DIESEL FUEL ANALYTICAL TESTS

Cetane Number

Cetane number is a measure of ignition quality or how readily the fuel starts to burn. A fuel with a high cetane number burns shortly after it is injected into the cylinder. A fuel with a low cetane number takes longer to ignite, making it harder to start the engine. Cetane numbers apply only to distillate fuels (#1 and #2 diesel); they are not measured for fuels containing petroleum residual such as # 4 diesel or marine fuel. Increasing the cetane number of the fuel can decrease the amount of knock by shortening the ignition delay. Less fuel has been injected by the time combustion begins and it has had less time to mix with air. As a result, the rapid pressure rise, along with the resulting noise is less.

BTU

The energy content of diesel fuel is its heat of combustion, the heat released when a known quantity of fuel is burned under specific conditions. In the U.S., the heating value is usually expressed as British thermal units (Btu) per gallon at 60°F. Btu per gallon is directly proportional to density of the fuel. Density is the weight of a unit volume of material at a specific temperature. The unit used to report density in the U.S. is API Gravity. API numbers typically range from 10 to 70. As the numbers increase the density and the Btu of the fuel decrease.

Stability

For the majority of consumers, storage stability should not be a concern, but for those who store diesel fuel for a extended periods of time, i.e., more than two years, there is a possibility that fuel integrity may be compromised. These users include hospitals, power plants, and telecommunication companies who maintain backup generators for use during outages. It is essential that the fuel supplied to these systems be free of contaminants that could interfere with startup and uninterrupted operation. Regular analysis of these fuels is recommended.

Stability is defined as uniformity over time. This can be chemical or physical. Chemically, the fuel is stable if it is not contaminated with oxidation byproducts or prone to the formation of oxidation byproducts. The Dupont Stability test is designed to measure this property. The test is performed by subjecting the fuel to excessive heat for a specified time and measuring the amount of oxidation that occurs.

Storage conditions as well as age influence fuel stability. A fuel that is treated with an appropriate stabilizer and is kept cool and dry will last much longer than one that is not. The presence of free water encourages corrosion of metal storage tanks and provides the medium for microbiological growth. Testing for water, microbes, particulate, and metals should also be a part of the stability determination.

Fuel stabilizers are available to improve stability. The recommended product or products would contain an antioxidant, biocide, and corrosion inhibitor.

Cold Temperature Properties

Low temperature can cause wax crystallization, which can lead to filter plugging if #2 diesel is used during cold weather. The cloud point of the fuel marks the temperature at which this crystallization occurs. A #2 diesel can have a cloud point anywhere from -10F to +20F. The cloud of a #1 diesel is approximately -50F. It is common practice for fuel suppliers to blend the two fuels during the winter months to improve cold weather performance. The cloud point of No. 2-D is lowered by about 3°F for every 10% volume of No. 1-D in the blend.

The cloud point of a fuel that has been treated with Cold Flow Additives may not accurately measure the filter plugging point. The reason being is most cold flow improvers do not change the temperature of crystallization. They function by limiting the size of the crystals formed so that they are small enough to pass through the filter. If a fuel is suspected of being treated there are other tests available to measure filter plugging temperature. They are the Low Temperature Filterability Test (LTFT) and the Cold Filter Plugging Point (CFPP). These tests pass the chilled fuel through a filter to determine the temperature at which the filter plugs.

Sulfur

High sulfur in fuel is directly related to deposit formation and engine wear. This is due to reaction of sulfur during combustion transforming it to sulfuric acid. This acid can enter the crankcase in the form of blow-by gas and cause an increase in wear rates.

In 1990's the EPA mandated that the sulfur content of commercial diesel fuel be lowered from 0.5 to 0.05%. The level of sulfur in home heating oil and farm use vehicles however was not changed. The sulfur limit for these fuels remains at 0.5%.

Does low sulfur diesel fuel have enough lubricity? Yes. Even though the process used to lower the sulfur in diesel can also remove some of the components that give the fuel its lubricity, reputable refiners monitor this property and use an additive, as needed, to raise the lubricity to an acceptable level.

Viscosity

The lubricity of No. 1-D is likely to be slightly lower than that of No. 2-D because of its lower viscosity. Its lubricity is unlikely to be low enough to cause catastrophic failure. However, a steady diet of No. 1-D in equipment designed for No. 2-D may result in greater long term wear in the fuel delivery system.

Flash Point

1% or less gasoline will lower the flash point of a gasoline/diesel fuel blend below the specification minimum for diesel fuel. This will not affect the fuel's engine performance, but it will make the fuel more hazardous to handle. Larger amounts of gasoline will lower the viscosity and/or cetane number of the blend below the specification minimums for diesel fuel. These changes can degrade combustion and increase wear.


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