

Your Generator Won't Start – Determining If The Problem Is Mechanical Or The Fuel

Executive Summary

This PSA document addresses common misdiagnoses of generator no-run or no-start conditions, particularly the tendency to blame "bad fuel" without adequate evidence. Following proper diagnostic steps can save you substantial costs and ensure the real issue is identified and resolved. Here are the key action steps you should take:

1. Conduct Initial Diagnostics:

- Check Fuel Filters
 - Replace primary and secondary fuel filters.
 - Inspect old filters for signs of microbial contamination (e.g., black, slimy growth).
 - If contamination is found, treat the tank with a biocide.
- Inspect Fuel Lines and Valves:
 - Blow air through the fuel line to check for obstructions.
 - Inspect and clean foot or check valves, and replace inline fuel filters if present.

2. Address Potential Microbial Contamination:

- Look for signs of microbial growth in filters and water separators:
- Confirm contamination with microbial testing (e.g., ATP-By-Filtration).
- Treat confirmed contamination with biocide and schedule regular filter replacements.

3. Evaluate the Fuel:

- Test fuel at a qualified third-party lab before considering disposal:
 - Send fuel samples to a qualified lab for ASTM confirmation testing (e.g., Flash Point, Distillation Curve)
- Proper Sampling Techniques:
 - Take samples 3-6 inches above the tank bottom to avoid skewed results. Use a fuel sampler.

4. Interpret Lab Results:

- If fuel meets ASTM specifications, it is unlikely the root cause of the issue.
- Use test results to confirm or eliminate fuel as the problem, avoiding unnecessary and expensive fuel disposal or system component replacements.

5. Engage Experts If Needed:

- If you've followed these steps and your no-run/no-start problem persists, now is the time to consult with a fuel mechanical expert like Bell Performance to guide you through troubleshooting for your specific situation..

By following these steps, you can confidently diagnose and resolve generator issues while avoiding unnecessary costs for incorrect repairs or fuel disposal.

Introduction: Identifying the Source of the Problem

If this hasn't happened to you, you probably know somebody it has. Your generator system shuts down or won't run. What to do? You call in the generator service company for a technician to diagnose the problem. The technician looks things over and issues a relatively simple diagnosis - the system won't run because "the fuel is bad".

Over the past several years, we've seen numerous generator service technicians claim that a no-start or no-run condition is due to bad fuel condition. Yet, when samples of the fuel in question are submitted to a third-party lab for testing, they come back showing the fuel is, in fact, in good condition - good enough even to meet all ASTM D-975 specifications for in-spec diesel fuel.

A no-start or no-run condition is a serious matter, so it's important to take the right approach to finding the true answer to the condition, instead of relying on assumptions that might prove to be wrong. Most of the generator service technicians who conclude the condition is due to a fuel problem don't know that much about fuel. But they'll blame the fuel anyway because it's the easiest thing to do.

The Importance of Getting It Right

When the generator won't run, the easiest thing to do is blame the fuel. Yet, in many cases, the fuel won't be the real culprit.

It's important to get the right answer here because it can get expensive chasing a diagnosis that isn't actually the right answer. This is especially true if the incorrect diagnosis leads you to replace parts that aren't the real problem.

Maybe a service technician incorrectly tells you that you need to replace the injectors or the fuel injection pump to get the system up and running. Replacing injectors might cost you \$1,000 or more. Replacing fuel injection pumps can push that cost to \$5,000 or more.

Or the technician tells you "the fuel is bad" and advises you to dump it. That can get really expensive, really fast, because it's not just about the cost of replacing the fuel. You'll have to have a licensed company who will charge you a basic disposal fee that goes by weight of the fuel - \$0.80 to \$3.00 per pound - which comes out to between \$5.00 and \$20.00 per gallon. Then there's the extra fees - labor and service charges, hazardous waste transportation fees (could be \$200 or more, depending on the state), and environmental or regulatory fees. Not to mention, you do still have to buy the new fuel to replace the old fuel.

Let's say a service technician tells you your 500 gallons of fuel is bad. If we pick a median disposal cost of \$2.00 per pound, this diagnosis is going to mean a total bill of \$6,500 - \$8,500 for disposal + maybe another \$300 in various fees + another \$1,700 to replace it with new fuel.

Whether replacing system parts or replacing the "bad" fuel - both are expensive fixes to get your system back up and running. You better be sure they are the right solution. That's why it's worth your while to dig a little deeper to make sure you come up with the right solution so you don't drop substantial amounts of money on fixes that don't address the problem.

Having said that, here are some things you can do to point you in the right direction.

Proper Diagnostics: Fuel System Issues

Many times, instead of defaulting to "the fuel is bad" and stopping there, it's worth looking at elements of the fuel system to make sure they aren't the real cause of the problem.

#1 - Check the fuel filters

If the engine shuts down or will not come up to RPM, it is a good rule of thumb that simply changing the fuel filter (or filters) remedies the problem. Start with changing the primary and secondary fuel filters.

If changing the fuel primary and secondary fuel filters solves the running or RPM issue, do something else. Take a hack saw and cut the old filters open to inspect the paper inside. If you see black and slimy growth, or you feel slimy growth inside the filter that appears neutral in color, this tells you two things - you most likely have microbial contamination, and you likely have water in the system. These are linked together because, in most cases, if you have water, you will have microbial growth as well. So your tank will need to be treated for both issues.

Beyond this, though, you can breathe easier. By changing the filters, you've avoided a four- or five-figure "solution" and solved your actual problem for the minute cost of a couple filters.

#2 - Check The Fuel Line

If changing the filters in #1 didn't solve your problem, don't worry. Proper diagnosing procedures often involve moving through multiple steps to locate the problem. After going through each of these next steps, you'll want to check to see if your system will run. If it does, you've found your problem.

Start with the fuel line going into the tank. Blow air back through the line to make sure there is no obstruction in the line. An obstructed fuel line means obstructed fuel flow which means the engine won't run.

One thing to note, however - If the fuel line in the tank has a foot valve, blowing air will not work because the foot valve will close and no air will pass through it.

After this, extracting the fuel line from the tank for inspection and cleaning would be the next step. This is also when you'll check the foot or check valves, depending on which one your system has. Not all fuel systems have one of these foot valves. If your tank does not have a foot valve you will usually find a check valve in the same fuel line. These check valves are found between the tank and the lift pump or primary filter, and they function to prevent drain back causing slow starts with extended engine cranking.

Whichever valve your system has, remove it and clean it to make sure it is free to work properly. Reinstall it and check to see if your problem has been resolved.

#3 - Check For An Inline Fuel Filter

Lastly, your fuel system may also have a third fuel filter in the line from the fuel tank, that resembles an automotive-type inline fuel filter. If your checks up till now haven't resolved the problem, you can try replacing this third fuel filter as well.

The fuel line, check or foot valves, fuel filters - any one of these simple checks can turn up the real cause of your no-run/no-start situation.

This troubleshooting sequence is worth working through because if the problem really is any of these, you will have saved thousands of dollars with a simple fix. Paying thousands to dump fuel or replace expensive parts like the injector pump should not be considered before you've done your due diligence by working through these initial procedures to make sure these simple parts aren't the real cause of your problem.

Microbial Contamination: Another Possible Cause

The diagnostic procedure up to this point has focused on checking some of the often-overlooked fuel system components. Recall that one thing we mentioned in #1 above is to pay attention to whether either of the filters clue you in to the possibility of microbial contamination growing in your system. It's a problem becoming more widespread across fuel systems with each passing year. You want to make sure you know whether microbial contamination is a contributing factor to your operational problem. If it is, it can be remedied for a whole lot less than dumping the fuel or replacing expensive parts.

Recognizing those tell-tale signs in your fuel filters from earlier is one clue. Another thing you'll want to do is examine your water separator filter, which is a perfect environment for microbial contamination to grow, multiply, and be dispersed to the rest of the fuel system.

In fact, we should expect this to be the case. Microbes can grow easily anywhere there's an available supply of moisture - something that happens to be true for water separator filters.

Signs of microbial contamination in a water separator filter often include 1) the same kind of black slimy residue seen in fuel filters, 2) a distinct sour or rotten smell, 3) leopard spotting on the filter paper or medium, indicating colonies of microbes grouped together, 4) the presence of clumps or particles of organic matter in the separated water or fuel, and 5) cloudy or milky liquid in the separator, which indicates that microbial contamination in the system is leading to fuel-water emulsification that is likely contributing to your problem.

If any of these signs lead you to suspect microbial contamination in your system, you should have it confirmed through microbial testing. A test methodology like ATP-By-Filtration can confirm if you have such contamination or not. ATP microbial testing is relatively simple to perform if you utilize a testing kit available from companies like Bell Performance. You receive sample packaging materials that enable you to package your own fuel sample and ship it for microbial testing.

If testing confirms that you have microbial contamination in your system, it's important to treat the tank with a biocide and perform regular filter replacements to prevent further problems with the fuel system. Again, this is a much-less-expensive fix for resolving a no-start/no-run situation than paying thousands to replace parts or dump fuel that isn't actually the real cause of your problem.

What If It Really Is The Fuel?

To this point, you've examined some of the fuel system elements that are commonly overlooked in diagnosing operational problems. You've also addressed whether microbial contamination might be a contributing factor.

If you haven't gotten a satisfactory answer by now, this is when you want to put the "fuel is bad" diagnosis to the test. Yet that doesn't mean dumping the fuel quite yet. Before committing to such an expensive solution, you have a little more due diligence to perform – which means you need to understand what fuel can and cannot do relative to what the technician claims is true for your problem.

Generator service technicians are not fuel experts, so it's easy even for professionals like them to misunderstand the role that bad fuel can or cannot play in a no-run or no-start situation. It's a real temptation to use the fuel as a fallback culprit when the technician is unable to find the real problem. They might claim that the foundation of the problem is that the fuel is bad, but they cannot explain how it is bad or why its suspected "subpar condition" is causing the overall problem.

This is when it's appropriate to be skeptical of that diagnosis. Remember, it's your money that's at stake.

The Real Problems Out-Of-Spec Fuel Can Cause

If your fuel isn't in the condition it should be (i.e. it's "out of spec"), it can contribute to certain problems.

If the fuel doesn't have the proper combustion characteristics, meaning its flash point is too high or low, its distillation curve is off, or its cetane is too low, the engine might have trouble starting or maintaining load while using the fuel.

If the fuel's lubricity rating is catastrophically low, it can damage fuel pumps and injectors to the point of their failure. Please note, however, it's rare to find diesel fuel with such low lubricity because almost all diesel fuel today contains a small amount of biodiesel that fixes any existing lubricity problem. Still, theoretically, your fuel's lubricity rating does matter in this context.

What about excess particulate in the fuel leading to filter compromise? In that kind of situation, the fuel could theoretically contain so much particulate and sediment that the fuel filter(s) becomes plugged in its effort to keep contaminants from reaching critical engine parts. The filter wasn't being damaged or "eaten up" by contaminants in the fuel, it simply reached its load-bearing capacity and needs to be changed. Until it is changed, there would be a possibility of excess particulate reaching places it's not supposed to.

"Bad" fuel can cause certain problems like these. The problem with the common "fuel is bad" diagnosis is that the technician doesn't have enough information or knowledge to point to anything more specific than that. If they can't tell you how the fuel is bad or what deficiency of the fuel is directly linked to your problem situation, the chances are greater that they're wrong.

Here's What Fuel Can't Do

In considering how the fuel might be falsely linked to your problem, let's talk about filter damage.

In one real-world situation, a customer in Florida was having to replace fuel injection pumps in multiple generators. The generator service technician concluded that a customer's fuel was "bad". In their diagnosis, they claimed that the fuel itself was "eating up the filters", leading to continual damage to the fuel injection pumps that necessitated their replacement (at costs of thousands of dollars, of course).

The technician doesn't know enough about fuel to recognize that their claim about fuel damaging the filters isn't supportable by what's seen in the real world. The more you know about fuel, the easier it is to recognize that. We can say this for several reasons.

First, fuel filters use cellulose paper filter mediums. Cellulose is commonly used just because it works but also because it's impervious to damage from chemicals in the fuel. Un-additized fuel simply doesn't have anything in its composition that would be expected to "eat up" paper filter medium in this way.

Second, note that we just said "un-additized". Maybe the tech counters with "what about that stuff you put into the fuel? The biocide or the stabilizer? Maybe that's what did it."

Except that it doesn't correspond with reality, either. Leave aside the fact that thousands upon thousands of businesses and customers have used both biocides and fuel stabilizers without problems – because there's nothing about those chemistries that would cause the kind of problem the generator technicians is accusing them of.

Then consider that all fuel treatments, whether biocides or detergents or stabilizers or cetane improvers or other kinds, have to be registered with the EPA. The EPA can tell from their formulas whether they contain anything that might cause damage to engine components or filters. Legal approval from the EPA is designed to give you confidence that using a registered additive won't cause the kind of problems this technician insists they are. This means as long as you're using a properly registered fuel additive, the idea that the fuel additive is causing the fuel to damage any of the filters simply doesn't correspond with reality.

Before you commit to dumping thousands of dollars of stored fuel over a technician's hunch, you need to take some proper diagnostic steps to confirm whether the fuel is, or is not, bad and causing the problems they think it is. This means some kind of fuel testing.

A Quick Way To Judge Contamination

Most of the fuel testing we'll be talking about should be done at a third-party laboratory running ASTM fuel tests. But there is at least one thing you can do on your own that will tell you something meaningful about one of the more common fuel contamination situations you're likely to come across - diesel fuel contamination with gasoline.

If gasoline/diesel contamination (something that can cause real damage in systems) is suspected, the way a lab would confirm the contamination (short of doing something like a GC/MS test that tells you all the different molecules in it) would be to run a Flash Point test. The Flash Point temperature would show up as being much lower than it should be. #2 diesel fuel has a flash point of 129 degrees F and gasoline has a flash point of -45 degrees F. It would take as little as 2% gasoline contamination to drop the diesel fuel flash point below the

minimum ASTM specification. Running a Distillation Curve test in a lab would also give you credible clues on whether there's gasoline contamination.

If you suspect that you have gasoline contamination in your diesel fuel, give us a call immediately (407-831-5021) and we can walk you through a quick way to test to determine if this is likely the case. If it is determined to be true, that would be a situation where you really would need to discard your entire tank of fuel to avoid fuel system damage.

The Role of Fuel Testing In Proper Diagnostics

It's all well and good to say you should "examine the fuel" to confirm or rule it out as a cause of your problem, but the average person (or generator service tech) doesn't know what "examining the fuel" entails. From a best practice standpoint, it means taking a fuel sample and sending it to be tested, giving you results that tell you something meaningful about the fuel's condition with respect to whether it's causing the no-run problem.

There are hundreds of kinds of tests that can be run, but many of them, even ones that are normally important, won't tell you what you need to know for a no-run or no-start situation.

If the question is about whether the fuel's condition is preventing the engine from starting or maintaining load, that would be confirmed by documenting its combustion properties. Tests that would shed light on the fuel's combustion properties are the ASTM tests that measure combustion:

- Flash Point
- Distillation Value
- Cetane Rating

If the question is whether the fuel (or something in the fuel) is damaging filters such that system components normally protected by the filters are being compromised (like the fuel injectors or the injector pump), then it's going to be the tests that measure contamination in the fuel:

- Water By Karl Fischer
- Water/Sediment Content
- An ISO Particulate Count test can also be useful in documenting the specific particulate content (how much and what size) of the fuel. In the situation described earlier, where excess particulate matter from the fuel was thought to have compromised the fuel filter, an ISO test (with or without a Water & Sediment test) could be used to prove if this was true of the fuel or not.

If the technician's hypothesis is that the fuel is contributing to wear-damage in injectors or fuel pumps, then an ASTM Lubricity test will work to confirm or refute that.

All of these ASTM fuel tests can be run at a qualified laboratory that specializes in petroleum fuel testing. If you're not sure which lab to choose, contact Bell Performance and we can suggest some qualified labs that can serve your needs.

Good Fuel Testing Need Good Fuel Sampling

There's a foundational truth that testing is only as good as the sample being tested. To make sure your test has the highest "diagnostic value" possible, it's helpful to keep a couple things in mind while you're getting the fuel sample.

First, consider where (the depth) in the tank you should pull your sample. Most generator fuel supply tanks have their fuel pickup pipes positioned three to four inches off the bottom. In most cases, any water or emulsified fuel phase present will be below that pickup point, meaning they will not be ingested into the engine fuel system under normal circumstances. Most fuel storage tanks also have some amount of fine particulate or sediment on the tank bottom. If you do not disturb it, in most cases it will not create any filter plugging issues (meaning its presence is not definitive proof that the fuel is "bad" or causing problems).

Let's say that you pull a sample for testing, but you take it from below that point, such as from the "dead bottom" of the tank. Your sample is likely to contain a much higher amount of water and emulsification and particular sediment than your overall fuel does. And your sample is likely to yield failing test results because all of that contamination will skew your test results when it won't actually be causing a problem in the engine itself due to its position below the fuel pickup line.

Most fuel testing labs recommend that samples be taken somewhere between three to six inches off the bottom of the tank – a point above where this common contamination is normally found. We have found that in many cases where fleets have received failing test results, it's due to having improperly retrieved fuel samples.

How do you retrieve fuel samples for testing the right way? To avoid disturbing the particulate, you must have the proper sampling equipment. The best thing to use to retrieve fuel samples is a Fuel Sampler, also known in the industry as a "Bacon Bomb". Bell Performance can guide you on how to use this kind of Fuel Sampler to obtain and submit fuel samples that have maximum diagnostic value for your situation.

Visual Examination Of Your Fuel: What You Can Learn

Once you retrieve your fuel samples, before you send them for testing, see if you can tell anything useful about them from a simple visual examination.

A good rule of thumb to follow is to put the fuel sample in a clear glass jar. If it is clear and you can see through it, the fuel is most likely fine and will not plug a filter. It's also highly unlikely that it will contain particulate or other contamination that might be expected to either damage engine components or not support proper operation.

Too many times, someone may pull a fuel sample that looks visually clear, but still insist that the fuel needs "polishing" (filtration). Fuel polishing will not help fix fuel that is not bad. It would just be a waste of time and money.

For this kind of visually-clear fuel, one of the few things that could cause fuel like this to do damage is if gasoline has been introduced into the diesel tank. Mistakes like this have been made by fuel suppliers, so it is not unheard of. Gasoline contamination is bad news for components like fuel injector pumps because gasoline is a solvent and has no lubricating properties. These components depend on the lubrication properties of diesel fuel because it is an oil. Try the combustion test we referenced earlier. If it lights, send it off to a lab for testing that will give you official confirmation. If it is confirmed that your diesel fuel is contaminated by gasoline, you will want to replace the contaminated fuel with fresh diesel fuel.

Choosing Which Fuel Tests To Run?

Given that there are so many, how do you know which tests to choose? On the one hand, you can "test yourself into the ground". You also don't want to miss the opportunity to have the best chance of finding the right answer to your problem.

For this "best chance", you'll get the best results by having an ASTM Mission Critical test slate run. This slate groups together the most important tests listed in the ASTM D-975 specification for diesel fuel - both the fuel tests that define combustion characteristics and the fuel tests that cover contamination levels.

If you're not sure if that group of tests will tell you everything you need to know, consult with a fuel expert who can give you more direct guidance for your situation. You can be sure your best answer is in there, even if you need a little help knowing where to look.

What Do The Test Results Mean?

We know which tests will shed the most light on whether the fuel really is contributing to a no-run condition, but what do the results likely mean?

The most important thing the ASTM Mission Critical test slate will confirm to you is, if all the tests come back "in spec", then you can conclude your fuel meets the minimum requirements in the areas that have to do with its minimum functions of supporting engine operation and not contributing to component damage.



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That simple realization will be enough for you to cross off the fuel as a causative factor in why your system isn't running the way it should. And that means it will save you from spending thousands of dollars getting rid of fuel that isn't the problem.

What If None Of This Works?

Up to this point, you've investigated the most common "simple" mechanical causes of inoperability. You've diagnosed whether microbial contamination exists. And you've confirmed the fuel's condition without relying on speculation from people who may be guessing about it.

We realize that it's entirely possible that you've executed all of these steps and your no-start or no-run situation still persists. What do you do now?

This means your problem is due to something more involved than what can be solved by simple fix. Now, your situation needs consultation with an expert that knows about both the mechanics of generator systems and the fuel that goes into them.

Your next steps, having done all of your due diligence and crossing the simple fixes off the list, would be to contact Bell Performance for a more in-depth consultation on what's going on with your system. The answer may be still relatively simple. If it is, we'll help you find it. And if your answer is more complicated, we can help you find that, as well.

Conclusion

If you're in the unenviable position of dealing with a no-start or no-run situation with your generator system, you know it's imperative to get to the bottom of what's causing it. Hopefully you have a little clearer path and idea of the direction you need to take to solve your problem and get things where they need to be.

You do not, however, need to go this problem-solving route alone. Dealing with fuel and generator issues can be a daunting task, especially if you're not a "fuel expert".

Bell Performance is always available to help guide you through the steps you need to take so you are confident that the solution you pursue is actually going to be the right one. Reach out to us today, and we'll be happy to help guide you through to the best solution that's right for you and your situation.

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