," *Tribology Letters* 5, (1998) 45

<sup>2</sup> [http://www.valvoline.com/pages/products/product\\_detail.asp?Product=95](http://www.valvoline.com/pages/products/product_detail.asp?Product=95)

increasing cost. Use of oil with insufficient detergent can cause sludge and varnish buildup in a street motor over a short period of time.

2) Viscosity range, so important to correct street engine operation over a broad temperature range, is not available in as many choices in racing oils. In drag racing, tenths or even hundredths of a second can make the difference between a win and a loss. The parasitic drag of heavy-weight oil and its pumping losses become important criteria when considering oil for racing use. This requirement is quite different than that for street car oil. An engine used for street performance use must have the appropriate viscosity over a range of temperatures.

3) Racing oils usually do not have to contend with a long term build-up of acids from blow-by products, so some may not have the acid-neutralization package usually engineered into an oil meant for normal street driving. Some acid neutralization is supplied as an adjunct function of the ZDDP. If oil without sufficient acid neutralization characteristics is used for all-season driving, corrosion and dissolving of metals from bearings and other engine parts can result, even as the car is stored in a temperature controlled garage.

4) The cost of racing oils is usually higher than that of more commonly available high-quality SM oil. The use of racing oil will usually result in a 5-quart oil change costing \$50 or more! Since the additive package is not designed for extended change intervals, you will end up changing the oil more often as well, further increasing the cost. On the other hand, a 5-quart oil change with a name-brand high-quality SM oil can cost as little as \$18. Splurging on a premium synthetic can bump the cost to \$25 or more, still far less than the cost of the racing oil.

An excellent solution is to add ZDDPlus™ to a modern high-quality SM oil of the proper viscosity for your gasoline engine. The amount of ZDDP in a 4 oz bottle is designed to provide the very highest level of EP protection appropriate for your classic high-performance flat-tappet engine. The special ZDDP utilized in ZDDPlus™ contains additional corrosion fighting protection to help prevent corrosion of internal engine parts, even during long storage intervals. The base oil characteristics of modern high-quality SM oil are superior to those of earlier oils, and will exhibit much less sludging or high-temperature breakdown than earlier oils. You could say the blend of ZDDPlus™ and modern SM oil is synergistic, and offers the advantages of each.