

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

Fuel polishers provide an essential service that helps their customers get business done on their end. For their customers, preserving the health of their stored fuel is all about getting the job done and avoiding nasty surprises. And so those, too, become priorities for the fuel polisher as well. As the professionals who know about fuel, fuel health and tank conditions, good fuel polishers have the opportunity to set themselves apart from the pack by advising their customers on the recommended fuel tests that will make their professional lives easier. Regular fuel inspections and fuel testing are essential to ensuring anyone who relies on stored fuel stays equipped to do their job by staying ahead of any shifts in stored fuel condition. In addition, many of these tests can document, for the customer, the positive changes to their fuel's condition that have resulted from the fuel polishing service. That's a win-win for both sides: customers know for certain their fuel is better than when it started, and fuel polishers gain legitimacy and the confidence of their customers.

But which ones to do? Sensory (sight and smell) fuel inspections are better than nothing. However, analytical fuel testing by an accredited lab is the only way to assess the current condition of essential stored fuel, as well as the only way to track its condition over time.

**These are the essential fuel tests that fuel polishers and their customers should consider for optimal stored fuel health.** We'll summarize what each test does, what problems relevant to their 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 that the customer might encounter without service?</b>	<b>What to do if your fuel fails before the service?</b>
<p>Measures and quantifies the levels of both water and sludge sediment in samples of stored fuel, which fuel polishing services aim to reduce</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>POLISHING SERVICE EFFICACY:</b> Changes in water and sediment content can document how effective the fuel polishing service was, instead of leaving it up to assumption.</p> <p><b>MICROBIAL GROWTH:</b> Water presence supports microbe growth in fuel and storage tanks.</p> <p><b>TANK CORROSION:</b> Failure on this test is the #1 predictor of the presence of storage tank corrosion damage, which fuel polishing aims to help prevent.</p> <p><b>POOR PERFORMANCE:</b> Injector fouling and engine deposits from the fuel itself, leading to substandard 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 equipment. Documenting changes from before &amp; after can provide</p>	<p>A failed water and sediment reading confirms the need for fuel polishing service.</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>Fuel and tank cleaning, utilizing a combination of chemical treatment, mechanical tank cleaning, and filtration of the fuel.</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 fuel polishing customers that rely on stored fuel to get critical jobs on the likelihood of having problems right now with their fuel, as well as the chance of problems in the near future.</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 that the customer might encounter without service?</b>	<b>What to do if your fuel fails before the service?</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>ENGINE 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>- <b>Poor starting</b></li> <li>- <b>Rough running and operation</b></li> <li>- <b>Excessive black smoke production from incomplete fuel combustion</b></li> </ul> <p>Any of these may be of particular concern when the equipment in question is emergency backup equipment where operation failures may be disastrous to a govt. entity's constituents.</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 during the polishing service.</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 stored fuel is most important when it's backup fuel that has been or will be in storage for significant periods of time. Fuel polishing customers do not want an unpleasant surprise should they go to use the fuel at a critical time.</p>		

## Test #3: 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 that the customer might encounter without service?</b>	<b>What to do if your fuel fails before the service?</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>POLISHING SERVICE EFFICACY:</b> Changes in water content test results can document how effective the fuel polishing service was.</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).</p> <p>Consider incorporating the use of water scavenging fuel treatments during polishing services to remove trace remnants of water in the storage 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 during polishing service.</p> <p>If excessive free water (&gt; 0.25 inches by stick method) can be found by the customer during their regular monitoring, they should consider modifying their tank monitoring procedures to regularly check for water presence at least monthly. Tanks should always be checked manually – do not rely solely on in-tank water monitoring equipment.</p>
<p>Testing for <b>Water Presence</b> is an essential element of proper stored fuel and tank maintenance. Fuel polishers can advise their clients on the need for water presence monitoring in between service intervals.</p>		

## Test #4: 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 that the customer might encounter without service?</b>	<b>What to do if your fuel fails before the service?</b>
<p>Cultured test strips are easy to use for technicians to use, and give a qualitative (yes/no) indication of microbe presence, but take several days to work.</p> <p>“Fuel Stat” test kits give an immediate and semi-quantitative reading of specific kinds of microbes.</p> <p>ATP tests also give immediate results and indicate not just the presence of microbes but how many.</p> <p>Microbial Count testing by a certified lab uses phase contrast microscopy and a machine to mechanically count the number of microbes within the sample.</p>	<p><b>TANK CORROSION</b> from strong and weak acids produced by microbes in the tank.</p> <p><b>FUEL DEGRADATION</b> from being consumed by microbes.</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 engine performance.</p> <p><b>EMERGENCY EQUIPMENT FAILURE</b> from the reduction in fuel ignition and combustion quality. A user can't predict exactly when they'll be called on for use in a critical situation.</p>	<p>Application of biocide to the fuel in the storage tank is the only way to effectively reduce microbial counts in fuel. It will also reduce the need for unexpected future re-servicing by the fuel polisher.</p> <p>Fuel polishing to remove biomass and dead microbial presence after biocide application. This will reduce future filter plugging and remove some of the existing precursors for future fuel instability.</p> <p>Use of biomass dispersants &amp; anti-corrosion treatments during polishing service to help remove biomass and microbial presence.</p>
<p><b>Microbial Presence/Count testing</b> is vital to keeping on top of the most damaging single element in the universe of fuel storage. Fuel polishers should advise their customers that regular monitoring of microbial counts is a best practice to enable sound decision making on how and when to utilize biocide treatment in the stored fuels they need to keep in peak condition. This enables the fuel polisher to provide an added value to their clients.</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 that the customer might encounter without service?</b>	<b>What to do if your fuel fails before the service?</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; 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>TANK CORROSION:</b> The presence of acids in fuel and water bottoms</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 and fuel polishing needs to be taken to head off potential problems.</p> <p>Removal of water bottoms and treatment of the tank with biocide during polishing service.</p> <p>Highly acidic fuel itself may need to be disposed of, unless it is diluted with fresh fuel before use.</p>
<p><b>pH level</b> of fuel can be a concern for fuels stored long-term for use in critical or emergency situations. It can be a warning sign for that they need to look more closely at the conditions in their fuel storage tank, especially if the storage tank holds fuel needed to emergency services. Ph monitoring also gives the fuel polisher a critical issue to address with their clients.</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 that the customer might encounter without service?</b>	<b>What to do if your fuel fails before the service?</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>POLISHING SERVICE EFFICACY:</b> Changes in the fuel’s stability rating can document how effective the fuel polishing service was, instead of leaving it up to assumption.</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 insoluble do not combust as freely or cleanly as fresh, stable fuel does.</p> <p><b>INJECTOR AND EQUIPMENT DEPOSITS, LEADING TO 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 government entity providing essential/emergency services.</p>	<p>Failure in the stability test provides justification that fuel should be polished or cleaned to remove existing insoluble and sludge.</p> <p>Fuel should then be chemically treated during polishing service with a stabilizer to halt further degradation and extend its effective storage life.</p>
<p><b>Fuel Stability</b> is an essential test to run because it gives a direct predictive indicator of a stored fuel’s ability to withstand degradation over time. This is essential information for fuel polishing clients that use stored fuel, if they want to minimize unexpected problems. Tabulating fuel stability data gives them a useful running picture of the state of their stored fuel.</p>		

These are the most important tests that fuel polishers can advise their clients to consider when they need to have an accurate picture of their fuel’s condition at any given time. Running these essential tests a la carte can cost upwards of \$2000 at an accredited lab.

That may be sticker shock for many, but may not be all that much when compared to the cost of large volumes of stored fuel. Factoring in additional potential costs incurred if the client entity cannot provide essential services in an emergency because their stored fuel doesn’t perform as needed, and the perspective on the cost of testing shifts. As it does for the fuel polisher that may have been faced, in the past, with the costs of re-servicing polished fuel that still had problems – problems that could have been predicted by fuel tests such as these.

Fuel polishers and their clients 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.