

# The Essential Fuel Tests Generator Dealers Need To Know About To Save Time, Money & Headaches

Generator dealers and service companies, unlike entities like hospitals or fuel distributors, don't deal with stored fuel directly. Rather, stored fuels impact their business from their role in helping the generator company's primary products fulfill their mission and their customer expectations – making the generators work as needed, every time. For this reason, generator dealers and service companies have every reason to pay attention to the fuel their customers use, as it is the fuel that is the primary cause of generators not working or not performing up to customer need/expectations. When this happens, the customers never blame the fuel; they blame the service company or the generator dealer, because it was their product that didn't work when needed.

To ensure the optimal and proper operation of the generators they sell and service, generator companies (dealers & service companies) should be paying attention to the fuel their customers use. For their customers, regular fuel inspections and even fuel testing are essential to ensuring that their generators stay problem free. But which tests to do? Sensory (sight and smell) fuel inspections by service technicians during service calls are better than nothing. However, analytical fuel testing by an accredited lab is the only way to assess the actual condition of essential stored fuel, as well as the only way to track its condition over time.

**These are the essential diesel fuel tests that both generator users and generator service companies should consider for their stored fuel.** We'll summarize what each test does, what problems relevant to their customer needs the test can detect, and what should happen if a test result comes up short.

## Test#1: Water & Sediment Content

<b>Water and Sediment Content (ASTM D-2709)</b>		
<b>What is this test? How do you run it?</b>	<b>What problems can it predict or detect?</b>	<b>What to do if your fuel fails?</b>
<p>Measures and quantifies the levels of both water and sludge sediment in samples of stored fuel.</p> <p>A sample of diesel fuel is centrifuged to force any water and sediment in the sample to the bottom of a tube. The volume of water and sediment is then measured.</p> <p>Healthy fuel that meets legal specifications is expected to have a water/sediment content below a certain % level.</p>	<p><b>MICROBIAL GROWTH:</b> Water presence supports microbe growth in fuel and fuel tanks. This can be disastrous for an emergency generator.</p> <p><b>POOR PERFORMANCE:</b> Injector fouling and engine deposits from the fuel itself, leading to substandard generator engine operation.</p> <p><b>EMERGENCY EQUIPMENT FAILURE:</b> Presence of excessive levels of both water and sediment can predict operational problems in emergency or critical-use generators that may be needed to run at a moment's notice, and for which the cost of failure is high.</p>	<p>Fuel and generator tank cleaning, utilizing a combination of chemical treatment, mechanical tank cleaning, and filtration of the fuel.</p> <p>This will reduce the water and sediment of the fuel and should enable it to meet water and sediment test standards.</p>
<p><b>The Water and Sediment Content test</b> is an essential picture of the stability and viability of stored fuel at any given time. It can give key information to generator users and service companies as to the likelihood that the fuel to be used by the generator will do what it needs to do on any given day in the future when it may be called upon to do so.</p>		

## Test #2: Cetane Index

<b>Cetane Index</b>		
<b>What is this test? How do you run it?</b>	<b>What problems can it predict or detect?</b>	<b>What to do if your fuel fails?</b>
<p>Estimation of the cetane rating of diesel fuel, which itself provides a picture of the combustion quality of the fuel.</p> <p>Measuring cetane index would involve submission of a fuel sample to a lab, which would run distillation and density measurements and calculate an estimation of cetane index/rating from that.</p> <p>Cetane index does not account for the addition of cetane improver additives; hence, it is most useful as a picture of the fuel's condition prior to any additization.</p>	<p><b>GENERATOR PERFORMANCE PROBLEMS:</b>            Poor cetane index/rating of diesel fuel contributes to a host of combustion problems in the diesel engine:</p> <ul style="list-style-type: none"> <li>- The generator have trouble starting</li> <li>- The generator may be unable to sustain load</li> <li>- Excessive black smoke production from incomplete fuel combustion</li> </ul> <p>Any of these may be of particular concern when the generator in question is relied upon as an emergency or critical use tool.</p>	<p>Because cetane index does not account for the addition of cetane improver additives, it provides a picture of when the fuel may need to be treated with cetane improver additives.</p> <p>Cetane deficiency is easy to remedy through application of chemical cetane improvers to raise the fuel's cetane rating from 2-6 points.</p>
<p>Measuring <b>Cetane Index</b> for generator stored fuel is most important when the fuel is intended to be in storage for significant periods of time, waiting for the opportunity to be used. Unfortunately, this is not uncommon. Generator users do not want an unpleasant surprise should they go to use the fuel at a critical time, so it is imperative for generator companies to partner with them to ensure their generator has quality fuel to run on.</p>		

## Test #3: Microbial Presence

<b>Microbial Presence/Count</b>		
<b>What is this test? How do you run it?</b>	<b>What problems can it predict or detect?</b>	<b>What to do if your fuel fails?</b>
<p>Multiple test options, ranging from simple and quick to more rigorous.</p> <p>Cultured test strips are easy to use and give a qualitative (yes/no) indication of the presence of microbes in a sample.</p> <p>"Fuel Stat" test kits give a immediate and semi-quantitative reading of specific kinds of microbes that may be present in the fuel and water bottoms.</p> <p>ATP tests also indicate not just the presence of microbes but how many.</p> <p>Microbial Count testing is done by submitting fuel samples to a certified lab and uses phase contrast microscopy and a machine like a Coulter Counter to mechanically count the number of microbial bodies within that pass through a scanner.</p>	<p><b>FUEL DEGRADATION</b> from being consumed by microbes during their life cycle.</p> <p><b>BIOMASS FORMATION, FILTER PLUGGING DEPOSIT FORMATION</b> which are, at the least, a hassle, and at worst, can be a major cause of both waste time &amp; resources and lost generator performance.</p> <p><b>EMERGENCY GENERATOR FAILURE</b> from the reduction in fuel ignition and combustion quality. Additionally, the "out of sight, out of mind" nature of tank contamination coincides with the purpose of emergency/backup equipment – a generator user can't predict exactly when their generator will be called on for use in a critical situation.</p>	<p>Application of biocide to the fuel in the generator storage tank is the only way to effectively reduce microbial counts in fuel. Extra filters should be kept on hand to remove the dead microbial biomass.</p> <p>For larger generators with larger fuel tanks, mechanical fuel processing to remove biomass and dead microbial presence after biocide application.</p> <p>Use of biomass dispersants &amp; anti-corrosion treatments to help remove biomass and microbial presence from tank surfaces and protect generator from re-inoculation of their fuel supply.</p>
<p><b>Microbial Presence/Count testing</b> is vital to keeping on top of the most damaging single element in the universe of generator fuel storage. Regular monitoring of microbial counts is a best practice for generator users to enable sound decision making on how and when to best ensure the fuel in their generator works as it is supposed to, when it is supposed to.</p>		

## Test #4: Water Content

<b>Water Presence &amp; Content (Stick Test   Karl Fischer)</b>		
<b>What is this test? How do you run it?</b>	<b>What problems can it predict or detect?</b>	<b>What to do if your fuel fails?</b>
<p>There are multiple methods for determining water content in fuel, both in-field testing and lab tests.</p> <p>In the field, presence of free water (i.e. a tank water bottom layer) can be confirmed and measured through the use of water finding paste (“tank sticking”).</p> <p>For a more qualitative measurement, the Karl Fischer lab test gives a qualitative measurement of water content as a percentage of the fuel.</p>	<p><b>TANK CORROSION:</b> Water content contributes to tank corrosion through multiple chemistry avenues.</p> <p><b>MICROBIAL GROWTH:</b> Water provides an essential medium for microbial growth in stored fuel.</p> <p><b>FUEL DAMAGE IN STORED GASOLINE:</b> Increases the risk of phase separation in stored ethanol-blended gasoline, which can quickly destroy the fuel’s viability.</p> <p><b>EQUIPMENT DAMAGE:</b> Excessive water content may also damage fuel injectors and cause problems with common rail diesel engines</p>	<p>Excessive free water should be mechanically removed (pumped out or drained) from the generator tank.</p> <p>Consider incorporating the use of water scavenging fuel treatments to remove trace remnants of water in the tank.</p> <p>Excessive dissolved or entrained water can be treated with a demulsifier chemical to make the water drop out of the fuel, enabling it to be removed by mechanical means.</p> <p>If excessive free water (&gt; 0.25 inches by stick method) can found, consider modifying your service monitoring recommendations to regularly check for water presence at least monthly, whether by the technician or by the customer.</p>
<p>Testing for <b>Water Presence</b> is an essential element of proper generator maintenance. Keeping generator tanks water free gives the best chance for ensuring the generator stays well prepared for future action.</p>		

## Test #5: Fuel/Water pH Level

<b>pH Level</b>		
<b>What is this test? How do you run it?</b>	<b>What problems can it predict or detect?</b>	<b>What to do if your fuel fails?</b>
<p>Measures the acid/base level of a fuel sample and/or water bottom samples from the tank.</p> <p>0 is acid whereas 14 is base(ic). On the pH scale of 0 – 14.0, 7.0 is neutral, while healthy fuel will almost always fall between 5.6 and 8.</p> <p>The pH scale is logarithmic, meaning each increment of value going toward the acid end of 0.0 increases in size. Therefore, there’s a much greater difference in going from, say, a 2.1 pH to a 2.0 compared to going from a 5.1 to a 5.0 pH.</p> <p>Fuel pH can be quickly and easily measured by using a pH meter.</p>	<p><b>MICROBIAL GROWTH:</b> Low pH (acidic) readings below 5.6 may indicate accelerated microbial growth in the fuel, as microbes produce acidic byproducts that lower fuel pH.</p> <p><b>FUEL DEGRADATION:</b> High acid levels in stored fuel are responsible for accelerating the rate of degradation of the fuel. They also contribute to tank corrosion and damage.</p>	<p>Consistently acidic pH readings, when taken as part of a monitoring program, should be an indicator that additional action needs to be taken to head off potential problems.</p> <p>Removal of water bottoms and treatment of the tank with biocide to kill microbes that created the acidic environment.</p> <p>Highly acidic fuel itself may need to be disposed of, unless it is diluted with fresh fuel before use.</p>
<p>The <b>pH level</b> of generator fuel can be a concern for generators used in critical or emergency situations. It can be a warning sign for the generator service company that they need to look more closely at the conditions in the fuel storage tank.</p>		

## Test #6: Fuel Stability

<b>Fuel Stability (ASTM D-2274)</b>		
<b>What is this test? How do you run it?</b>	<b>What problems can it predict or detect?</b>	<b>What to do if your fuel fails?</b>
<p>Also known as Oxidative or Accelerated Stability.</p> <p>Measures the storage stability of fuel.</p> <p>Fuel sample is heated and exposed to oxygen to simulate the process of fuel oxidation that occurs in real life storage. Insolubles like sludge are produced in the process and measured at the end of the test.</p>	<p><b>FUEL INSTABILITY:</b> The Fuel Stability test predicts upcoming fuel instability because unstable fuel produce higher quantities of measurable insolubles.</p> <p><b>REDUCED COMBUSTION PROPERTIES:</b> Unstable fuel with high level of insolubles do not combust as freely or cleanly as fresh, stable fuel does.</p> <p><b>INJECTOR AND EQUIPMENT DEPOSITS, LEADING TO GENERATOR PERFORMANCE ISSUES AND ELEVATED BLACK SMOKE EMISSIONS:</b> Unstable fuel predicted by the D-2274 test will darken and stratify in storage at a faster rate, producing sludge and reducing combustion viability. These heavy fuel elements form performance-robbing deposits in injectors and engine areas. They also produce elevated levels of black smoke emissions.</p> <p><b>PERFORMANCE UNCERTAINTY FOR CRITICAL EQUIPMENT:</b> Fuels that are severely unstable may not be able to sustain proper engine operation, which may be disastrous for a generator user relying on it for providing emergency services.</p>	<p>Fuel should be polished or cleaned to remove existing insoluble and sludge.</p> <p>Fuel should then be chemically treated with a stabilizer to halt further degradation and extend its effective storage life.</p>
<p><b>Fuel Stability</b> gives a predictive indicator of a generator fuel's ability to withstand degradation over time. This is essential information for ensuring that the fuel will support the generator operating as needed in the future.</p>		

## Test #7: Sulfur Content

<b>Sulfur Content (ASTM D-2622)</b>		
<b>What is this test? How do you run it?</b>	<b>What problems can it predict or detect?</b>	<b>What to do if your fuel fails?</b>
<p>There are multiple methods for determining sulfur content in fuels. D-2622 utilizes X-ray fluorescence to give an accurate measurement of sulfur content.</p> <p>This is an essential test for confirming that stored ultra-low sulfur diesel (ULSD) fuels do not maximum sulfur content allowable by law.</p>	<p>Sulfur content in excess of 15 ppm may be the fuel at risk for violating applicable sulfur content laws, with the exception of health care fuels.</p> <p>High sulfur content in diesel fuel also shortens the life of DPF systems, increasing maintenance costs.</p>	<p>There are no viable chemical or mechanical solutions for lowering sulfur content. Dilution of the fuel may be possible but depends upon starting sulfur content.</p> <p>If this is not possible, the fuel may need to be disposed of.</p>

These are the most important tests recommended for generator service companies to consider in ensuring their customers' generators operate as needed on demand. Running these essential tests a la carte can cost upwards of \$2000 at an accredited lab. That may be sticker shock for some operations managers, but may not be all that much when compared to the cost of failure for emergency generators called into action but being unable to perform due to substandard fuel. The cost to the generator company may be just as large as the cost to the customer.

Generator service companies can reduce these costs by partnering with someone who has existing relationships with accredited testing labs - a great way to get these done, but at a fraction of the cost. Customers of the Bell FTS Program for preventive fuel maintenance can have these tests run for a fraction of the cost.