Essential Fuel Tests Healthcare Facilities Need To Know About

To Save Time, Money & Headaches

Hospitals & healthcare facilities rely on stored fuel to execute the critical emergency backup functions that ensure they can continue giving critical care at all time. Given how important these services are to their patients & their customers, preserving the health of this stored fuel is of utmost importance – so much so that many healthcare facilities are governed by specific regulations that require them to pay more attention to their stored fuels and emergency generators than other types of users. An example of this might be the AHCA requirement to test backup generators at least once a month for at least 30 minutes.

For stored backup fuel, **AHCA guidelines mandate the fuels be tested annually to show they meet full ASTM D-975 requirements**. This slate of more than ten tests helps define what legally can be called 'diesel fuel'. So at a minimum, health care facilities would need to ensure their fuel meets this standard. But if the goal is to reduce the likelihood of stored fuel problems as much as possible, then the D-975 slate may not be the entirety of the answer. There are other tests that may have hospitals and health care facilities specific insight as to how the condition of their stored fuel might be changing and leading to potentially disasterous problems.

What tests do the D-975 slate cover? Flash point, Water and sediment content, Distillation properties, Viscosity, Ash%, Sulfur content, Copper strip corrosion, Cetane number or index, Cloud point/cold filter plug point, carbon residue, and lubricity. For entities not required to do the full D-975 slate, it would normally be recommended to do Cetane Index, Water/Sediment Content, and Sulfur Content as part of a regular test slate to keep track of their fuel's condition. Health care facilities have this covered.

In addition to D-975 as specified by AHCA, these are the essential fuel tests that health care facilities should consider for their stored fuel. 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: Microbial Presence

Microbial Presence/Count		
What is this test? How do you run it?	**What problems can it predict or detect?**	**What to do if your fuel fails?**
Multiple test options, ranging from simple and quick to more rigorous. Cultured test strips are easy to use and give a qualitative (yes/no) indication of the presence of microbes in a sample. "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. ATP tests also indicate not just the presence of microbes but how many. 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.	**TANK CORROSION** from strong and weak acids produced by microbes in the storage tank. **FUEL DEGRADATION** from being consumed by microbes during their life cycle. **BIOMASS FORMATION, FILTER PLUGGING DEPOSIT FORMATION** which are, at the least, a hassle, and at worst, can be a major cause of both waste time & resources and lost engine performance. **EMERGENCY EQUIPMENT FAILURE** from the reduction in fuel ignition and combustion quality. Additionally, the "out of sight, out of mind" nature of storage tank contamination coincides with the purpose of emergency/backup equipment – a health care facility can't predict exactly when they'll be called on for use in a critical situation.	Application of biocide to the fuel in the storage tank is the only way to effectively reduce microbial counts in fuel. Mechanical fuel processing 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. Use of biomass dispersants & anti-corrosion treatments to help remove biomass and microbial presence from storage tank surfaces and prevent re-inoculation of the fuel supply.
Microbial Presence/Count testing is vital to keeping on top of the most damaging single element in the universe of fuel storage. Regular monitoring of microbial counts is a best practice for health care facilities to enable sound decision making on how and when to utilize biocide treatment in the course of ensuring their stored emergency fuel stays sound.		

Test #2: Water Content

Water Presence & Content (Stick Test | Karl Fischer)		
What is this test? How do you run it?	**What problems can it predict or detect?**	**What to do if your fuel fails?**
There are multiple methods for determining water content in fuel, both in-field testing and lab tests. 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"). For a more qualitative measurement, the Karl Fischer lab test gives a qualitative measurement of water content as a percentage of the fuel.	**TANK CORROSION:** Water content contributes to tank corrosion through multiple chemistry avenues. **MICROBIAL GROWTH**: Water provides an essential medium for microbial growth in stored fuel. **FUEL DAMAGE IN STORED GASOLINE:** Increases the risk of phase separation in stored ethanol-blended gasoline, which can quickly destroy the fuel's viability. **EQUIPMENT DAMAGE:** Excessive water content may also damage fuel injectors and cause problems with common rail diesel engines	Excessive free water should be mechanical removed (pumped out or drained). Consider incorporating the use of water scavenging fuel treatments to remove trace remnants of water in the storage tank. 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. If excessive free water (> 0.25 inches by stick method) can found, consider modifying your tank monitoring procedures to regularly check for water presence at least monthly. Tank should always be checked manually – do not rely solely on in-tank water monitoring equipment. Always verify by another method.
Testing for ***Water Presence*** is an essential element of proper stored fuel and tank maintenance. Even though water/sediment content is required by D-975, checking for water manually at regular intervals is easy to do and can head off many problems.		

Test #3: Fuel/Water pH Level

pH Level		
What is this test? How do you run it?	**What problems can it predict or detect?**	**What to do if your fuel fails?**
Measures the acid/base level of a fuel sample and/or water bottom samples from the tank. 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. 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. Use a pH meter to check it.	**MICROBIAL GROWTH:** Low pH (acidic) readings below 5.6 may indicate accelerated microbial growth in the fuel, as microbes produce acidic byproducts that lower fuel pH. **TANK CORROSION:** The presence of acids in fuel and water bottoms **FUEL DEGRADATION:** 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.	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. Removal of water bottoms and treatment of the tank with biocide to kill microbes that created the acidic environment. Highly acidic fuel itself may need to be disposed of, unless it is diluted with fresh fuel before use.
PH level of fuel can be a concern for health care fuels stored long-term for use in critical or emergency situations. It can be a warning sign for the health care facility that they need to look more closely at the conditions in their fuel storage tank, especially if the storage tank holds fuel needed to execute emergency services.		

Test #4: Fuel Stability

Fuel Stability (ASTM D-2274)		
What is this test? How do you run it?	**What problems can it predict or detect?**	**What to do if your fuel fails?**
Also known as Oxidative or Accelerated Stability. Measures the storage stability of fuel. 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.	**FUEL INSTABILITY**: The Fuel Stability test predicts upcoming fuel instability because unstable fuel produce higher quantities of measurable insolubles. **REDUCED COMBUSTION PROPERTIES:** Unstable fuel with high level of insoluble do not combust as freely or cleanly as fresh, stable fuel does. **INJECTOR AND EQUIPMENT DEPOSITS, LEADING TO PERFORMANCE ISSUES AND ELEVATED BLACK SMOKE EMISSIONS**: 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. **PERFORMANCE UNCERTAINTY FOR CRITICAL EQUIPMENT**: Fuels that are severely unstable may not be able to sustain proper engine operation, which may be disasterous for a hospital providing essential/emergency services.	Fuel should be polished or cleaned to remove existing insoluble and sludge. Fuel should then be chemically treated with a stabilizer to halt further degradation and extend its effective storage life.
Fuel Stability 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 hospitals and health care facilities 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.		

Combining these tests with the required ASTM D-975 slate will give hospitals and health care facilities the best and most accurate picture of their fuel's condition at any given time. Given what's at stake for these facilities, they are well worth considering.

Yet, running these essential tests a la carte can cost upwards of $1000+ at an accredited lab. That may be sticker shock for some health care purchasing or operations managers, but may not be all that much when compared to both the costs of large volumes of stored emergency fuel and the tremendous costs of failure should their fuel not perform when called upon to do so. Factoring in the additional potential cost incurred if a health care facility cannot provide essential services in an emergency because their stored fuel doesn't perform as needed, and the perspective on the cost of this kind of testing shifts significantly.

Health care facilities 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.