

Soltron™ - Product Specs

Physical Specifications



Gravity, API at 60°F (D-287)	43.0
Specific Gravity at 60°F	0.78
Sulfur, PPM	0
Liquid Density, 6.700lbs/gal@60.00°F	804kg/1@16.00C
Corrosion	0
Bulk Density	900lbs/ft3
Composition Vol.%Aromatics	2-3
Pour Point, (variable range)	-12°F/-24°F
Distillation, °F (D-86) IBP	394 (201.1°C)
Color (D-156) Clear & Colorless	30
50%	411 (210.6°C)
Kauri-Butanol Value (D-1133)	29.2
Dry Point	490 (254.4°C)
Aniline Point, °F (D611)	166 (74.4°C)
Kg. per Liter, 60°F (15.4°C)	0.80
Acidity of Distillation Residue (D-1093)	Neutral
Pounds per Gal., 60°F (15.6°C)	6.65
NFPA, (blend) Health -0 Reactivity -0	Flammability 1-2
Enzyme Concentrate, Proprietary	N/A
Flash, °F (D-56)	165 (73.9°C)
Mix Ratio – Normal Conditions	1 quart to 1,000 gallons
Mix Ratio – Remediation of Fuel	1 quart to 500 gallons



What is Soltron™?

Soltron™ is a new EPA-approved active enzymatic fuel treatment. Soltron™ improves the combustibility and stability of all gasoline and diesel fuels. Soltron™ is a unique product, pays for itself with real cash savings, and provides several other key benefits.

Soltron's™ soaring popularity in the shipping, recreational boating and trucking industry has not happened by chance. Soltron™ fixes most fuel problems, and pays for itself with better fuel economy (8-11%). Soltron™ fuel treatments save you time and real money.

Add Soltron™ to fuel and it improves economy, reduces emissions, increases power, dissolves fuel sludge, cleans injectors, reduces knocking, eliminates bacteria and algae, and removes water.

Why is Soltron™ Enzyme Fuel Additive Added to Contaminated Fuel?

One of the unexpected but very endearing characteristics of Soltron™ is that it works wonders on contaminated fuel. Soltron™ rapidly dissolves fuel tank sludge. This claim may at first seem incredulous. On closer examination, the reason Soltron™ so effectively cleans out biomass accumulation (bugs) from fuel tanks actually becomes very simple.

Unlike any other fuel treatment, Soltron™ is an organic enzyme. Soltron™ contains enzymes harvested from genetically modified bacteria and distributed in a concentrate form.

How does it Work?

The enzyme package in Soltron™ is used to break down the long-chain aromatics in fuel into more combustible short-chain hydrocarbons. A sufficient dose of the Soltron™ enzyme package in a fuel system interacts with any and all available hydrocarbon targets. There are microorganisms that live in your fuel tank and eat your fuel. Most people recognize them as fuel tank slime and algae. The creatures are formally known in the fuel industry as Hydrocarbon Utilizing Microorganisms. The short name for these creatures is H.U.M. bugs. The name is cute but once they start a colony in your fuel tank there is nothing amusing about them.

H.U.M. bugs excrete enzymes to break down the hydrocarbons in fuel and allow themselves to digest (eat) your fuel. Soltron's™ enzyme package has many of the same enzymes excreted by H.U.M. bugs. The H.U.M. bugs use the hydrocarbons they eat to both build their bodies and metabolize for energy. Fuel tank sludge, in the form of fuel bug bodies and fuel bug waste (excretions), accumulates as this process progresses. Thus one of the largest components of fuel tank sludge is the waste products and bodies of H.U.M. bugs.

You are what you eat and this causes a very useful side effect of the Soltron™ fuel treatment. Both bugs and their bodies have chemistry very similar to large chain hydrocarbons. The same enzymes in the Soltron™ fuel treatment we use to break up long chain hydrocarbons also dissolve H.U.M. bugs and their coagulated waste products.





Soltron™ cannot tell the difference between a free floating hydrocarbon and a hydrocarbon used to build a cell wall on a H.U.M. bug -so Soltron™ dissolves both.

Soltron™ directly reduces the amount of sludge in the tank. By dissolving the organic slime component (from the H.U.M. bugs) that glues the sludge mass together Soltron™ helps break up the sludge mass. This allows your filters to catch the free floating sludge with the filter element and pull it out of your fuel system. The end result is that your fuel tank finally gets cleaned out.

What about the water in my fuel?

Some water is consumed when Soltron's™ enzymatic activity takes place. As the enzymes react there is a de-watering effect on the fuel. Soltron™, when used consistently, has been shown to resolve water contamination problems. Fuel systems with massive amounts of water will still need to have the tanks polished with either a mobile or on-board fuel polishing system.

Soltron™ goes to work quickly and immediately. When added to a fuel tank and circulated, the results from Soltron™ are usually visible to the naked eye in 18-24 hours.

Once your tanks are clean do you need to continue to use Soltron™?

This is largely a matter of choice. When questioned, most long term operators who use Soltron™ first mention the increase in power and fuel economy. The third most common reason cited is as a means of preventing fuel problems from re-occurring. Long-term Soltron™ users report back that they have very clean fuel tanks, very long lasting fuel filters and very little water forming in their separators.

Can I use it with my fuel polishing system?

Yes! Absolutely! A fuel polishing system is an excellent complement to Soltron™ treatments. Soltron™ goes to work most quickly when thoroughly mixed with your fuel. In frequently used trucks and boats this is not a problem. In stationary engines and infrequently used vessels the fuel circulation usually needs a little help.

When you are installing a fuel polishing system Soltron™ can be a great help. A single Soltron™ shock treatment (double dose) will greatly reduce the number of element changes you will need to perform. Simply put Soltron™ lets you get the "tank-cleanup" phase of fuel polishing over and done with very quickly.

Is Soltron™ a Fuel Polishing System Replacement?

No. Soltron™ is a simple enzyme that very simply produces consistent effects and improvements. Many of them are very polishing system-like. For operators with minor or intermittent fuel problems it may represent a final solution. Soltron™ is not capable of and should not be expected to remove gallons of water from a fuel system or magically dissolve the rust and non-organic matter found in the tank sludge mass. Complete particle and mass-water removal is only accomplished by circulating fuel through a good filter.



How does Soltron™ produce better fuel economy, reduce emissions, reduce soot, and lower exhaust temperatures?

The key to understanding how Soltron™ gets results is to examine Soltron's™ effect on fuel combustion. We will start by examining the Piston Down stroke

The Piston Down Stroke

There is only a short window of time in an internal combustion engine for fuel to burn and then harness the released energy. This window of time is during the piston down stroke

a.k.a. the power stroke. If the fuel burn is too slow, the still burning fuel charge and any unburned fuel components are vented out the exhaust system during the piston up stroke.

Several problems can occur from an incomplete burn.

First is the obvious waste of fuel. Every gallon of fuel has a finite amount of stored chemical energy. Combustion, the rapid oxidation of carbon in the presence of oxygen, releases this energy. The expanding ball of hot gas is pushed down on the piston to create mechanical energy. The extent the engine converts the available chemical energy into mechanical energy is called the rate of efficiency.

Engineers have labored for years to maximize this efficiency. After engineering and design, fuel quality will most likely determine an engine's efficiency. When engineers determine the efficiency of an engine the industry gospel is the Carnot Cycle.

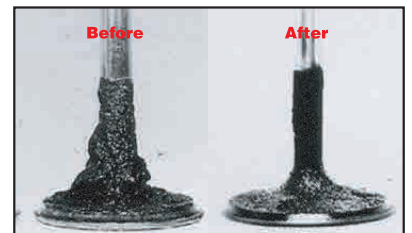
The Carnot Cycle

The Carnot Cycle is a mathematical equation. The Carnot Cycle determines an engine's efficiency by taking the Combustion Temperature minus Exhaust Temperature divided by Combustion Temperature. All other factors held constant, the lower the exhaust temperature then the more efficient the conversion of the fuel charge's energy to (piston) motion.

Ignition

Every engine has a given point of ignition, the exact spot where the fresh fuel charge first lights off. In a Spark Ignition (gasoline) engine, the spark plug ignites the fuel directly in contact with the spark. In a Compression Ignition engine (diesel) the rising piston compresses and rapidly heats the fuel charge to the required ignition temperature. The focal point of this pressure determines the exact ignition spot. After the first droplet ignites, each successive droplet is ignited by the previous one. The subsequent flame ball spreads out towards the piston and the cylinder walls.

Fuel injection patterns and flame spread make up some of the most studied (and most complicated) science in all of diesel engineering. The ability to control how, when, where, and why the fuel ignites is crucial to the Carnot Cycle.





What about the water in my fuel?

As the ball of flame expands, the ability to burn 100% of the fuel before the piston reaches bottom is crucial. If any remaining fuel is still burning at the end of stroke, then the burning gases are forced out through the exhaust system. First in line for this tough abuse are the exhaust valves. The extreme heat from these gases can burn the valves and valve seats. This causes premature failure.

When there is still burning fuel in the exhaust gases the exhaust system is under additional stress. The high heat and excessive backpressure of the still expanding gases chokes off the exit flow of cylinder gases. This resists the upward motion of the piston, places an increased load on the crankshaft and lowers the efficiency of the engine.

Another factor is flame quench. As the hot flame reaches the cylinder walls, the flame is extinguished, or as the engineers say, quenched. If too much fuel hits the cylinder walls, the unburned fuel is rapidly cooled, and the partially burned fuel goes out the exhaust as soot. Part of this soot builds up on the piston crown and in the rings. This leads to increased friction and liner scoring. The more rapidly a fuel charge combusts the less of fuel charge affected by quench.

What are the other effects of poorly burning fuel?

Further damage occurs when not all of the fuel is burned. Low quality fuels or fuels that have aged have components that tend not to ignite at all. The hot gases and raw fuel left in the combustion chamber are now subjected to extreme heat, as the piston compresses the old fuel, being hot; it pre-detonates just before the fresh fuel charge is ignited. The two pressure waves are now approaching in different directions, and the combined high-pressure waves spike above engineering design, and the concussive jolt to the engine is heard and felt as knocking.

That death rattle you hear in your overloaded car when you are going up hill on a hot day with cheap fuel is also called pinging. When it happens in a diesel, the knock is so severe the entire vehicle shakes. Knocking sounds like tiny little men inside your engine with big hammers pounding your pistons, rings, and valves into scrap metal.

Knocking is the start of a dangerous cycle. When leftover (unburned) fuel vapors get superheated the engine starts to knock (predetonate). The vibration and increased friction cause additional heat and these cause even more predetonation. The increased predetonation causes more heat until the engine reaches a critical point known as thermal runaway. At the thermal runaway stage the metal eventually changes into a liquid and then you call the local tow operator.

Remember Carnot?

Exhaust temperature is a relative indicator of efficiency. The more energy converted into motion (when the engine's designers wanted it, during the pistons down stroke) and the less fuel still burning at the end of the piston down stroke, the lower the resulting exhaust temperature. Higher temperatures indicate less efficient conversion of the fuel's energy into motion.



How does Soltron™ improve engine efficiency?

The enzyme catalysts in Soltron™ break down some of the largest hydrocarbons in fuel. These molecules, most notably, the polycyclic aromatics, have been identified by scientists as some of the most carcinogenic compounds known to man. Soltron™ breaks down some of the hydrocarbon branches, allowing them to react with more oxygen, and rapidly accelerating their burn rate. Soltron™ makes the fuel more ready to burn in much the same way splitting logs into smaller sticks makes firewood easier to burn.

How does Soltron™ lower exhaust temperature and improve fuel economy or mileage?

If all of the fuel burns during the power stroke, the engine uses all of the available energy (BTU's) to drive the engine. With no leftover vapors to be compressed and predetonate, the engine runs cooler; specifically, the exhaust valves and exhaust system stay considerably cooler. With less or no still burning fuel at the end of the power stroke there is less still burning fuel entering the exhaust system during the exhaust stroke and thus exhaust temperatures are lowered.

As Soltron™ does not affect the temperature of combustion, just the rate of burn, the combustion temperature remains high, but the exhaust temperature is lowered. Accordingly, the Carnot Cycle, or engine efficiency is improved. The engine has produced the maximum amount of mechanical energy from each gallon of fuel, the exhaust components have been put under less stress and their useful life expectancy has increased.

In untreated fuel, unburned fuel from flame quenching literally runs down the sidewalls of the cylinder and flows into the engine oil. This thinning of the oil can cause a severe drop in lubrication effectiveness long before the oil has reached its predicted life expectancy. Diesel fuel and gasoline are not recommended components of engine oil.

Operators using Soltron™ can dramatically reduce the unburned fuel contamination rate of their engine oil.

Are there other reasons to use Soltron™?

There are a number of reasons to use Soltron™. The most popular reason for many operators without fuel polishing systems is that Soltron™ can get some very fuel polishing system-like results. If you have a fuel system problem but cannot install a polishing system Soltron™ will unquestionably help your situation.

Soltron™ reduces smoke, reduces carbon deposits and improves economy. Your results will vary but you will see changes. Most operators consistently report increased engine performance and liveliness after a few hours. We have pictures of valves from a seafood company that show minimal carbon valve deposits where millimeter+ thick deposits were the norm. Engine life is increased from less wear on soft metal surfaces.

Soltron™ is often used in mining equipment fuels where it reduces CO (carbon monoxide) emissions almost to zero. For the boating community this has certain safety implications. The US Park Service has requested Soltron's™ addition to one park's fuel stations after many houseboat CO-related deaths.



For many operators the improved economy alone offsets the cost of the Soltron™. This tends to make Soltron's™ other benefits an icing-on-the-cake kind of proposition.

Can Soltron™ Make My Broken Old Engine Run "Just like New" Again?

No. It can help some but it cannot repair a worn out engine. Soltron™ will not eliminate the blue smoke from worn out rings. The special over-hyped additives and the miracle tricks they supposedly perform (engines running without oil, under water, etc.) are available through late night TV infomercials. We do not make outrageous claims about Soltron™ but Soltron™ will do everything our marketing literature claims.

Soltron™ is a state of the art tool for improving the combustibility of hydrocarbon-based fuels. It has a nice side effect (sludge destruction) that we find to be very useful. The limit of our claims is that you will like the results you will get from using it. Sorry no miracles. Worn-out engines need replacement or overhauled.

Can Soltron™ Be Used In Gasoline Engines?

Yes. Due to the high concentration of aromatics in gasoline, the operational improvements from Soltron™ should be slightly more evident in gasoline-based engines than in diesel engines. We should however note that many of the problems we normally prescribe Soltron™ to cure (sludge, clogging elements, slime and water) are not common problems in gasoline.

Will Overdosing on Soltron™ Damage My Engine?

No. It just wastes the excess Soltron™. Soltron™ is simply a natural organic enzyme. It will not dissolve your seals or injector system parts. A Soltron™ overdosed system will not be impaired in its ability to destroy yeasts and microorganisms in your fuel.

We should note that under-dosing will diminish the results of the Soltron™ enzyme package.

How do I use Soltron™ to clean up a fuel tank with high levels of contamination?

The first thing you need to understand about cleaning up a fuel tank is the size of the sludge mass that accumulates in the bottom of the fuel tank. The sludge mass in the bottom of the fuel tank will be proportionate to the size of the tank, not the amount of fuel currently in the tank.

When cleaning up an older fuel system it is normal to "shock" the system by double dosing with Soltron™ for a single tank. Horribly fouled fuel systems (you know who you are!) have sometimes required two shock doses during the cleansing cycle.

A shock dose of Soltron™ is a double-dose based on the fuel tank size. When adding a shock dose, always add doses of Soltron™ based on tank size and NOT on the number of gallons currently in the tank. In case of very heavy fouling this may need to be repeated for two or three fuel loads. Under dosing Soltron™, as with any additive, will diminish speed at which you will get finished cleaning up the fuel tank.



What are the emissions benefits obtained from Soltron™?

Soltron™ has been used in the mining industry because it usually cuts CO (carbon-monoxide) emissions to almost immeasurable levels. In enclosed spaces, or where emissions inhalation is a concern, Soltron™ can reduce the risk of carbon-monoxide poisoning. Soltron™ has been suggested by several government agencies as a means of reducing carbon monoxide hazards for boaters.

Another benefit of Soltron™ is the reduction of unburned aromatics. (Aromatics are one of the precursors of soot.) For example, partially burned aromatics are the black lines on your grilled swordfish, the black tar from that cigarette, and the black sticky scum on your transom. California, as well as several other states, has declared diesel soot to be a Toxic Air Contaminant. We think reducing soot is a good idea. Soot does not just accumulate on your transom or rig; it also sticks to the inside of your lungs.

What makes Soltron™ Different than Other Products?

Soltron™ is the only fuel product on the market that is an enzyme based system. Soltron™ works in a fundamentally different manner and without the use of any harsh chemicals. Soltron™ treats the cause of most fuel quality problems instead of merely treating the symptoms. Soltron™ actually improves the characteristics of fuel that determine the fuel's combustion efficiency.

Can Soltron™ be used instead of a toxic fuel BIOCIDE?

Soltron™ is commonly and effectively used in place of toxin based fuel treatments. While Soltron™ is not safe for human consumption (do not drink it), Soltron™ is no more hazardous to your health than your fuel is. Soltron™ contains natural organic enzymes harvested from genetically modified bacteria. The enzymes are suspended in a low-odor base solvent to make them easy to measure and dispense. The base solvent is combustible but is usually not classified as flammable.

The air cargo carriers we use classify Soltron™ as a non-hazardous cargo. As with any other liquid they do however require good fluid-tight packaging. Fluid-tight packaging is required so in the event that one of our sturdy boxes is crushed a mess isn't made.

Soltron™ does not contain the seal damaging alcohols found in many chemical-based additives. Unlike most other additives it does not contribute to the sludge mass on the bottom of your tanks or damage your seals, even if over-dosed.

How will Soltron™ affect my fuel filters? Is filter element life shortened with Soltron™?

No. The fact that Soltron™ makes the particulate mass in the tank free floating often gives many operators the mistaken impression that filter element life would be shortened (more particles in the fuel = shorter element life). The result with Soltron™ is quite the opposite.

Yes, you will find more and larger chunks of debris in your filter at first, however the elements will not clog as often after the fuel system is clean.



The elements will not clog as often because the chunks of debris you find on the filter element are slime-free resulting in a porous layer. The organic slime that normally glues the particles together and forms the element choking seal is not present. Surprisingly thick layers of chunky debris can accumulate on the filter element before it starts to clog.

Why Does Fuel Go Bad?

In a word, WATER! Water gains entry to your fuel tanks through the breathers and then condenses. Water also enters at the fuel dock when you are buying fuel as a part of the fuel coming out of the pump. Water leads to three primary problems: microbial contamination, fuel tank corrosion, and engine failure.

First let's discuss microbial contamination. When water is present in diesel fuel it provides a habitat that allows microbes and algae to grow. Specifically microbes and algae grow at the points where the fuel and water come into contact. The more water present in the tank, the greater the amount of surface area contact between the fuel and water. This surface area is the place where the algae and microbes grow. In short the more water, the more habitat for these organisms to grow.

If there is no water in your fuel system there is no place for these microorganisms to grow. In the absence of water, fuel will last forever. Case in point; the fuel in your tanks sat underground for millions of years before it was brought to the surface in usable condition. Why did the fuel last for millions of years? NO WATER!

To get the fuel in your tanks to remain usable you have to get the water out and keep it out. Soltron™ has been proven to remove substantial amounts of water from fuel. It is commonly employed as emergency first aid at gas stations that have received a bad load of fuel. (For really extreme cases i.e. "we just added fifty gallons of fresh water to the fuel tank by mistake" you will need to use a fuel polishing system.)

Water in the fuel is also a major factor in fuel tank corrosion. Remove the water from your fuel and it is almost impossible for the tanks to rust out from the inside, a problem rampant with many makes of trawlers. How long can you expect a black iron fuel tank filled with water-contaminated fuel to last? 10 years? Maybe 15? These should sound like hauntingly familiar numbers to many boat captains who are replacing their leaking rusted-out tanks.

Diesel fuel, provided it has no water in it, provides excellent protection to iron from corrosion. Why do you think that the military wraps weapons in oilcloth before crating them for long-term storage? Oil protects iron and steel from oxygen and water in the air. Keep your tanks filled with water-free fuel and the tanks get the same excellent protection oilcloth provides to weapons. If your tanks are filled with water-free fuel they will probably never rust out from the inside.

A final note about water. We all know that water does not burn. If you do not do something to remove water then when your tanks get low enough or the sea gets rough enough you will finally suck the water from your tanks into your motor. When this happens your engine

will stall and will not restart until you purge your fuel system of the water. This is never a good way to spend the afternoon, either alone or with guests.

A fuel system treated with Soltron™ will be largely water free, will not grow H.U.M. bugs and is very unlikely to go "bad".



Tell Me about Microbial Contamination

While a bowl of petroleum fuel would kill a human, not all creatures we share the world with have the same physiology. There are microbes, which we will refer to as bugs, which can and do feed off of the hydrocarbons in your fuel. Like all microorganisms they can multiply with astonishing speed. These bugs can double their population every half-hour or even faster.

Fuel bugs are real. The most common types found in petroleum products are *Cladosporium Resinae* and *Pseudomonas Aeruginosa*. This class of fuel eating microbes is known in the industry as Hydrocarbon Utilizing Microorganisms or H.U.M. bugs. There is nothing amusing about them.



Once H.U.M. bugs enter a fuel system and find a place to live, they multiply with astonishing speed. As the bugs grow in number their bodies begin to take up space. They also produce waste products that float around in the fuel around them. The waste products are of course carbon molecules that can be abrasive. H.U.M. bugs are easy to spot as they quickly form what is called sludge, algae, or dark pasty crud. They can eat almost anything petroleum or hydrocarbon based: fuel, gaskets, seals, hoses and more!

If you would like to see some H.U.M. bugs look at the inside of a fuel tank. Look at your fuel filters. You will see H.U.M. bugs and their waste products. They need to be removed from your fuel. They will gum up and block your filter and then stall out your engine. The bugs and waste that do pass through your filter acts upon your engine just like normal particulate matter: they sand blast away at your engine's internals. These smaller particles cause meaningful and absolutely avoidable wear. Your fuel will also not burn as well which causes performance and fuel economy to suffer.

The cure for H.U.M. bugs is two-fold. Remove the ones you already have from your fuel system and do not give them a place to live.

H.U.M. bugs enter your fuel system through several means. When you take on fuel you are picking up bugs with your fresh load of fuel. Yes, the refining process pasteurizes fuel, but as it travels to where you bought it fuel is exposed to contaminated tanks, trucks, and fuel pipelines. Even if perfectly sterile fuel is pumped into your tanks the fuel is not safe yet. Bugs will enter your tanks and get to your fuel through your tank vents, water that drips into your tanks, the filter you just installed on your engine, or any other means by which a single microbe can contact your fuel. You need take measure to prevent bugs from growing in your fuel system. The presence of Soltron™ in a fuel system makes it very difficult for a bug colony to become established.

H.U.M. bugs like all creatures need a place to live. H.U.M. bugs live and breed on the boundary layer where the water in your tanks meets your fuel. A few gallons of water can provide hundreds or even thousands of square feet of surface area capable of sustaining huge populations! Bugs CANNOT live in pure fuel. They must live in water. Take away the water in your fuel system and you will leave them with no place to live. Sounds too simple but it are true. Without water the bugs cannot live and multiply. Why do you think that the nefarious H.U.M. bug has not yet eaten the oil coming out of the oil wells after millions of years?

Soltron™ is highly effective at removing moderate amounts of water from fuel and depriving H.U.M. bugs of their habitat. In short, Soltron™ can help cure your existing bug problems and prevent new ones from getting started.