SOLVING INSUFFICIENT FUEL PROBLEMS

Similarly, shutting off the fuel pump during a collision might be a function of a collision-related module. So, diagnosing a cranking, no-fuel or insufficient fuel condition on modern vehicles can be a challenge. In any case, let’s start with the basics.

CRANKING, NO-FUEL
Let’s begin with the familiar cranking, no-fuel condition. The simplest method of diagnosing a no-fuel condition is to judiciously spray a small amount of throttle body cleaner or propane into the throttle plate as the engine is being cranked. If the engine momentarily starts, the cranking, no-start complaint usually lies with the fuel delivery system.

Most Powertrain Control Modules (PCMs) prime the fuel injectors by activating the fuel pump relay for about three seconds as the ignition is turned on. The PCM then deactivates the fuel pump relay and waits for the starter motor to activate. As soon as the starter activates, the fuel pump relay is again activated. Once the engine starts, the crankshaft position (CKP) sensor signal tells the PCM to keep the fuel pump relay activated.

In most cases, an activated fuel pump should be audible. If the fuel pump is audible, make sure that the fuel tank contains fuel. If the fuel level sensor is defective, a DTC should be stored in the PCM. If in doubt, add several gallons of gas to ensure that the fuel pump is immersed in fuel.

When diagnosing an inactive fuel pump, don’t forget the simple things like checking the fuel pump fuse with a voltmeter. Similarly, check the owner’s manual to see if the vehicle is equipped with an inertia switch that might have accidentally been tripped. If the fuel pump isn’t audible, a standard diagnostic technique is to rap the fuel tank with a soft-faced hammer. If the pump activates, the pump either has a bad connection at the tank or has worn commutator brushes. In this case, the fuel pump should be replaced and the appropriate wiring harnesses inspected for electrical arcing or corrosion.

DIAGNOSTIC CODES
With a few systems, if the PCM or immobilizer module can’t identify the ignition key, the PCM simply won’t activate the fuel pump. Because I’ve had no-fuel conditions caused by something as simple as a resistance chip falling out of the ignition key, I always begin each cranking, no-fuel diagnosis by checking for DTCs. In this situation, a DTC indicating an ignition key identification problem will be stored. In other cases, an immobilizer code might be stored. In general, anti-theft or immobilizer codes must be resolved before proceeding with a cranking, no-start diagnosis.

FUEL PRESSURE ISSUES
If scan tool data indicates a fuel pump duty cycle value, you might find yourself dealing with a pulse-modulated fuel pump system. Because many pulse-modulated systems use a dedicated module to control fuel pump operation, it’s vitally important to use a scan tool and apply application-specific service information to diagnose these systems.

In brief, the PCM helps control the air/fuel ratio on these systems by modulating fuel pressure. Fuel pressure is modulated by changing fuel pump speed. A pressure sensor is located in the fuel rail to monitor the difference between commanded and real-time fuel pressures. When the commanded and real-time values don’t correspond, a DTC might be stored in the PCM. All testing on these systems must be done by using a professional scan tool and following the service information. Most of these systems don’t have a Schrader port for a fuel pressure gauge because fuel pressure isn’t a fixed value in these systems.
Conventional fuel pump systems incorporate a vacuum-modulated fuel pressure regulator that, at high vacuum levels, modulates fuel pressure to at least 10% less than the key-on, engine off value. Many modern fuel systems integrate a fixed-value pressure regulator into the in-tank fuel pump module. With that said, it’s extremely rare for a fuel pressure regulator to cause an insufficient fuel condition.

Testing fuel pressure with a mechanical gauge should include a volume test. While a delivery rate of several pints per minute is a rule of thumb, always check service information for published values. In some cases, the volume is more accurately measured at a disconnected fuel pressure regulator return line. If volume isn’t sufficient, check the fuel filter and fuel lines for restrictions before replacing the fuel pump.

FUEL PUMP RELAYS

In some applications, a professional scan tool can be used to activate the fuel pump relay. Please notice that I said “fuel pump relay” and not “fuel pump.” If this bi-directional feature is available, the activation of the fuel pump relay can be determined by hearing the relay click as it activates or by simply touching the relay to feel the contacts close.

If the scan tool can’t command the fuel pump relay on, or if the contacts don’t close, several aftermarket manufacturers offer relay diagnostic tools that allow the relay terminals to be tested. In some cases, the terminals can be jumpered to activate the pump. If in doubt, replace the fuel pump relay with new or known good. If it’s a high-mileage vehicle, it’s a good idea to replace the relay along with the fuel pump.

If the scan tool won’t communicate with the PCM, follow the steps outlined in the scan tool’s help screen or operator’s manual to test the diagnostic link connector (DLC) for power and ground to the PCM. If a generic scan tool is available, connect it to verify a no-communication problem with the PCM.

In addition, check the PCM fuses and, as a last resort, pin-test the power and ground connections at the PCM itself. Keep in mind that the PCM, not the ignition switch, operates the fuel pump through the fuel pump relay. In addition, the PCM relay must power up the PCM before the PCM can activate the fuel pump relay. If power and grounds are correct, the PCM might be defective. If communication can’t be established with the PCM, the PCM itself might be defective.

FUEL DELIVERY PROBLEMS

While it’s a rare condition, a fuel pump can deliver the correct pressure and volume even as the engine lacks sufficient fuel to start and/or run. In this case, inspect the air intake ducting for leakage between the mass air flow (MAF) sensor and throttle plate. On older imports, the fuel pump can be activated by a mechanical switch located in the mechanical air flow meter. In both mechanical and full-electronic applications, a leaking duct will cause the MAF sensor to starve the engine for fuel during start-up.

In equally rare cases, a mis-calibrated manifold absolute pressure (MAP) sensor might indicate a much higher intake vacuum than what exists in the intake manifold and cause the PCM to miscalculate the air/fuel ratio. Similarly, the engine coolant temperature sensor (ECT) circuit can be shorted to voltage, causing the ECT data to indicate 300°F engine coolant temperature. Either case will cause an insufficient fuel or cranking, no-start condition.

DIAGNOSTIC TROUBLE CODES

Insufficient fuel delivery at highway speeds generally results in a P0171 DTC (lean, bank one) and a P0174 (lean, bank two). In either case, a DTC is generally stored when positive long-term fuel trim values approach 25%. In addition, freeze-frame values will be stored along with the DTC.

Because only slight differences exist between freeze-frame data generated by insufficient fuel delivery and data generated by a sensor-induced miscalculation in fuel delivery, it pays to spend some time looking at the applicable freeze-frame values. If, for example, the freeze-frame values indicate that the DTC occurred at wide-open throttle (WOT) at 3,500 rpm and that the oxygen sensor voltages were less than 500 millivolts when the DTC was stored, it’s possible that the fuel filter is clogged or the fuel pump delivery rate is marginal.

If, on the other hand, the “calculated load” value in the scan tool data stream is less than 80% at WOT, the MAF sensor might be miscalculating airflow into the engine. In most instances of low calculated load values, the MAF is out of calibration or it’s dirty or clogged with debris.

I mention using the calculated load value because it’s easier to use than the grams-per-second value. While calculated load values vary among applications, it pays to track those values so that a relationship can be developed between normal and abnormal values. Last, an insufficient fuel condition can be created by the driver filling the fuel tank with E85 ethanol gasoline. If the vehicle isn’t designed for E85, the fuel injectors can’t flow enough fuel to create the desired air/fuel ratio. In other cases, gasoline contaminated with diesel fuel might cause the same effect. And, while we’re at it, it still might be possible that the fuel injectors are partially clogged from using old or inferior-blend gasoline. Clogged fuel injectors are a long shot, but one that must be always considered when diagnosing insufficient fuel problems.