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Diesel Fuel Quality is a Question Not a Guarantee (Feature Article) March 2005

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When it comes to the "acceleration" of diesel fuel quality, it just doesn't compare to the diesel engines it's supposed to "rev" up.

Diesel engine designs striving to increase engine performance have made great advancements in engine fuel delivery to the combustion chamber. Today's diesel engine is quieter, smoother and more powerful. But today's diesel engine owners are overlooking one important factor. The quality of today's diesel fuel has not advanced at the same rate as the engine improvements.

Diesel fuel begins to deteriorate as soon as it is produced. Within 30 days of refining, all diesel fuel regardless of brand, goes through a natural process called re-polymerization and oxidation. This process forms varnishes and insoluble gums in the fuel by causing the molecules of the fuel to lengthen and bond together. These components now drop to the bottom of the fuel tank and form asphaltene also known as diesel sludge. The fuel begins to turn dark in color, smell bad and in most cases causes engines to smoke. The engines smoke because some of these clusters in the early stages are small enough in size to pass through the engine filtration and into the combustion chamber. As these clusters increase in size, only part of the molecule gets burned. The rest goes out the exhaust as unburned fuel and smoke. With increases in cluster size they begin to reduce the flow of fuel by clogging filters. The filters only address the symptom and not the cause.

It is estimated that eight out of every ten diesel engine failures have been directly related to contaminated fuel. The build-up of contaminates in the fuel systems and storage tanks can quickly clog filters, thus resulting in engine shut down, fuel pump wear and diesel engine damage.

The Culprits

Understand that most fuel has some amount of water in it from either condensation or vents. This threat requires that we realize the added burden placed upon diesel fuel as opposed to gasoline. Gasoline acts as a fuel only. Diesel fuel, on the other hand, also must cool and lubricate injection system parts. These parts are engineered to very close tolerances -- up to 0.0002 of an inch -- and any contamination means rapid part wear. Water displaces the diesel fuel. When the fuel is displaced wear occurs because lubrication is now absent.

Water that enters the combustion chamber results in even more serious damage. When it comes in contact with the heat of the combustion chamber (in excess of 2,000 degrees F), it immediately

turns to steam and often explodes the tip of the injector. Water causes corrosion of tanks, lines, injectors and greatly reduces combustibility.

Other areas of concern include the generation of more exhaust emissions and effecting EPA standards.

Bacteria also presents a serious problem. Bacteria feeds on nitrogen, sulfur and iron that may be present in the fuel or tank.

Then there is algae. There is absolutely no algae in diesel fuel. You may have fungus and microbial contamination but no algae. This is a misnomer for diesel sludge. So if you have a diagnosis of ALGAE and add a biocide, you have done two things, 1) found a mechanic that is wrong and 2) done nothing to fix the problem.

What your engine manufacturers recommends

Your engine manufacturers recommend that your fuel not be stored for more than one year and to operate on fuels meeting the properties of ASTM designation D975 (grades 1-D and 2-D).

If you have stored fuel or have fuel of questionable age and have to polish it by an outside service, you may be shocked at the going rate of "half the price of new" to clean your fuel. This number can really affect your maintenance budget. Fuel polishing is the repeated filtering of the entire tank volume on a regular basis. Turning the entire volume of the fuel every thirty days is recommended, but most only do it once in 120 days. Running equipment for an hour that depends on that fuel is a waste of time. The OEM filtration on an engine is not intended to process hundreds or thousands of stored gallons. A fuel management system is required with the specific capabilities to handle your volume of fuel.

For more information on this topic refer to:

- CATERPILLAR (see publication #SEBD 0717-01 Diesel Fuels and Your Engine)
- DETROIT DIESEL (see publications Engine Requirements, Lubricating Oil Fuel, and Filters)
- JOHN DEERE (see publication #ISBNO - 86691-143 X)

Why is there so much bad fuel?

The number one reason is due to the increased popularity of diesel power and the accompanying increased demand for more diesel fuel. There was a time when diesel fuel remained in the refinery storage tanks long enough to naturally separate and settle, allowing the clean fuel to be drawn off. Now with increased demand, diesel fuel never remains stationary long enough for settling and the suspended water and solids are passed on to you, the user.

The change in refinery techniques is another problem. In order to get more products per dollar; diesel fuel is now being refined from more marginal portions of the crude oil barrel. This results in a lower-grade product that is inherently thicker and contains more contamination.

Finally, current fuel distribution methods also have a negative impact on the condition of the fuel at the time of delivery. In many cases, brokers control fuel sales to major distribution terminals and determine delivery dates. There is no telling how long that fuel has been in the distribution network and how many times it has been transferred. Seldom do these distributors filter the fuel as they transfer it.

The solution

On-sight storage tanks always have a small amount of the first gallon of fuel ever put in them, unless it is drained 100 percent and cleaned. So adding new, fresh fuel always has a bit of the bad added to it every time fuel is purchased. Diluting the bad with good over time is a loosing battle. The fuel will always be bad fuel until the core problem is addressed.

The order of treatment for fuel related problems should always begin with a determination of whether there is water in the fuel and if the fuel has microbes (fuel bugs) in it. Water Paste and Fuel Test Kits can be used for this stage of maintenance. If microbes are detected, then the use of biocides is needed. Biocides have no effect on and will not eliminate the sludge problem. Biocides kill bacteria, that's all!

The water issue should always be remedied first by the use of fuel water separators on the tank or on the equipment. Next a chemical additive should be added to dissolve diesel sludge, gums and varnishes that clog filters and injectors. For long-term prevention, the use of magnet fuel conditioners is recommended. These devices continually reverse the re-polymerization of the fuel and reduce the need for ongoing additive use.

There is no good time to find out that your engine won't operate or that half its life span is gone prematurely because of contaminated diesel fuel. A sudden need for diesel fuel stored to run back up systems and generators can create another disaster in minutes. Those systems usually run until bad fuel clogs and "kills" the engine. Ground transportation equipment and boats can be stranded until the filters are changed. Or worse, life support and evacuation systems can quit in commercial buildings, financial institutions, hospitals and communication facilities. Since no one can predict an emergency, the only safe method is prevention.

Realize now that you do have a problem and manage it, or deal with the unexpected catastrophe and reduced equipment life that comes at the absolutely wrong time and is not in the budget!

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