TSB: MO-2009-10-01

Technical Service Bulletin

Date: 10/29/09
Revision: 7/28/11
Product Description: AMSOIL Premium API CJ-4 Diesel Oil (DEO, DME)
Subject: Fuel Dilution Issues in 2007 – Present Light-Duty Turbo-Diesel Pickups

OBJECTIVE:

Communicate the discovery and cause of excessive fuel dilution in 2007–present light-duty diesel pickups from Ford, GM and Dodge and the resultant reduction in the drain interval recommendation for AMSOIL Premium Diesel Oil in these applications.

ISSUES:

AMSOIL has documented increasing levels of diesel fuel contamination (fuel dilution) in the engine oil in 2007–present light-duty diesel pickups from Ford, GM and Dodge.

Research indicates that fuel dilution is intensifying due to the use of in-cylinder post-fuel injection during the engine's exhaust stroke to regenerate the diesel particulate filter (DPF). A field study performed in 2010 confirms fuel dilution is affecting engine oil at alarming rates.

Fuel in the oil reduces the oil's life expectancy and effectiveness. Because diesel fuel is a natural solvent, fuel dilution in motor oil causes a decrease in viscosity which may lead to an increase in engine wear.

TECHNICAL DISCUSSION:

Current emissions legislation set by the Environmental Protection Agency (EPA) mandates that all 2007 and newer on-highway diesel-fueled vehicles come equipped with a DPF. A DPF is generally a honeycomb-like filter positioned in the exhaust stream to collect particulate matter and soot to prevent it from exiting the vehicle. DPFs are highly efficient and can usually remove 80-90 percent of particulate matter from diesel exhaust.[1] When the filter is near its capacity, soot trapped in the filter is burned, freeing the plugged media and enabling the filter to remain serviceable. The process of burning the residual matter is termed **regeneration** and can be either active or passive.

Active regeneration uses raw diesel fuel as a combustion source to burn the accumulated soot and clear the filter. Active regeneration is accomplished using either in-stream or in-cylinder injection. **In-stream injection** systems inject raw diesel fuel directly into the exhaust stream before it reaches the DPF. **In-cylinder injection** systems inject raw diesel fuel directly into the cylinder on the exhaust stroke. The unburned fuel evaporates and travels down to the DPF to burn out the soot built up in the filter.

Passive regeneration requires exhaust gas temperatures of approximately 600°C (1100°F).[2] These relatively high exhaust gas temperatures occur naturally in trucks operating under heavy load and can trigger the combustion of soot in DPFs. Passive regeneration does not increase fuel consumption the way active regeneration does because, by design, it does not require the injection of additional fuel to increase exhaust temperatures.

All class 8 over-the-road tractors and medium-class applications use active regeneration via in-stream injection. In this method, diesel fuel used to burn soot in the DPF is injected directly ahead of the DPF and does not reach the crankcase, leaving the oil uncontaminated.

Light-duty diesel pickup manufacturers (Ford, GM, Dodge) have opted for a less-costly in-cylinder injection system. With in-cylinder injection systems, raw diesel fuel injected on the exhaust stroke can wash directly past the rings and into the crankcase, mixing with the oil. Regular washing of cylinders is a continuous source of fuel contamination in the crankcase and is not conducive to long-term engine protection. Used oil analysis results from 2007–present light-duty diesel vehicles show varying levels of elevated fuel dilution.

NOx Reduction – EPA emission mandates taking effect in 2010 require the reduction of nitrogen oxides (NOx) to .2 grams per brake horsepower (g/bhp). To meet this limit, engine manufacturers use either selective catalytic reduction (SCR), NOx adsorbers or advanced exhaust gas recirculation (EGR).

Most over-the-road truck and tractor manufacturers use SCR technology, with International the only major manufacturer to use advanced EGR technology. Neither system is expected to increase fuel dilution. Light-duty diesel pickup manufacturers Ford and GM use SCR technology in their 2011 model-year trucks. Dodge employs SCR technology in its medium-duty chassis cabs but continues use of its NOx adsorber technology in the company's light-duty pickups.

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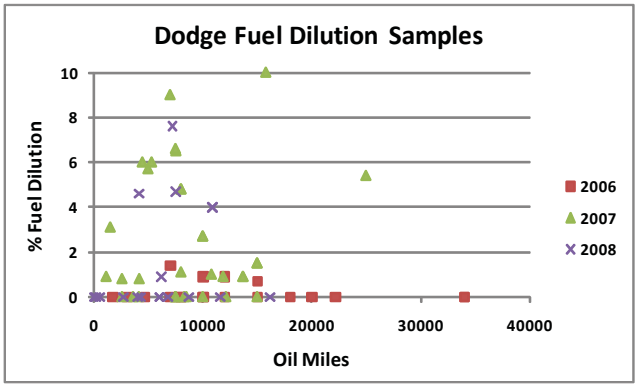
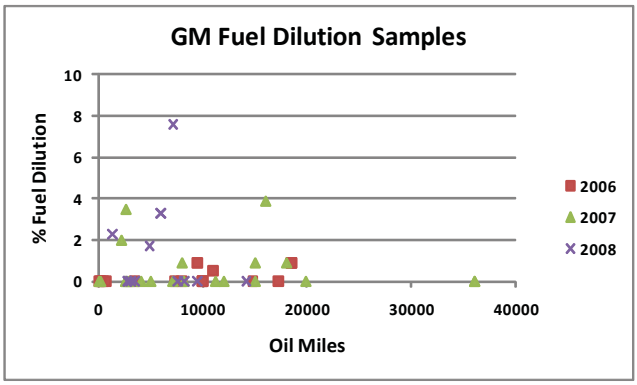
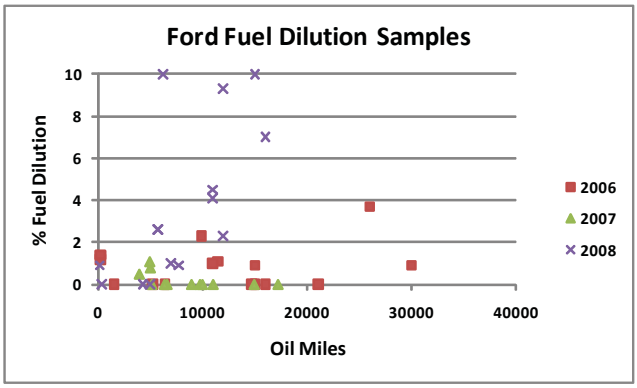
Like DPFs, NOx adsorbers need to be regenerated. However, they require significantly more fuel to regenerate than DPFs, which only compounds the fuel dilution problem.
In Dodge light-duty turbo-diesel pickups, the combined regeneration requirements of the DPF and NOx adsorber technologies are causing high fuel dilution of the engine oil.







As illustrated in the charts, model-year 2007 and newer light-duty diesels are experiencing higher fuel dilution than previous model years. Although these vehicles are experiencing higher fuel dilution, regeneration cycles vary based on service (engines operating in severe service conditions do not actively regenerate as often as engines operating in normal service conditions), and some applications are affected more than others. While not all 2007–present light-duty diesel vehicles develop this problem, fuel contamination can reduce oil viscosity and decrease film thickness. Other concerns include significantly reduced fuel economy, accelerated engine oil oxidation, increased volatility and overfilling of the oil sump.

RECOMMENDATION:

Although AMSOIL Premium Diesel Oil has shown the ability to maintain integrity under fuel-dilution conditions, the abnormally high rate and unknown long-term effects have forced AMSOIL to adjust its drain interval recommendations as a precautionary measure for 2007–present Ford, GM and Dodge light-duty turbo-diesel pickups.

In these applications, AMSOIL recommends changing AMSOIL Premium API CJ-4 Synthetic Diesel Oil (DEO, DME) at the manufacturer-recommended drain interval. Drain intervals may be extended further with oil analysis. The recommendation for this oil in gasoline applications remains 2X vehicle manufacturer recommendation.[3]

Owners of affected vehicles should use oil analysis to determine the severity of fuel dilution in their vehicle. If fuel dilution levels are above 5 percent, contact the dealership or OEM for help finding a solution. AMSOIL and OIL ANALYZERS condemn oils with greater than 5 percent fuel dilution.

Pre-2007 diesel applications not equipped with emission system devices are not affected by these changes. Those applications can still extend oil drain intervals to 3X vehicle manufacturer recommendation, not to exceed 50,000 miles/600 hours or one year.[3]

REFERENCES:

1. Clean Air Fleets Emission Control Technology. Accessed March 5, 2009. www.cleanairfleets.org/ect

2. Ranalli,Marco, et al. 'DPF Soot Mapping. A Simple and Cost Effective Measurement Method for Series Development.' Accessed July 24, 2009. http://www.arvinmeritor.com/media_room/CAS_Europe/sae_dpf_en.pdf.

3. Refer to the AMSOIL Product Recommendation and Drain Interval Chart (G1490) for details.

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