Ultra Low Sulfur Diesel
The Innovative Solution
The introduction of Ultra Low Sulfur Diesel (ULSD) signals a new direction for the fuel industry. Yet for the refiner, fuel distributor and retail outlet, the passing of the June 1st 2006 deadline has created numerous challenges.

Compliance with the new EPA legislation means ULSD must not contain more than 15ppm sulfur. But to achieve this new lower level of sulfur, a fuel handler is presented with a number of unique challenges.

The hydrotreating process used to remove sulfur from refinery streams has severe effects on fuel properties because it also removes many other functional species in the fuel. In addition to sulfur, nitrogen and oxygen are removed. Fuel additives can be used to correct these deficiencies, but this is not a viable option if the additives themselves have a sulfur content >15 ppm.

Innospec was the first company to launch an entire ULSD product line that contains <15ppm sulfur. Our LEGAL DIESEL™ Fuel Additives are all certified using proper Product Transfer Documents (PTDs). These PTDs clearly state that: “The sulfur content of this diesel fuel additive does not exceed 15 ppm.” This means that LEGAL DIESEL™ Fuel Additives can be injected downstream of the refinery without requiring fuel re-certification. Additionally, the PTDs provided with your LEGAL DIESEL™ Fuel Additives act as “your affirmative defense against presumptive liability.”

While the effect of removing sulfur from diesel fuel on lubricity is well recognized and widely understood, the effect on the fuel’s low-temperature handling, thermal stability (vulnerability to peroxide formation) and corrosion potential is less well documented.

Innospec’s line of LEGAL DIESEL™ Fuel Additives has been developed to compensate for the performance lost during the hydrotreating process. These additives contain <15 ppm sulfur.

Our product line incorporates technologies to improve a fuel’s lubricity, cold flow and thermal stability, as well as additives to inhibit corrosion.

Fuel Additive Product Transfer Document Statement Requirements, 40CFR80.591
April 2006

1 Products Sold in Bulk

1.1 If product contains <15 ppm sulfur, 40CFR80.591(a)(2):
• “The sulfur content of this diesel fuel additive does not exceed 15 ppm.”

1.2 If product contains >15 ppm sulfur, 40CFR80.591(b)(2):
• “This diesel fuel additive may exceed the federal 15 ppm sulfur standard. Improper use of this additive may result in non-complying diesel fuel.”
• “The additive’s maximum sulfur concentration is ___ ppm.”
• “The maximum recommended concentration for use of the additive in diesel fuel is ___ volume %.”
• “The contribution to the sulfur level of the fuel that would result if the additive is used at the maximum recommended concentration is ___ ppm.”


Innospec Fuel Specialties is the only manufacturing company solely focused on fuel and fuel additive technology.
Lubricity Improvers

A fuel with adequate lubricity is critical to the satisfactory operation of diesel engines. The engine relies on the fuel to lubricate many of the moving parts within the fuel injection system.

ASTM has incorporated a lubricity requirement as part of the diesel fuel specification, ASTM D975. As a result all diesel fuel must have a High Frequency Reciprocating Rig (HFRR) test result (ASTM D6079) of no more than 520 µ. However, the fuel components that inherently provide protection are removed by the hydrotreating process. This means ULSD typically has poor lubricity.

Using our LEGAL DIESEL™ Fuel Additives OLI-9000 series of products is a cost-effective way to boost lubricity performance to meet the ASTM or Engine Manufacturers Association (EMA) standard. These products are the only fully synthetic, non-interacting, non-acidic, sulfur compliant lubricity improvers.

“…for those parties who, at a downstream location, blend diesel fuel additives …into fuel trucks at a truck loading rack, the periodic sampling and testing program required under this paragraph must ensure, by taking into account the greater risk of non-compliance created through use of a high sulfur additive, that the diesel fuel into which the additive was blended meets the applicable standards subsequent to the blending”

*The Federal Register, Vol. 66, No 12, Thursday, January 18, 2001, Rules and Regulations, sub-section 80.613 (d) (2). P.5153*
Conventional cold flow improvers will be less effective in some ULSDs and will most likely require more additive to meet the desired performance level. New, more complex chemistries will be required to treat the broad range of ULSD blends.

**Cold Flow Improvers**

The introduction of ULSD presents a major challenge to the low temperature performance of diesel fuel.

- The ratio of the n-paraffins changes making fuel more difficult to treat
- The solvency of the fuel changes allowing more wax to precipitate out at higher temperatures. The solvency change can also reduce the efficacy of No. 1 Ultra Low Sulfur Kerosine (ULSK) when it is used as a blend stock.

The hydroprocessing used to remove sulfur impacts three major physio-chemical properties that affect low temperature operability.

- Unsaturated hydrocarbons become saturated and the fuel becomes more paraffinic (waxy)

Refining and logistics challenges warn of a shortage of ULSK fuel for use as a blend stock making low temperature fuel additives even more important.

Our CFI and PPD series of products provide fuel handlers a cost-effective way to achieve the required pour point depression or the regional low temperature operability targets in ULSD with an additive containing < 15ppm sulfur.
Stability

Refinery hydrotreating processes remove the naturally occurring antioxidants in the fuel. This allows the formation of peroxides in storage. These peroxides promote oxidation and polymerization and have a damaging effect on elastomers in vehicle fuel systems.

Analysis of various ULSD fuels using accelerated peroxide forming tests showed that all fuel consistently form peroxides. Traditional stabilizer additives for middle distillate ground fuels are not effective in preventing peroxide formation.

Using our LEGAL DIESEL™ Fuel Additives FOA-7 series of products, which all contain < 15ppm sulfur, can effectively inhibit peroxide formation and protect equipment from damage.

Corrosion Inhibitors

Like other diesel fuels, ULSD is naturally corrosive and if used untreated it can cause corrosion problems (tanks, pipelines, vehicles etc). However, most conventional corrosion inhibitors available for commercial use in diesel fuel contain sulfur levels above 15 ppm. If these are used, fuel re-certification may be necessary downstream of the refinery.

A fuel supplier faced with this problem has three options. He could refrain from adding a corrosion inhibitor to the fuel. He could take a risk and use an additive that may require the fuel to be re-certified or he could find a fuel treatment that guarantees compliance without re-certification.

Use of our LEGAL DIESEL™ Fuel Additive DCI-30 corrosion inhibitor is the only cost-effective solution. Our product is the industry’s only pipeline-approved corrosion inhibitor containing less than 15 ppm sulfur.
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