

Engine Oil Issues for Older Engines

The Issue

All engine oils contain anti-wear additives and the most common of the anti-wear chemistry is zinc dialkyldithiophosphate (ZDDP). This compound contains both elements zinc and phosphorus. Anti-wear additives provide protection for engine components during the start up phases of engine operation when the engine is operating in the boundary layer lubrication phase. The boundary layer lubrication phase exists until full oil pressure is obtained and flow is established to all the moving parts. In the case of flat tappets and cams the lobes never get out of the boundary layer phase of lubrication.

In 2005, in an effort to guarantee extended catalytic converter life time operational requirements in new vehicles, the American Petroleum Institute (API) and the International Lubricants Standards Approval Committee (ILSAC) instituted API classification SM and ILSAC specification GF-4 quality standards which reduced the maximum limit for zinc and phosphorus to 0.085% and 0.080% respectively. The standards also established a minimum for zinc and phosphorus of 0.065 and 0.060 respectively.

Prior to the SM GF-4 specification the lower limit of 0.10% zinc and phosphorus with no restriction on the upper level of zinc and phosphorus. With this major change in zinc and phosphorus the wear on surfaces requiring anti-wear additives in the boundary layer lubrication phase can be drastically increased. Oils containing minimal anti-wear will have higher wear rates on critical surfaces such as flat face lifters and cam shaft.

TECHNICAL DISCUSSION

The reason for the reduction in the ZDDP concentration is to lower the amount of zinc and phosphorus ingested by the catalytic converter. All oils have a volatility rate that is measured by the Noack Volatility method. Most of the petroleum oils have a volatility of between 12 and 18% where as the group 4 synthetic lubricants have a volatility of 6 to 9%. The higher volatility and the higher concentration of zinc and phosphorus equates to a shorter converter life expectancy. The EPA has extended the converter life requirement and the only way the petroleum oils can make the requirement is to lower the levels of zinc and phosphorus. The more modern engines have gone from flat faced lifters to roller lifters and this lowers the wear component on the cam and the lifters. The older engines need the higher concentrations of the anti-wear additives (ZDDP) or significantly increased wear will occur.

How is a person to know what oil to use? You will need to request the information from the manufacturer, have the oil tested to determine the levels of ZDDP, or get the results of the 4 ball wear test (ASTM D4172). The 4 ball test demonstrates oil's ability to prevent wear in the boundary layer lubrication phase. This test uses 4 half inch diameter

steel balls. Three of the balls are locked into a group and the fourth ball rides on the first three. The oil is held at a temperature of 150 degrees centigrade and the load on the balls is 40 kg and the center ball is rotated at 1800 RPM for one hour. At the end of the test duration the scar diameters of the three fixed balls are averaged and this is used as the comparison that indicates the amount of wear. The smaller the scar diameter, the higher the protection against boundary layer lubrication wears protection.

There are many other issues with lubricants and filtration that can be discussed should members have interest in this subject. Additional information can be obtained by listening to PEAK PERFORMANCE on KID 590 Saturday mornings at 10 to 11 am

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