



Diagnostic Tests

Running Tests

IMPORTANT DIAGNOSTIC FACT:

To make the engine start and idle only, you don't need any sensors or computers or electric lift pump. You only need 12 volt power, ground, and fuel to the VP44.

NO START – TEST #1 FUEL SUPPLY TEST

If the fuel gauge reads 1/8 – 1/4 of a tank, put a few gallons in the tank and bleed the fuel system. We say this because of the famous Dodge fuel tank sender problem. Your gauge may have just failed and be out of calibration for the first time and the tank is actually empty. In this situation air and fuel is what you are trying to start the engine with! Pressure indicators don't know the difference between air and fuel pressure, so they make you falsely think everything is fine. You will be very glad you did this if your truck runs again and you don't need an Injection Pump!

If the engine was running BEFORE you CHANGED THE FUEL FILTER or OPENED A FUEL LINE, and it HASN'T STARTED SINCE, or, it started and stalled after doing this, and it WON'T BLEED or restart, and you can hear the Lift Pump running, but won't fill the filter canister, you most likely have a bad electric Lift Pump.

Please remember when you are doing this diagnosis that the ECM turns on the electrical power to the Lift Pump only for 4 seconds when the key is in the "on" or "run" position.

When the ECM sees the "start" signal from the ignition switch it runs the lift pump for 25 seconds, and when it sees idle RPM it runs continuously. If the lift pump doesn't come on, or doesn't pump fuel into the filter canister when you click the key to the "start" and release it to the "run" position, you can bleed the system to get fuel to the VP44 and get the engine to run again by pressurizing the fuel tank with air pressure, or diagnosing and replacing the electric Lift Pump.

The reason this strange scenario happens, is because there is a mechanical lift pump built into the VP44 which works fine UNTIL air gets into the system. This explains why VP44 fueled engines don't die on the side of the road when the electric one fails.

NO START – TEST #2 FUEL SYSTEM ELECTRICAL TEST

Next test the electrical wiring and verify that there is battery voltage getting to the VP44 with the key in the "run" AND "start" positions.

Remove the big plug on the back of the injection pump by wiggling the plug with your right hand pulling toward the firewall and the left hand pulling the indented locking tab toward the fender.

When you have the plug in your hand, hold it so it looks like a smiley face, with six pins below the smile and three pins above.



Using a test light or voltmeter with its ground connection on the engine, verify battery voltage on the bottom right pin (pin #7, which is a red wire with a light green tracer on a Dodge), during both "run" and "start" key functions.

Then verify the ground on the bottom left pin (pin#6, which is a black wire with a tan tracer on a Dodge), by doing the voltage test again at pin 7 with the ground connector of your test instrument on pin 6 in the plug.

If you see no voltage then, it means there is no ground! Use only pin positions, not wire color, when diagnosing a Ford or Freightliner.

If you don't have power at the plug, check the fuse in the PDC (Power Distribution Center, aka fuse box under the hood) for the fuel system, and if that is good, check fuse #9 in the fuse box on the left side of the dash.

If they are both good, then try swapping the fuel system relay in the PDC with the one for the horn.

Hopefully you find your problem this easily, but if not, get out the schematic for this circuit.

If you don't have one, go to ALLDATAdiy.com.

If you have battery voltage on pin #7 in both key positions, and a known good ground on pin 6, cut the black tape off the VP44 plug harness to access the wires going into the plug and reinstall plug.

On a Dodge find the light blue wire with a red tracer (pin #5 on other trucks) and verify that there is NOT battery voltage there during either the "run" or the "start" functions of the ignition switch, WITH THE PLUG PLUGGED IN. The ONLY time there should be battery voltage on pin 5, is for about three seconds after turning the key to the "off" position.

If there is battery voltage there at any other time, the engine is being told to not start or run, by a pissed off ECM. This test is accurate 99% of the time in my experience. It is not unusual and OK to see low voltage, like .2 - 2.4 volts at pin 5.

The important thing here is to NOT have battery voltage there, and if you do have it at the wrong times, In DODGES ONLY, cutting that wire usually fixes the problem and the truck will run fine forever!

NO START TEST #3

HOT WIRE TEST - THE "FOR SURE TEST" TO DETERMINE IF THE VP44 IS WHY THE ENGINE WON'T START

It is very rare, but possible, for a problem with the wiring harness or the CAN Bus wires to prevent the engine from starting, so if you want to be 100% sure it IS the Injection Pump causing the no start, follow the following directions exactly, to be sure of not damaging a possibly good pump. This test POSITIVELY eliminates the possibility of overlooking an electrical problem caused by other components that could affect the start or run function of the VP44, as long as you have verified fuel delivery to the Injection Pump.



Remove the electrical plug at the back of the Injection Pump and hot wire the pins on the pump as follows.

Get two wires long enough to reach from the battery to the VP44.

Install an INSULATED ¼ inch female spade connector onto one end of each wire.

Use a set of dykes and cut the flat part and one of the "curls" away from each spade connector to leave one "curl," which will be about the right size to go over the pin on the pump.

Connect one INSULATED connector to pin 7 on the pump, which is the pin on the BOTTOM row of the socket on the Injection Pump, closest to the engine, to preferably fused (10 amp is fine) positive battery power in the PDC (Fuse box under the hood), or directly to the positive battery terminal if you like to take risks!

Connect the other INSULATED connector to the pin directly above the previous connection, the top row of pins, the one closest to the engine, and attach the other end to battery ground.

Now try to start the engine and if it doesn't start, you absolutely positively 100% need an Injection Pump! If the engine starts this way but NOT with the big plug installed on the pump, you know there is something in the harness or CAN bus wiring to the ECM telling or causing the engine to not start. Call us for help if this is the case.

IF YOU HAVE FUEL, POWER AND GROUND, PROVEN BY THE ABOVE TESTS AND STILL HAVE NO START AFTER TEST 3, YOU ABSOLUTELY POSITIVELY NEED AN INJECTION PUMP!

If you want more proof, or really want to know WHY it won't start, loosen all of the injector lines at the valve cover. Crank the engine for 30 seconds, and if fuel comes out of only one line, better than the others, this indicates a seized rotor, and the engine will never run again until you change the VP44, because only one cylinder is getting fuel. For the engine to start you need HIGH PRESSURE fuel, AND NOT AIR, to POP OFF at least three of the injectors. If you have only a feeble fuel flow from the open lines, you are looking at only Lift Pump pressure, and the engine will never start. To determine if it is or is not HIGH pressure, look for a puddle on the ground after 60 seconds of cranking. No puddle, no high pressure. If high pressure fuel doesn't come out of the open lines when cranking, the solenoid pintle valve may be stuck, or the pistons may be stuck compressed in the rotor, due to fuel contamination or corrosion. Low pressure can also be caused by an electrical issue in the computer, where the computer doesn't energize and close the fuel solenoid to make high pressure, so low fuel pressure going through the injector lines is WHY the engine won't start. Any of these situations confirms that the engine will not start until you replace the VP44, as long as you have done the other tests above.

AIR IN FUEL TEST

If the engine runs rough for a brief period of time after starting, just a few seconds, or sounds funny when running, this usually indicates air in the fuel supply system, caused by either fuel drain back or air getting into the fuel supply line somewhere. This symptom is NOT caused by the Injection Pump. Please know that good fuel



pressure does NOT mean that there is no air in the supply line, as the pressure sensor doesn't know the difference between fuel and or air pressure!

My latest trick to accurately determine if air is a problem or not, is to get a 12 foot section of clear polyethylene or vinyl 3/8" hose from the hardware store and put it in the steel line between the Fuel Filter and the Injection Pump where the rubber section is.

For aftermarket plumbing upgrades, figure out how to install it between the Fuel Filter and the Injection Pump.

Loop it up under the windshield wiper for easy observation while driving and starting.

Bleed the system to get all the air out of the newly installed line, and when you know the engine will be hard to start, monitor the line before, during, and after starting, and even driving, to determine if air ever gets into the pump.

Be sure to drive the truck even if you don't see air under no start or no load conditions, as air can be ingested intermittently from various sources only when the engine is under load.

The hose under the wiper allows you to drive and diagnose the air situation under any and all circumstances you like, to see when it does or does not happen. This test positively tells you that you DO or DO NOT have an air issue which can be very important when diagnosing the VP44 fuel system.

If you do have air in the clear line, run the engine from a can of diesel in the bed of the truck with a rubber hose stuck in it, connected to the inlet of the Lift Pump, and do the same test under the same conditions that saw air in the fuel, again.

If the air goes away, the problem is behind the Lift Pump.

If it is still there, the cause is forward of the inlet of the Lift Pump. This can be the Lift Pump itself, if it is a Fass with a leaky o-ring inside, leaking sealing washers, the water drain seal on the filter canister, or it can be leaking o-rings on the "Fuel Tubes" in the cylinder head.

This last one is cool, as it shows its symptoms in a very unique way. If you park the truck facing up hill, overnight, on a fairly steep grade, it will start hard the next morning, but if you face it the other way on the same hill overnight, it will start fine! This is because of fuel drain back, and air getting into the system through leaky fuel tube o-rings and going to the highest place in the fuel system. When it faces up hill, the air goes into the fuel filter. When it faces down hill, it goes to the fuel tank! Call me if you need more help determining where the air is coming from.

MAP SENSOR, KEY ON SIGNAL VOLTAGE, TEST ONE:

The ECM wants to only see MAP signal voltage on 1998 - 2000 trucks between .5 and 1.74 volts and 1.0 to 2.2 volts on 2001 - 2002 trucks. These voltages are the same for a Freightliner or a Ford. If the MAP signal voltage at the sensor on the grey wire with a red tracer on a Dodge, or the MAP signal wire on other trucks, is low to start with, this can cause this symptom, and typically sets a 237 code.



To be sure this isn't the cause of low power, check the signal voltage with the key in the "on" position and the engine NOT running.

If it is lower than the lower voltage above, it is RARELY be due to a bad MAP or BOOST sensor, but more likely it is because the truck has a device on it that attaches to the MAP sensor harness, like a timing box, performance device, or electronic gauge component, that draws the supply voltage down below the desired parameters.

To determine if one of these components is the cause of the low voltage, disconnect the wires of the device(s) from the engine's MAP sensor harness. You can't just turn it (them) off to see if the problem goes away because any device connected to either the 5 volt supply wire or the signal wire at the MAP sensor can draw either voltage down, even if the add-on device isn't turned on.

If the MAP signal voltage is still lower than spec after disconnecting the device(s), the devices are NOT to blame.

Then check the plug of the sensor with the key on, looking for a 5 volt supply. If it is less, then you have to look at the ECM output voltage, as rarely an ECM can cause erratic low or high supply voltage to the sensor, which of course causes low or high signal voltages.

Look at the ECM section below to address that problem. If you have good supply voltage to the sensor, but the signal is too low still, you can do my "enema" fix before buying a MAP sensor. That is to remove the sensor, plug it back into the factory harness, turn the key to on and read the signal voltage while you push on a little screwdriver in the hole of the sensor.

When you push on it the voltage will go up, and when you let go it will come down.

What you need to do now is keep pushing a little harder each time you push, and sooner or later you will actually bend the diaphragm inside the sensor and the low voltage will be higher the more you bend the diaphragm.

Take your time doing this as you can't unbend it! Stop when the low voltage is just at or above the specs for your year truck, and the ECM will be happy to command fuel when it should.

If the voltage is way too high, two things will happen. One is the ECM will get grumpy and defuel the VP44 when it sees too high a voltage at the high end, and two, if you have an electrical boost gauge, it will lie optimistically. So patience is a virtue here. The worst thing you could do here doing this, is ruin a bad sensor, and you will have to pay for a new one!

**IF KEY ON VOLTAGE IS HIGH ENOUGH,
THEN DO TEST TWO:**

Remember that the ECM wants to only see MAP signal voltage on 1998 - 2000 trucks between .5 and 1.74 volts and 1.0 to 2.2 volts on 2001 - 2002 trucks.

If the signal voltage is outside of these parameters, a code 234 or 237 may be set, but for sure the ECM will cut back fuel delivery commands to the VP44 and make the engine run in a de-rated or "Limp" mode.



To do this electrical test, make an extension wire connected to the grey with a red tracer wire, or MAP signal wire, at the sensor go up to any kind of voltmeter on the dash of the truck and DRIVE THE TRUCK.

You should see close to 1.74 volts on 2000 and older trucks, and close to 2.2 volts on 2001 - 2002 trucks when driving under hard load and high RPM, with NO power enhancement devices plugged in. If the voltages are within limits, then monitor the MAP signal voltage AT THE SAME PLACE ON THE FACTORY HARNESS, with the device(s) back in the system, and if still OK, then the MAP sensor or circuit is NOT the cause of Doggy on Take Off, and you have bad computer on your VP44. This is usually worse when cold, right after start up, in the morning.

CONTAMINATED FUEL AND ALTERNATE FUELS

Lastly, is the internal Injection Pump damage caused from using any kind of WVO, more than 5% Biodiesel or contaminated pump fuel. The resulting corrosion causes the close tolerance parts inside to gall, seize or stick and cause drivability complaints, such as a low or high speed skip, low power cold, low power always, or no start. These problems can rarely be cured by some sort of fuel additive being put in the fuel AFTER the problem is observed.

These corrosion problems are the most common reason Bosch denies a warranty claim. Most often if there are drivability issues due to contaminated fuel, ALL the internal parts of the injection pump will be ruined and have to be thrown out, which usually means the pump is not worth rebuilding, and possibly not even eligible to be a core! These situations are so hard for me to deal with and explain to customers, because typically they don't know they have a contaminated fuel issue until too late, when we open up the pump for warranty consideration, failure diagnosis, or repair.

HOW TO DIAGNOSE INDIVIDUAL COMPONENTS OF THE VP44 FUEL SYSTEM TO SEE IF THEY WORK CORRECTLY!

To test an APPS SENSOR to see if it is working properly, follow the directions exactly under "Dead Pedal."

The only way to diagnose an INJECTION PUMP is to read above. Don't forget you only need one symptom to condemn the injection pump! I get a few calls each month telling me they think it can't be the pump because when it runs it runs fine, or it ran when they shut it off. Oh...if only this were true!

To test an ENGINE CONTROL MODULE on the engine is impossible. The only way I know of to test an ECM is to swap it out with another to compare the operation of each one. As they fail very infrequently and ALL of them that I have found to be bad, have had at least one of the symptoms described above in the "RPM GOES UP ON ITS OWN OR WAIT TO START LIGHT IS DUMB...." section, I feel you can be very confident it IS a bad ECM if you have any ONE of the unique symptoms described above. A 606 code, MAY add credibility to your diagnosis.

A MANIFOLD AIR PRESSURE SENSOR, OR MAP OR BOOST SENSOR can be determined to be good or bad by doing the "Doggy on Takeoff....." tests above.



Don't forget to check the supply voltage at the sensor, because if the supply voltage is low or high, the signal voltage will be low or high too!

INJECTORS can be accurately tested by removing them and having a qualified shop test them for pop off pressure, spray pattern, and fuel volume, to determine if they are within tolerance or very close to all being the same, which is what you want. If you have a skip at idle or at a specific RPM, and think it might be an injector, which is VERY VERY RARE with OEM injectors with up to a million miles on them, and can dependably demonstrate and maintain the RPM AND THE SKIP, loosen one injector line at the valve cover at a time with the skip occurring and when you crack a line where the RPM or sound doesn't change as much as another, THAT may be the problem injector. To be sure if it is the injector, and not some other mechanical gremlin, swap that injector with the one next to it and retest. If the problem moves it IS the injector. If the problem stays with the same cylinder it is NOT the injector. If you have what I call a rolling skip, I mean one that seems to be one cylinder this time tested, and another next time, or is not clearly the same cylinder every time its line is loosened, that always means a bad injection pump, in the VP44 fuel system, if it is NOT air.

IF YOU DON'T NEED AN APPS, AND YOU HAVE DEAD PEDAL SYMPTOMS, YOU FOR SURE NEED A VP44!

If you don't have access to a scan tool, or more importantly, an analog voltmeter, and want to trust my experience, let me explain the difference in symptoms between a bad APPS and a bad computer on the Injection Pump. A bad APPS usually is just a flat spot at a certain throttle opening, usually 65-70 MPH, and smacking the pedal to the floor a few times, usually clears it up. If pushing the throttle just a bit more makes it take right off, or if going back to a lesser throttle opening makes the engine run fine, then it is most likely a bad APPS. This usually occurs most frequently, but not always, in cold and or wet conditions. If it is caused by the computer on the VP44, the Dead Pedal or power drop occurs at ALL throttle positions and power comes back only if you let the throttle pedal go to idle for a brief time to re-establish Idle Validation and reset the computer, or push the clutch in, or shut off and restart the engine, or just wait. This kind of Dead Pedal happens most often hot or towing, but sometimes when cold.

A great resource for wiring diagrams, connector locations, and general electrical and general diagnostic help, can be accessed from ALLDATAdiy.com for a truly reasonable price.

Blue Chip Diesel

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