EFFECT OF THE USE OF ULSD (ULTRA LOW SULFUR DIESEL)

ULSD

At least 80% of the highway diesel produced or imported is now ULSD fuel, contains maximum 15 ppm sulfur, replacing most all Low Sulfur Diesel (LSD) fuel, which contains a maximum of 500 ppm sulfur. Used in combination with cleaner-burning diesel engines and vehicles, ULSD fuel is improving air quality by significantly reducing emissions.

ULSD Effects

Sulfur is not a lubricant in of itself, it can combine with the nickel content in many metal alloys to form a low melting point eutectic alloy that can increase lubricity. The process used to reduce the sulfur also reduces the fuel's lubricating properties. **Lubricity is a measure of the fuel's ability to lubricate and protect the various parts of the engine's fuel injection system from wear**. The processing required to reduce sulfur to 15 ppm also removes naturally-occurring lubricity agents in diesel fuel. To manage this change ASTM International (formerly the American Society for Testing and Materials) adopted the lubricity specification defined in ASTM D975 for all diesel fuels and this standard went into effect January 1, 2005. The D975 standard defines two ULSD standards, Grade No. 2-D S15 (regular ULSD) and Grade No. 1-D S15 (also known as kerosene. It is a higher volatility fuel with a lower gelling temperature than regular ULSD).
The refining process that removes the sulfur also reduces the aromatic content and density of the fuel, resulting in a minor decrease in the energy content, by about 1%. (Citation needed) **This decrease in energy content may result in slightly reduced peak power and fuel economy.** The transition to ULSD is not without substantial costs. The US Government has estimated that pump prices for diesel fuel will increase between $.05 and $.25 per gallon as a result of the transition. And, according to the American Petroleum Institute, the domestic refining industry has invested over $8 Billion to comply with the new regulations.

ULSD will run in any engine designed for the ASTM D975 diesel fuels, **however, it is known to cause some seals to shrink, and may cause fuel pump failures** in Volkswagen TDI engines used in 2006 to pre-2009 models. TDI engines from 2009 and on are designed to use ULSD exclusively; biodiesel blends are reported to prevent that failure.

The use of Xp3 as an additive to the ULSD will solve the problems generated by this fuel. It will improve the lubricity and power peak.

ULSD effect on filters when in low temperatures

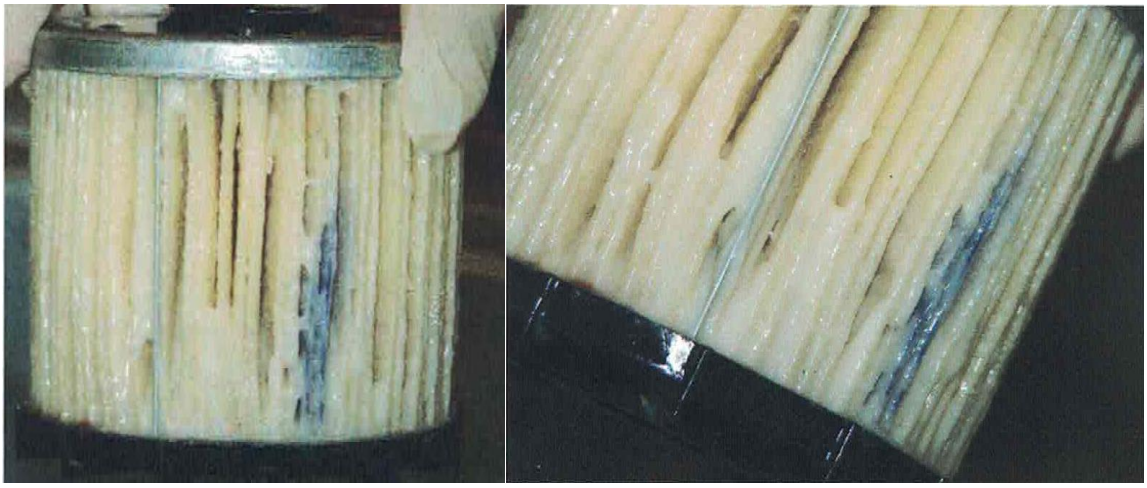
The use of ULSD (Ultra Low Sulfur Diesel) fuels have less than 15 ppm (compared to 500ppm in the past) of sulfur created significant winter operability problems. These operational problems varied from low power complaints to complete engine shutdown (failure) as well as field storage tank filter plugging and fuel system delivery blockage.

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These result of the sulfur reduction typically raises the fuel Cloud Points, and significantly lowers the aromatic content of the fuel during production. The reduction of the aromatic content, and the natural tendency of the paraffin content to remain in suspension when it changes to a solid wax at the Cloud Point temperature is dramatically reduced. This will result that at ambient fuel temperatures below the fuel Cloud Point (the temperature at which the paraffin changes from a liquid to a solid wax), the wax crystals tend to precipitate faster and accumulate in the bottom of the vessel, vehicle tank or diesel storage tank.

This wax settling phenomenon results in the solid wax (paraffin) crystals being drawn into the fuel filter of a storage tank pump or vehicle fuel filter as soon as the pump system is activated to supply diesel fuel or deliver fuel to the engine. Since the fuel filters are typically 10 microns, this solid wax material will not go through the fuel filter elements.

Additionally, the paraffin content in a diesel fuel tends to bond with any moisture (water) in the diesel fuel. A higher diesel fuel aromatic content impedes this bonding tendency; however, with the lower aromatic content in the new ULSD fuels, this natural protection is gone. Therefore, any fuel system that has moisture present will have increased fuel-fouling problems.



The waxy deposits in this plugged fuel filter were laboratory tested for Pour Point - the result was + 62°F. This indicates the deposit material plugging the filter is paraffin.

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