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Portable Power

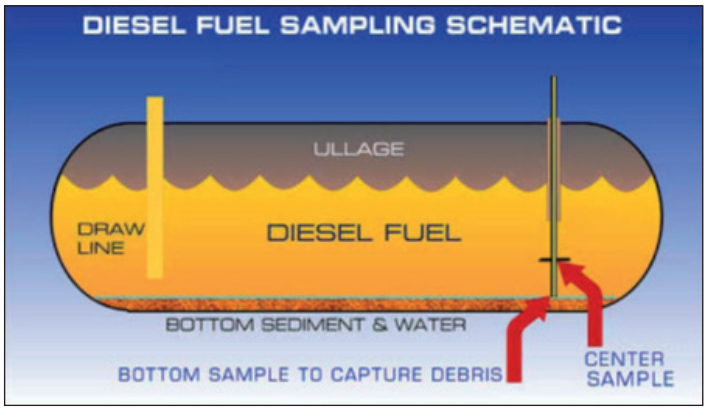
Portable Power Service News | Maintenance

Recommendations for fuel sampling and analysis

This bulletin is meant to guide you when taking diesel fuel samples from equipment tanks or external fuel tanks. Obtaining a correct sample is very important when you require analysis to be done for failure investigation purposes.

External Fuel Tanks:

FIG. 1



Tanks used to re-fuel your equipment can be a source of contaminants that could lead to fuel system damage.
Contaminants will spread throughout the entire tank due to fuel circulation created by the fuel return or when re-fueling the tank.
The increased addition of bio fuels can also affect bulk storage tanks and they will need to be checked and sampled on a regular basis particularly for any microbiological growth.
A general rule when a bulk tank has been refilled is not to draw off fuel immediately, leave to settle for 1 hour for every 30 centimeters height of the tank.
Every fueltank should be fitted with a 2 micron breather filter to keep airborne dust from contaminating your fuel.

Internal Fuel Tanks:

On-board fuel tanks will be contaminated by fuel delivery from external tank or tanker , dust ingestion through tank breathers or introduction of contaminants during re-fueling (open gas cap).
Contaminants will mix with clean fuel and spread throughout the entire fuel system, even the best filtration system will never separate 100% of contaminants so the best way to prevent engine damage is to prevent contaminants from entering the fuel tank.

Concern:

Three primary factors have a direct impact on your engine and fuel performance: physical characteristics, stability in storage, use, and contamination.
Excessive water, dirt, particulate debris, oxidation products, and microbiological growth can cause plugged filters and early fuel pump and injector failure. Water and debris are especially destructive due to the close tolerances in modern fuel pumps and injectors.
Erosion and corrosion of valve seats and lapped metal-to-metal surfaces cause poor combustion, smoke, and high or low combustion temperatures in the cylinder. A poorly adjusted or malfunctioning injector can wash the cylinder wall of its lubricating oil film causing premature wear and failure of pistons, rings, cylinder liners, or bearings.

Solution:

These external tanks should be properly cleaned either at regular intervals or when fuel sampling indicates the presence of contaminants.
If the tank is directly connected to your equipment (feed & return hose) it is extremely important to operate only from a known clean tank.
If the equipment is filled by hand from this external tank than we suggest installing a filtration package between tank and fuel nozzle. This package should consist of two fuel filters/ water separators in parallel; filtration to 30micron is a must.

Example (FIG.2) shows trolley mounted filter and pump package. A large water separation capacity combined with 30micron filters will ensure debris in any contaminated tanks will not end up in the equipment on-board fuel tank.

FIG. 2

Fuel Sampling:

Sampling does not automatically imply the need for a possibly expensive laboratory test, certain information about the state of the fuel provided can be determined by inspecting the samples you draw from two different tank locations. (FIG. 1)

FIG. 3: sample kit from Fleetguard

One sample should be taken at the lowest point of the tank, this can be done through the tank drain plug if so equipped or by dropping a fuel sample suction device into the tank.
The second sample should be taken at the 50% fuel fill mark to inspect fuel quality located above the layer of sediment which you may find in the bottom of the tank.

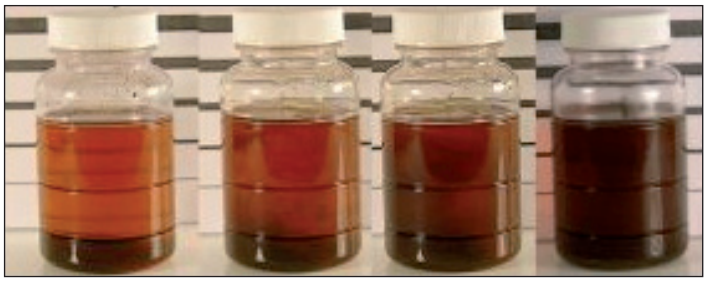
Sample Inspection:

The initial inspection can be done on-site once you have taken the samples, use clean receptacles of at least 500ml and let them settle until all contamination has separated from one another.

COLOR

Fuel does not come in one standard color as shown below, depends on the crude used and the refining process. Darker shades as the sample on the right shows is a sign of fuel degradation and will affect engine performance.

FIG. 4

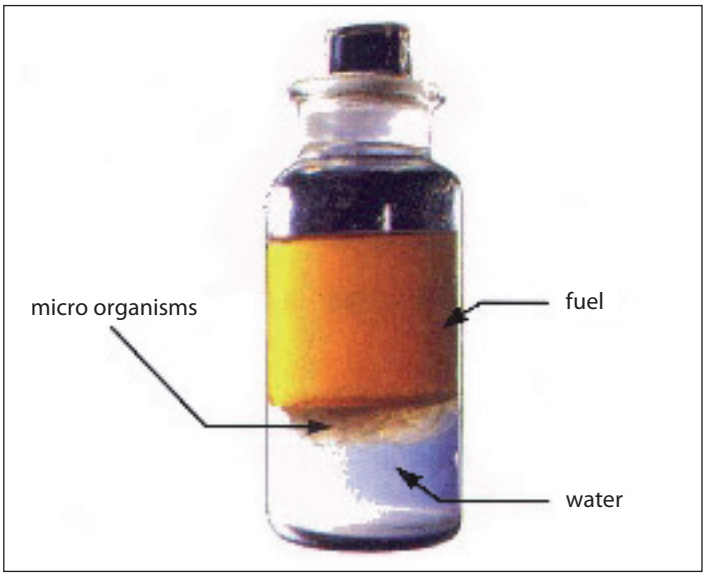


In some countries a dye will be added to colour fuel for tax reasons .

MICRO ORGANISMS

The increased addition percentate of bio fuel added to bulksupplies can affect bulk storage tanks and they will need to be checked and sampled on a regular basis for any evidence of microbiological growth.
Fig. 5 shows a sample with obvious contaminants that will lead to filter plugging and if not corrected fuel system damage.

FIG. 5



Microorganisms can quickly contaminate your entire supply system, evidence can be found in :

Slimy material - in filters, tanks, and other fuel system components
Black grit - in filters, and water separator bowls
Corrosion - to fuel system components due to acids produced

The diesel fuel itself, since it is degraded, also shows symptoms:
Color - fuel is darker, and can be more opaque
Odor - a rotten egg smell due to hydrogen sulfides

FIG. 6

FIG. 6 shows a Microbiological test kit from Fleetguard, test strips will alert the user to the presence of micro organisms in the diesel fuel sample.

WATER
Water can cause injector nozzle and pump corrosion, microorganism growth and fuel filter plugging with materials resulting from the corrosion or microbial growth.
Both equipment and storage tanks should be checked frequently for water and drained or pumped out as necessary.
In cold climates, ice formation in fuels containing water creates severe fuel line and filter plugging problems. Regularly removing the water is the most effective means of preventing this problem.

ASPHALTENES
These are components of asphalt that are generally insoluble and are usually present to some extent in all diesel fuel.
This black sludge is made up of long molecules. Fuel with a high percentage of asphaltenes will drastically shorten the life of a fuel filter.

FIG. 7

If uncertain about the physical qualities of your fuel we suggest sending a sample to a local laboratory.
Different labs will require different sample size or even suggest different tests to be carried out.

The following is a standard fuel sample test to determine overall fuel quality:

TEST	METHOD
ASH CONTENT	ASTM D482
CARBON RESIDUE, 10% RESIDUE	ASTM D524
CETANE INDEX (CALC.)	ASTM D4737
CLOUD POINT	ASTM D2500
COPPER CORROSION, STRIP	ASTM D130
DENSITY @ 15º C	ASTM D1298
DISTILLATION	ASTM D86
FLASH POINT (PMCC)	ASTM D93
SEDIMENT & WATER (BS&W)	ASTM D1796 / D2709
SULFUR CONTENT	ASTM D4294
VISCOSITY @ 40° C	ASTM D445

Note:
Additional tests can be run if required but for most failure analysis cases the standard test will provide sufficient detail in order to provide a satisfactory explanation to your customer.

The following is a standard fuel sample test for Biodiesel blends:

TEST	METHOD
ACID NUMBER	ASTM D664
ASH, SULFATED RESIDUE	ASTM D874
CARBON RESIDUE, RMS, % WT	ASTM D524
CETANE NUMBER	ASTM D613
CLOUD POINT	ASTM D2500
COPPER CORROSION, STRIP	ASTM D130
DISTILLATION, (REDUCED PRESS.)	ASTM D1160
FLASH POINT (PMCC)	ASTM D93
GLYCERIN, FREE & TOTAL	ASTM D6584
OXIDATION STABILITY (ACCEL.)	ASTM D2274
POUR POINT	ASTM D97
SEDIMENT & WATER (BS&W)	ASTM D1796 / D2709
SULFUR CONTENT	ASTM D4294
SPECTROCHEMICAL, ppm	ASTM D6728
VISCOSITY @ 40° C	ASTM D445

Fuel Degradation:

In time, stored fuel will darken due to oxidation, re-polymerization and agglomeration of certain components.
The darkening is accompanied by the formation of sediment that plugs filters and causes poor combustion.
“Did you know” that fuel degradation can be as high as 25% after only 1 month of storage!
“Did you know” that fuel vendors suggest not storing diesel fuel for more than 6 months!

Watch out for future releases:
- Fuel specifications and how to improve fuel quality.
- Fuel filtration and how to adapt your system for best performance when using low quality fuels.