AIRTEX® ENGINE MANAGEMENT COMPONENTS
Counter Point
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THE ELECTRONIC, DIAGNOSTIC AND DRIVEABILITY RESOURCE.

Evaporative Emissions Systems Part Two

An EVAP-approved smoke machine can make short work of system diagnosis and repair.

In the last *Counter Point* (Fall 2004), we gave you an overview of evaporative emission (EVAP) system operation and explained how OBD II monitors these systems to prevent the uncontrolled release of unburned hydrocarbons into the atmosphere. We also alluded to the fact that these systems may not work perfectly for the life of the vehicle. When or if they fail, OBD II is right there to let the vehicle owner (and you) know that a problem exists. To correct that problem and get the vehicle back on the road quickly and efficiently, you're going to need a strategy. The following is a basic outline that should serve you well:

- Retrieve and record all diagnostic trouble codes (DTCs), freeze frame and/or failure record data before erasing any DTCs.
- Consult your reference material to determine the manufacturer's definition of the DTC.
- If the DTC has flagged a leak in the EVAP system, find out if it's a hard code. Is the system leaking now?
- If the DTC indicates a current EVAP system leak, perform the necessary leak detection procedures to find and fix the leak.
- If the DTC has flagged a circuit or component DTC, perform the necessary circuit tests to complete your diagnosis.
- Clear the DTC(s) and operate the vehicle under the same freeze frame data conditions that originally set the DTC.
- Make certain the system has been properly repaired and has not set a memory DTC.

Remember, OBD II tests for more than shorts and opens in the component wiring. It also tests to determine if the EVAP system is performing properly. The stored DTC can be misleading. For example, if the purge valve is stuck open (allowing vapor flow at all times), the PCM may set a rich mixture DTC. And if the PCM does not see the expected change during self-testing, it may set a no-flow DTC.

Handling EVAP Leak DTCs

Determine whether the system is leaking now. You have a DTC and freeze frame data indicating a fault occurred in the past, but is the EVAP system leaking now? Is there any benefit in driving the vehicle to get it to run the monitor again? *Remember, it already failed at least twice, to turn on the MIL.*

Check to see if the gas tank is full. If it's full or nearly full, the PCM may not run the required tests, and gas cap or filler neck leaks may be masked. Most vehicles built since 1999 have on-board refueling vapor recovery (ORVR), which traps the fuel vapors exiting the tank during refueling. When the tank is full, the floating check ball at the end of the gas tank filler pipe seals off the filler pipe and a gas cap leak may not be evident.

Many resourceful technicians have developed ways to manipulate EVAP systems to seal and test them for leaks. *You're dealing with potentially explosive HC vapors, so don't do anything that could cause ignition.* That means no smoking, grinding, cutting, torching or any other type of flame or spark.

The pressures needed to test the system are extremely low and are measured in inches of water. Most EVAP testing is done at either a pressure or vacuum measuring about 7 inches of water, which is equivalent to approximately .270 psi. For reference, it takes more pressure to blow out a match.

Other EVAP Leak Test Equipment

OE dealer techs have had equipment for testing and locating leaks on EVAP systems since the systems first appeared. They're not usually found in aftermarket repair shops. To fill the void, several independent tool companies have developed testing devices for the aftermarket. Always use equipment designed expressly for EVAP systems, since you're dealing with a flammable gas.

All vehicle makers but one require inert gas for EVAP leak-testing and all EVAP-approved aftermarket smoke machine suppliers also strongly urge you to always use inert gas for EVAP leak tests. Nitrogen is the most commonly used inert gas.

EVAP-approved machines produce a specially developed nontoxic smoke that won't harm the activated charcoal inside the EVAP canister. They operate at a precisely controlled pressure that's not user-adjustable. Traditional general-purpose smoke machines produce about 1.00 to 1.50 psi. An EVAP-approved smoke machine's

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Fine Tuning

Fine Tuning questions are answered by Mark Hicks, Technical Services Manager. Please send your questions to: Mark Hicks c/o Airtex Engine Management P.O. Box 70, Fond du Lac, WI 54936-0070 or e-mail him at mhicks@airtexproducts.com. We'll send you a golf shirt if your question is published. So please include your shirt size with your question.

Q: I am working on a 2000 Dodge Durango with a 4.7L engine that is setting a DTC P0171. The engine is running very rich, with tons of black smoke coming out of the tailpipe. The fuel trim is at its maximum rich limit of +25% and the O_2 sensor is stuck on a very low voltage level. After replacing the O_2 sensor the engine runs fine for a while, but then slowly returns to this same condition. I have replaced the O_2 sensor on this vehicle several times in the past six months. The last time I replaced the O_2 sensor I noticed some kind of oil inside the connector.

Jim Grady
Grady's Auto
St. Louis, MO

A: A DTC P0171 indicates that bank 1 is running extremely lean and the long term fuel trim (LTFT) reading at +25% confirms that the PCM is attempting to compensate. At +25%, the PCM has ordered the injectors to remain open as long as possible. If the engine doesn't need this much fuel, it would explain the black smoke situation you are experiencing.

If the engine doesn't need the added fuel, why would the O_2 sensor say it was running extremely lean? And why did replacing the O_2 sensor temporarily resolve the problem? The interesting part of your symptom explanation is that you noted seeing some sort of oil inside the connector to the O_2 sensor. My first thought was that someone was pouring oil into the engine and spilled some onto the O_2 sensor connector. Perhaps this oil then seeped into the connector, creating resistance and causing a low voltage output.

Before I committed to this conclusion, I did a little research on the problem. It appears that Chrysler has had some problems with their power steering pressure switch. Yes, I said power steering pressure switch. Remember, in the '80s when GM had a problem with antifreeze wicking down the coolant temperature sensor wire and contaminating the computer? The same thing is happening here, except it is power steering fluid, not antifreeze. The defective power steering switch leaks fluid into the wiring harness. From there the oil wicks through the wiring and some of it ends up at the O_2 sensor.

The power steering switch is mounted on the power steering high pressure line. Pressure in this line can exceed 500 psi. With that much pressure behind it, it doesn't take long for the oil to move through the wiring harness and end up in some unexpected (and unintended) places. When repairing this problem, power steering switch and wiring harness replacement is recommended.

Results: The power steering switch and wiring have recently been replaced with no further driveability problems.

In the last *Counter Point* issue, we had a question from a technician who was dealing with a howling sound from the air intake on a 1998 Ford Explorer with a 4.0L engine. We have received more responses to this question than to any other that has previously appeared in *Counter Point*. We have also received more correct answers than ever, including

Quality Points

OE Quality... Or Better!

The Airtex Engine Management quality commitment is to produce components that are of original equipment (OE) quality or better. It's time to show our readers some of the ways we have actually *improved* on the OE design. Beginning here and continuing in the next few issues of *Counter Point*, we will show you several different improvements we have made to change trend failures into "never failures."

The following design change was made a number of years ago, but we thought it still deserved recognition today. Remember the days when it seemed every other Ford vehicle in the shop was there because it was running extremely rich with billows of black smoke out of the tailpipe? The problem was so common that you almost immediately knew the cause. That rectangular MAP sensor on the firewall usually needed replacement, right? Right!

The problem was that you were replacing a defective component with another that was destined to fail in exactly the same way. When any type of backpressure built up in the system, the vacuum connection inside the MAP sensor would blow apart. The backpressure could have been caused by a backfire, a restricted exhaust or something else. A damaged OE MAP sensor is shown in *Figure 1*.

After the MAP sensor was damaged, it could no longer report the manifold pressure reading to the PCM. Under these conditions, the PCM would respond to the absence of any vacuum signal by commanding the injectors to supply enough fuel for wide open throttle (WOT). The engine couldn't possibly burn the oversupply of fuel, causing the heavy black exhaust.

To overcome the shortcomings of the original design, Airtex Engine Management updated the circuitry to incorporate faster, more intelligent chips. The pressure sensor is also adhered to the vacuum connection, eliminating the trend failure of the original design. Airtex Engine Management MAP sensor is shown in *Figure 2*.

At Airtex Engine Management, we not only equal the reliability and performance of the OE component, we exceed it! AIRTEX

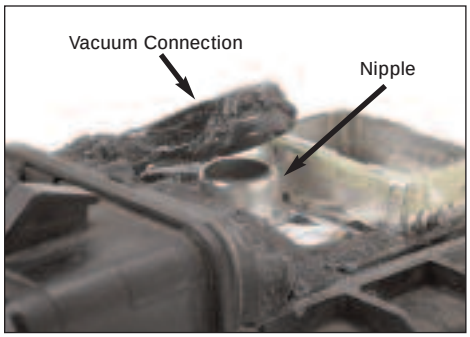

Figure 1 The vacuum connection on this OE MAP sensor has broken and separated due to abnormal backpressure.

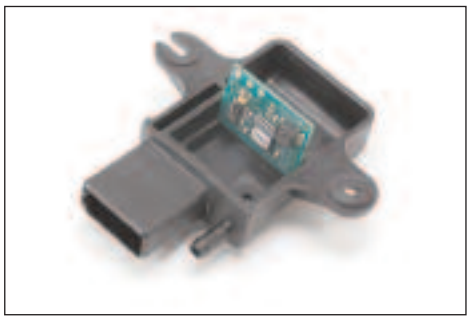

Figure 2 A non-potted, partially assembled Airtex Engine Management MAP sensor, with board tilted to reveal ICs.

several great explanations of the cause of the problem. You may see part of your answer contained in the following information.

The air intake system on this vehicle is similar in form to a trumpet, but perhaps more like a trombone. As the intake air control (IAC) begins to wear out, the inside pintle will not always completely close. This allows a small amount of rushing air to leak past it and cause the howling or honking sound. The fix for this problem is to replace the IAC; cleaning it may temporarily decrease the honking but it will quickly return.

The first correct answer received by mail was:
Billy McCart
AutoZone 173
Gallatin, TN

By e-mail or fax:
Gary Hingerton
Miami Dade Schools
Miami, FL

Ken Dornacher
Krafftkare Automotive
Bellwood, IL

Diagnose The Problem Win A Shirt

Q: I am working on a 2000 Toyota Tacoma 4x4 with a 3.4L 24-valve engine and manual transmission. If accelerated very slowly, the engine speed will usually pick up to a high RPM. But if it is accelerated normally, the engine hesitates badly and falls flat on its face. The engine idles pretty well, although it may have a slight lean misfire at times. No misfires show up on the scan data.

I have bench-tested the O_2 sensors for response. I have also checked fuel pressure at idle and under acceleration. It always holds within the 38 to 44 psi spec. I have checked the TPS for dropouts, and it looks fine. I have checked a couple injectors on a flow bench, and they are passing fuel within specifications.

The engine sounds like it has a spark knock at all times, even when cold. The knock sensors are reporting the knock and the PCM is retarding the timing, but the spark knock is still audible. The only way to stop the noise is to add octane booster to the fuel.

If you have the answer, we'd like to hear from you. Use the following contact information:

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Evaporative Emissions Systems - Pt. Two

regulator keeps operating pressure within 13 to 14 inches of water (.47 to .51 psi). The automakers specified this nonadjustable pressure control to minimize the risk of damaging the EVAP system. Excessive pressure could also create a false leak or force open a valve that's supposed to be closed.

Leak Checking

Enhanced OBD II systems may set a DTC P0442 or P0456 (.040- and .020-inch leaks, respectively). To confirm that these leaks actually exist or to confirm a repair without the hassle of running an EVAP monitor, a quick test is required. Turn the key ON, engine OFF. The purge valve is already closed because it's normally closed. All systems need a device to close off the air inlet vent and seal off the EVAP system. There's also a purge control device that opens the EVAP system to the intake manifold.

The smoke produced by EVAP-approved smoke machines includes a UV dye that leaves a fluorescent deposit at the leak. (photos courtesy Vacutec)

When testing the EVAP system in a Ford vehicle, the PCM has an output test that can be run with a scan tool to turn on all the solenoids and relays (except the fuel injectors). If you plan to use a scan tool to close the vent solenoid, unplug the vapor management valve (VMV) to keep it from opening. Chrysler uses a leak-detection pump on many systems. Unlike Ford and GM who use vacuum, Chrysler tests its system for leaks using pressure. The leak detection pump (LDP) uses manifold vacuum and a solenoid to stroke a diaphragm against a spring to create the pressure needed to test the system. When the solenoid is energized and the diaphragm is in the UP position, the vent is closed. Consequently, you'll need a vacuum source as well as a means to energize the LDP to close the vent and seal a Chrysler system. General Motors has a System Seal command that will close the vent solenoid.

After the system is closed up, connect an EVAP-approved smoke machine to the EVAP system's service port or the appropriate test point. Select the desired "checkpoint" on the smoke machine (.040 or .020 leak) and watch the ball inside the flow gauge. When the ball comes to rest, slide the red flag on the flow gauge alongside the ball. The flag's position now marks the actual flow caused by the .040 or .020 leak.

Next, move the smoke machine control to the TEST position, fill the EVAP system with nitrogen and watch the flow gauge again. If the ball drops below the red flag, there's a leak but it's smaller than your checkpoint. If the ball remains above the red flag, this is a serious leak that will trigger a DTC because it's greater than the checkpoint. If the little ball hangs high, start pumping smoke into the system and look for smoke signals or a UV dye deposit somewhere. However, if you fill the system with nitrogen and the flow gauge ball drops to zero, the system is tight — no nitrogen is flowing. The higher the gauge ball rises, the larger the leak.

Many EVAP systems allow you to command the solenoid ON and OFF (valve closed or open) with your scan tool. Pump smoke into the system, then operate the vent solenoid with the scanner. When the scanner says the vent is open, smoke should pour out of the vent in the rear of the vehicle.

When the vent solenoid is open, the flow gauge ball should jump up, indicating flow. When you close the vent solenoid, the smoke should stop flowing out of the vent and the ball should drop to the bottom of the flow gauge, indicating no flow. Open and close the vent solenoid valve 10 to 15 times while watching the flow gauge. The valve may intermittently stick or hang up during this test. Replace it if it sticks even once.

If you don't have a smoke machine, an exhaust gas analyzer can also be used to locate high HC levels near EVAP leaks. You'll find more information on EVAP systems and this testing method on the Airtex Engine Management *Counter Point* website at ww.airtexproducts.com.

When No Leaks Are Found

There are a number of reasons why the system might not appear to be leaking when you test. The gas cap might be bad or may have been left loose. The gas tank may be too full to run an accurate test. Some leaks seal up when the temperature increases, so you may need to retest the vehicle when it's cold. If the gas tank was too full, have the customer return after he drives it long enough to to burn the excess fuel.

There aren't many other options for EVAP diagnosis if the vehicle is not leaking when it reaches your shop. If the system has detected a leak (stored a DTC), but you can't detect a leak at the moment, record the data, clear the DTC and talk to your customer. Let him run the EVAP system drive cycle to see if the problem returns. AIRTEX

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Hot off the Wire

Recycling Award

The Airtex Engine Management distribution plant in Centerville, IA is one of eight Iowa businesses to receive the 2004 Iowa Recycling Award for Excellence. This award recognizes companies for their use of cutting-edge solid waste handling and recycling practices.

All Airtex Engine Management facilities are ISO 14001 environmental certified. One of the goals of this certification is to make continuous improvements to recycling processes. Our distribution plant set a goal to reduce its landfill waste by 10 percent over a two year period. Thanks to very creative thinking, Centerville was able beat that goal by 19 percent within the first year.

Airtex Engine Management – working smarter today for a better tomorrow! AIRTEX

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