Fuel Tank Cleaning
**Background**

**Diesel Fuel Problems**
Over the last several years we have seen the sulfur content in diesel go from 5,000 parts per million to 15 parts per million (ultra low sulfur) to comply with emissions standards.

Reducing the amount of sulfur in diesel fuel renders the fuel vulnerable to microbial growth. In addition to removing oxygen and nitrogen, the process for removing sulfur from fuel requires introducing water. When fuel becomes contaminated, the water in diesel fuel becomes a breeding ground for filter clogging bacteria and fungus.

Without proper maintenance, sitting water can become a veritable Petri dish in your fuel tank.

**Ethanol Fuel Problems**
Phase Separation is what happens to ethanol blended gasoline when water is present. When gasoline containing Ethanol comes in contact with water, either liquid or in the form of humidity; the Ethanol will absorb some or all of that water. When it reaches a saturation point the Ethanol and water will Phase Separate, actually coming out of solution and forming distinct layers on the fuel tank bottom.

The result could lower the octane to a point that the engine will not run; or if the alcohol/water mixture is ingested into the engine, sever damage can occur.
Fuel Polishing Benefits for the Fuel Retailer

- Slow fuel dispenser nozzle flow means clogged filters
- Clogged filters mean moisture in the storage tank
- Moisture in storage tank is causing microbe growth in diesel or phase separation in E-10

**Reduced Customer Complaints**
A proactive service program with A Fueltec Mobile System, all but eliminates slow flowing dispenser nozzles. Using Fueltec’s latest proprietary technology and equipment you can remove the filter clogging moisture and bacteria from fuel storage tanks thereby reducing the need to change dispenser filters by as much as 80%.

**Elimination of Down Time**
Fuel Storage tanks that are properly cleaned and maintained with Fueltec’s Mobile Systems suffer far less down time then tanks that are only serviced when pumps slow down and water is found on tank bottoms.

**Eliminate Expensive Emergency Service Calls**
Emergency service calls are sometimes done with vacuum service trucks to remove the tank bottom water. Using vacuum trucks without fuel/water separators; fuel retailers can lose as much as 300 to 400 gallons of product along with the water.

**Fueltec’s Systems Clean Tanks with no loss of Product**
Benefits for polishing diesel fuels:

In diesel fuel tanks colonies of filter clogging bacteria and fungus will grow at the fuel/water interface. The by product of these colonies is acidic sludge which corrode tanks and engine components.

Generator Engines may be exercised regularly and operate properly and to specification. However inside the fuel tank, out of sight, free and emulsified water is slowly accumulating from condensation, leaky tank openings, and even fuel deliveries with high water absorption. As the evening temperature falls the water begins to condense out of the fuel and build inside of the tank.

When the fuel/water interface grows high enough to reach the engines fuel supply tube which may be one or more inches above the tank bottom; the filter clogging microbes will be drawn into the fuel system and stop the engine.

A pro-active fuel tank cleaning program will prevent unexpected engine shut down.

Remove the tank bottom water and the micro-organisms will die.

Filters will not clog.

Tanks will not corrode from the acidic sludge.

Fuel Injection Systems will not be damaged by water and corrosion.

Emergency Generators will not become the Emergency.

A Pro-Active tank cleaning program will eliminate these problems.
TAKE FUEL SAMPLES:

1. Take one sample from the top ¼ of the tank to check for clarity.
2. Take one from the tank bottom to check for water, emulsification, and particulates.
3. Compare the two samples.
4. If no contamination is found (which is not likely) take another sample in 60 days.

5. A proactive testing program to monitor the tank bottom each 60 days is best.

6. A fuel storage tank owner might also consider a permanent fuel polishing system that works 24/7 to remove collected water and contaminates to prevent any unexpected engine shut down.
Microbes found in diesel fuel
Virtually all diesel fuel contains some moisture. Additional water accumulates in tanks as atmospheric moisture condenses. Moisture accumulates in diesel tanks as condensate droplets on exposed tank surfaces, as dissolved water in the fuel and as water bottoms beneath the fuel microbes depend on this water for growth. Additionally, microbes depend on the organic and inorganic molecules in diesel fuel for nutrition. Consequently, some species attack the fuel directly, growing at the expense of hydrocarbons and non-hydrocarbon fuel components. The biodegradation of fuel, in support of microbial growth, is a direct impact of contamination. Color, heat of combustion, pour point, cloud point, detergent and anti-corrosive properties change as microbes selectively attack fuel components. Sulfur-containing molecules are metabolized by a series of species, leading ultimately to the production of high concentrations of hydrogen sulfide. In addition to creating new cells, many microbes produce metabolites which promote further attack. Surfactants facilitate the emulsification of fuel, leading to the formation of a cloudy, invert-emulsion layer above the fuel/water interface. Polysaccharide slimes create microenvironments wherein mixed populations (consortia) of bacteria and fungi carry out biodegradation reactions that would be impossible for a single species outside the microenvironment. The slime also serves as a barrier, protecting the microbes from preservatives. A variety of organic acids (primarily 2 - 4 carbon atoms) are also produced as by-products of bacterial and fungal growth.
FUEL SAMPLER 4 oz.

For use with Gasoline, Ethanol Blends, Diesel, Bio-Diesel to take before and after cleaning samples for analysis.
• One (1") inch diameter for access to generator and marine tanks
• The trip valve allows you to take samples from all fuel levels
• Easily disassembles for cleaning.

Fuel samples taken before and after tank cleaning with a Fueltec Mobile tank cleaning system
Fueltec Systems exceed the engine manufacturers recommended ISO 18/16/13 cleanliness target.

ISO Fuel Requirements
The standard established by ISO (International Organization for Standardization) provides a common measurement system that engine and fuel system manufacturers use to designate acceptable particle levels in the fuel system. Determining fuel cleanliness requirements includes the measurement of both particle size and count. ISO 4406 utilizes a series of three numbers (18/16/13) to identify the particle count per milliliter at 4, 6 and 14 micron sizes. Engine manufacturers recommend ISO 18/16/13 or better as the cleanliness target in fuel tanks.

<table>
<thead>
<tr>
<th>Fuel Status</th>
<th>ISO Code 4406</th>
<th>Partial Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unacceptable Fuel Supply</td>
<td>22</td>
<td>Up to 40,000 particles &gt; 4 micron</td>
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<tr>
<td></td>
<td>20</td>
<td>Up to 10,000 particles &gt; 6 micron</td>
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<tr>
<td></td>
<td>16</td>
<td>Up to 2,500 particles &gt; 14 micron</td>
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<tr>
<td>Recommended by engine</td>
<td>18</td>
<td>Up to 2,500 particles &gt; 4 micron</td>
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<tr>
<td>manufacturers</td>
<td>16</td>
<td>Up to 640 particles &gt; 5 micron</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Up to 80 particles &gt; 14 microns</td>
</tr>
<tr>
<td>Fueltec Standards filtration</td>
<td>17</td>
<td>Up to 2,500 particles &gt; 4 microns</td>
</tr>
<tr>
<td>for fuel storage tanks</td>
<td>15</td>
<td>Up to 320 particles &gt; 8 microns</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Up to 40 particles &gt; 14 microns</td>
</tr>
</tbody>
</table>

A micron is a metric measure equal to one millionth of a meter, or 1/25,000th of an inch. The smallest particle visible to the naked eye is 40 microns across. A human hair is 80 microns in diameter, and a single grain of talcum powder is 15 microns.
A large number of aftermarket additive products are available to meet real or perceived needs. Some are aggressively marketed with testimonials and bold performance claims that seem “too good to be true.”

Some so called “catalysts” actually contain xylene a solvent used in paint thinner and wood preservatives.

There is no easy way using a magic formula that will dissolve sludge and clean a fuel tank containing fuel that will not effect the operation of your engine.

**Always read the ”Material Safety Data Sheets (MSDSs)” before using any additive or catalyst.**

As with any purchase, it is wise to remember the advice, caveat emptor, “let the buyer beware.”

It may be helpful to regard additives as medicine for fuel. Like medicine, they should be prescribed by an expert who has made an effort to get test results from a fuel sample sent to an independent laboratory to diagnose the problem, as well as the underlying causes.

Additives should always be used in accordance with the recommendations of the engine manufacturer.

Sometimes, indiscriminant use of additives can do more harm than good because of unexpected interactions.
Remediation of Phase Separated E-10 Fuel

FUELTEC Models 950AW & 955SS are used to remove Phase Separation

1% contamination in 6,000 gallons of E-10 product equals 60 gallons to be removed. 60 gallons in a 10,000 gallon horizontal round tank is approximately 2-1/4 inches When removing the contaminated phase pump slowly, do not agitate or mix with the upper phase. This upper phase can be salvaged by adding a 1:1 solution of fresh batch E-10.

E10 can remain stable at up to its saturation point with water; after the saturation point is reached the water and ethanol will begin to separate from solution. Stability decreases with cold weather and lower aromatic fuels. The Phase separation solution is more dense than gasoline, is polar, and will separate and sink to the bottom of the tank.

Photo shows a 10% Phase Separation sample
The tank cleaning process for fuel storage tanks:

- Check tank bottom for water with a sampler or paste on a pole.
- Fill 950 or 955 with clean fuel from top portion of the tank and observe the fuel color.
- Insert a suction tube to the tank bottom through a port in the tank near the submersible pump location; insert the return to tank tube in the fuel drop pipe.
- Start system and observe sight tube for a liquid color change. Water will be on the bottom, fuel on top. When water reaches top of sight tube, open drain valve to empty water while unit is in operation.
- Observe vacuum gauge from start of process; when gauge reading rises 15 Hg, change primary filter bag.
Choosing a Fuel Tank Cleaning System That’s Safe For All Fuels

FUELTEC’s Air Operated Mobile Tank Cleaning Systems are Intrinsically Safe for All Fuels including Gasoline, Diesel, Ethanol Blends, Avgas and Jet Fuel:

When ever you are cleaning a fuel storage tank or filtering and removing water (polishing) the fuel; it is the bottom 5%-10% of the tank’s contents that you are most concerned with because fuel contaminates are heavier than fuel.

Example:
If you find one inch of water & contaminates in a 10,000 gallon tank bottom; that equals only 17 gallons, two inches only 48 gallons, and three inches only 88 gallons.

If the tank is undisturbed 88 gallons can be removed in less than ten minutes with a Fueltec Model 950AW.

However if the tank is disturbed by normal activity; the fuel polishing process could take three hours or longer for a 10,000 gallon tank.

Fueltec Model 950AW System was designed for cleaning fuel in above and underground fuel tanks. This versatile system is also being used for truck, heavy equipment, and boat tanks as well as high capacity fuel storage tanks up to 10,000 gallons. This system uses low cost pre-filters to remove particulates prior to water separation. An air compressor with a capacity of 12-25 CFM at 40 psi is required for operation.

Fueltec Model 955SS is our largest and most powerful portable system. Hundreds of these systems are in use by fuel tank cleaning professionals at C-Stores (gas stations), generator sites, and government agencies. An air compressor with a capacity of 25+ CFM is required for operation.
Fueltec’s Electric Fuel Tank Cleaning Systems are designed for Diesel Tanks. They offer the same high quality filtration and water separation as the air operated systems.

Model 908 features an 8 GPM ½ HP Electric fuel pump, just the right size to service generator fuel tanks with small 2” access ports using Fueltec’s supply & return manifold. The filtration and water separation utilizes a 24” primary sludge filter and micro-glass fuel water separator.

Model 919 features a 19 GPM 1.5 HP Electric fuel pump with power to clean the larger tanks. The filtration and water separation also utilizes a 24” primary sludge filter and larger micro-glass fuel water separator.
Filters and other Consumables

PRIMARY FILTERS
The primary filters are the first to see the fuel’s contaminants. They are 4” x 24” flange ring polyester:
- One micron for gasoline, E-10, and Jet Fuel Part# 241004
- Five micron for diesel and bio-diesel Part# 241007
- Ten micron for diesel Part # 241001

COALESCERS
The micro-glass coalescers remove the tiny water droplets from the fuel
- Models 955SS & 919E use Part# 241024 which is 20” long
- Models 950AW & 908E use Part# 241023 which is 10” long

WATER SEPARATOR
The stainless steel/ Teflon water separator prevents the separated water from moving with the dry fuel.
- Models 955SS & 919E use Part# 241035 which is 22” long
- Models 950AW & 908E use Part# 241033 which is 11” long

DIAPHRAGM for AIR OPERATED PUMP
Models 955SS & 950AW are equipped with Viton diaphragms

TOP COVER O-RING
The top cover o-ring seal is made from Buna Part# 181019
The M-2 Manifold will allow you insert a fuel pickup tube through the manifold to the storage tank bottom to remove contamination then return the clean dry fuel to the top of the tank without disturbing or mixing with the tank bottom contaminates.

The M-2 will fit through a 2 in. tank opening.

The M-2 is commonly used on generator and equipment fuel tanks with small openings.
Fueltec’s Mobile Tank Cleaning & Fuel Polishing Systems

Features

1. Air operated systems intrinsically safe for all fuels in above ground and underground storage tanks.
2. Self priming air diaphragm fuel pumps with Viton seals and diaphragms.
3. Lifetime stainless steel filter housings with swing bolt latches.
4. Low cost, high capacity, Primary Sludge Filters down to one micron are first to see and remove contamination before the fuel reaches the pump and water separator.
5. The water separator is comprised of components commonly found on military and commercial airline fuel supply filtrations systems: a micro-glass coalescer that separates the water from the clean fuel and a teflon coated stainless steel hydrophobic cartridge that prevents the separated water from flowing with the fuel.
6. This pressurized separator incorporate a two gallon stainless steel water trap with clear sight tube and separated water drain.
7. Fueltec’s mobile electric models are used for diesel fuel and have all of the same filtration and water separation features as the air operated systems.

Benefits

1. Intrinsically safe for all fuels, gasoline, diesel, ethanol blends, and kerosene.
2. Capable of lifting fuel and heavy sludge as high as 22’ from underground tanks without cavitation.
3. Prevents corrosion and are easily serviced in minutes for filter changes in the field.
4. This prevents clogging the water separator with heavy sludge. The fuel pump is also protected from shards of rusty metal from tank bottoms containing water.
5. This highly efficient water separator system can remove water from all fuels to less than 50 PPM. The micro-glass coalescer causes the microscopic water droplets to grow larger so they cannot pass through the separator cartridge. This system does not require high priced water block filters normally found on less efficient water separator systems.
6. Separated water can be seen in real time in the clear sight tube as the system is working. Gallons of water can be drained from the trap as it accumulates without stopping the fuel polishing operation.
7. Electric models are primarily used on marine, generator, and heavy equipment diesel fuel storage tanks.
Tank Cleaning Service Equipment

**Fueltec Model FT 950AW Mobile Tank Cleaning System**
Air Compressor 13.1CFM 6.5hp Gas at 90PSI  
Primary Filters 24” x 1, 5, & 10 micron  
Coalescer cartridge 10” & Water Separator 11”

**Fueltec Model FT 955SS Mobile Tank Cleaning System**
Air Compressor 25CFM 13hp Gas at 175PSI  
Primary Filters 24” x 1, 5, & 10 micron  
Coalescer cartridge 20” & Water Separator 21”

**Fueltec Model FT 908E Mobile Tank Cleaning System**
115 Volt 1/2HP Electric  
Primary Filters 24” x 1, 5, & 10 micron  
Coalescer cartridge 10” & Water Separator 11”

**Fueltec Model FT 919E Mobile Tank Cleaning System**
115 Volt 1-1/2HP Electric  
Primary Filters 24” x 1, 5, & 10 micron  
Coalescer cartridge 20” & Water Separator 21”

Supply/Return Manifold 2”

Fuel Supply Pickup Tubes 1” diam. x 36”, 60”, 96” & 180” 1ea., ¾” diam. for generator base tanks

Waste Drums (for separated water) 55 gal. , Waste Container for soiled filters

Fuel Sampling Kit

Spill Kit w/ pads, Safety Cones, Hard Hats, Safety Glasses, Eye Wash, Ladder, Tools and Gloves

Signs & Graphics

Service Truck or Trailer
Fuel Tank Cleaning Facts:

1. Most fuel contaminants are heavier than fuel and will settle to the fuel tank bottom if undisturbed. To remove this contamination it is best to remove free and emulsified water and filter the contents in the lower 5%-15% of the tank. This process will keep from mixing the clean fuel with the contaminated fuel.

2. Tank cleaning is a relative term. A clean tank should be able to store fuel in a condition that exceeds the engine manufacturers recommended ISO 18/16/13 cleanliness target.

3. Fuel should be delivered to an engine with less than 100 parts per million of free or emulsified water.

4. Most fuel storage tanks do not have a protective coating on the inside; only raw metal with tiny pores that become home to fungi and acidic bacteria when any moisture is present. This contamination will become a problem if you use a biocide in your fuel. When the microbes die from the biocides they fall from the tank walls in a talcum powder like substance that can clog filters for many weeks until all microbes have been killed.

5. The most damaging fungi and bacteria problem is found floating at the fuel/water interface at the storage tank bottom. This contamination can easily be ingested into your engine’s fuel pickup tube, clog your filters and stop your engine.

6. Removing tank bottom water and the interface microbes will eliminate 98% of filter clogging problems.

Always draw fluid from the storage tank bottom when cleaning & de-watering
What does fuel tank cleaning cost?

The US Government GSA has negotiated (2012) fees that it pays contractors for diesel fuel tank cleaning:
25,000 gallon tank $4,051.
14,000 gallon tank $2,850.
8,000 gallon tank $1,955.
5,000 gallon tank $1,460.
2,000 gallon tank $895.

Typically fuel storage tanks are cleaned and the fuel polished from $0.16 to $0.70 per gallon plus an extra charge for filters and contaminated water disposal.

Fueltec’s heavy duty mobile tank cleaning systems will pay for themselves in short order!

1. Unlike some systems, Fueltec utilizes a low cost bag type pre-filter to remove heavy sludge, rust, and particulate matter to one micron before it can clog the filter/water separator system or damage the fuel pump.
2. The fuel pump only sees fuel after it has been filtered.
3. The system does not require messy back-flushing.
4. A (jet fuel type) micro-glass filter/water separator removes water from fuel down to less than 100 parts per million satisfying the engine manufacturers recommendations.
5. This system does not require pricey water blocking filters.
6. Fueltec’s air operated models are safe for all fuels including gasoline, E-10, Avgas, and jet fuel.
Generator Sub-Base Fuel Tanks  Often have limited access with tank openings 4” NPT or less many times only 2” NPT located on one end or in the tanks middle section.

When removing contamination from sub-base fuel tanks the fluid should not be pumped at a high velocity that would mix the clean upper phase fuel with contaminated fluid at the lower phase within a compartment.

If withdrawn at a low velocity; the contaminated fluid at the tank bottom, being heavier than the fuel, will flow through the baffle openings to the suction tube then on to the fuel polisher for removal.

A specially constructed supply/return manifold by “Fueltec” will allow both supply and return fuel to move through the small tank openings with a minimum of mixing.

The clean dry fuel is re-deposited on top of the upper phase clean fuel while the contamination is being removed from the tank bottom.

Fueltec’ mobile systems will force the contaminated water to a waste drum without stopping the cleaning operation.
Removing the STP sump cover and spill bucket cover for access to the tank

Tank access port

Spill Bucket

Tank access port

Accessing the underground tank