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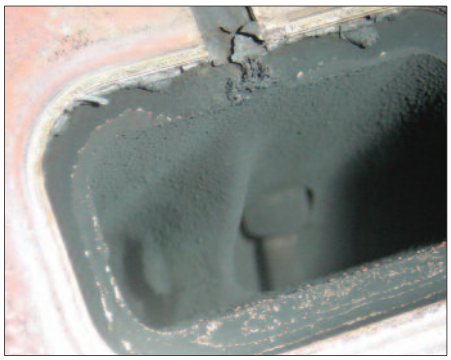
THE ELECTRONIC, DIAGNOSTIC AND DRIVEABILITY RESOURCE.

Stratus Head Case

What's wrong with this picture? It may seem obvious now, but not so much with the engine assembled.



This issue's case study was contributed by Pete Meier.

This diagnostic episode concerns a 2005 Dodge Stratus with a 2.4L engine (vin J) and an automatic transmission. The MIL is on, and a DTC P0491 (air injection system performance) has been stored. The car only has 39,000 miles on the odometer and is very clean. After checking for applicable TSBs, and finding none, I pulled the trouble code description to better understand how the code was recorded.

The air injection system feeds extra air into the exhaust when the engine is cold to more quickly heat the catalytic converter and bring it on line. This code is recorded when the PCM detects too little or too much airflow through the system, and is monitored with the engine running and the air injection pump commanded on.

A dedicated MAF sensor is located on the intake side of the air pump assembly to provide feedback to the PCM, and it is this feedback that is a primary consideration in the PCM's decision to turn on the MIL. DTC P0491 is a two-trip code. As a side note, this system does use feedback from the oxygen sensor as well, but this input only confirms a no-flow condition and not a partial-flow fault.

Freeze frame information didn't tell me which way the system had failed. This was a hard fault, and not an intermittent, because the "Good Trip" counter was still at "0." How best to proceed with my diagnosis?

I structure my diagnostic procedure to mimic what the PCM is doing as much as possible. In the case of the P0491, the PCM commands the air pump relay on, which in turn powers the air pump motor. Air is pulled through the filter, then the MAF sensor, before exiting the pump. From there, the air flows through a tube to a one-way valve located above the exhaust. This code occurs when the PCM knows it turned on the pump and didn't see the airflow it expects to see – either high or low. The pump only runs when the engine is cold, and for about 20 seconds or less.

The car was cold when I got it, which made my choice of diagnostic approaches a little easier. I decided to hook up my scope to see the system in actual operation. I could verify all I wanted in a few screen shots. Using three channels, I connected the scope at the following locations:

The PCM relay control wire. Connecting here tells me the PCM was commanding the system on. This pin provides the power to the air pump relay. This is the gold trace you'll see in the capture in Figure 1 on page 3.

The MAF signal wire. Connecting here tells me what the MAF was telling the PCM. This is the red trace in Figure 1.

The pump power wire, before the relay. Connecting a current probe here tells me the pump was running, and is the green trace in Figure 1.

This first screen capture (Figure 1) was taken with the system connected as it should be. The gold trace shows the PCM is indeed sending the power to the relay, and the pump current pattern shows the relay is engaged and the pump is running. MAF increased only slightly, however, to just under 1.0 volt.

Could the MAF be reading incorrectly, or is it possible the correct reading wasn't reaching the ECM? Could it be a restriction to airflow in the plumbing?

I disconnected the air tube at the one-way valve and tried again. Luckily, there was enough "cold" engine to run the test one more time. The pump didn't run as long this time, but the increase in the MAF signal led me to believe the change was due to an air restriction.

I removed the one-way valve for a visual inspection. How did the valve get so corroded (Figure 2)? And why is the current flow on the motor higher with the restriction removed? While there is no specification, 34 amps had to be too much. The car was "new" to our customer, but I suspect water had intruded into the pump somewhere in this car's past. I shared my

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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 Wells Vehicle Electronics, P.O. Box 70, Fond du Lac, WI 54936-0070** or e-mail him at **technical@wellsVE.com.** We'll send you a very nice Wells golf shirt if your question is published. So please include your shirt size with your question.

Q: I have been pulling my hair out for a week while working on a 2006 Dodge Stratus with a 2.7L engine and about 60,000 miles on it. It is setting a code P0720, but this is just a small part of the problem. When the engine is idling but the vehicle is not moving, the speedometer will jump and move as if the vehicle is moving down the road. The engine RPM will also increase along with the speedometer movement.

I have replaced the transmission speed sensor, the transmission wiring harness, the PCM and have checked for TSBs. I have the factory scan tool and have checked every circuit thoroughly. Regardless of everything I have done, the problem persists. Can you help?

David Jameson
Jameson Repair
Denver, CO

A: Please keep this thought in mind if you are diagnosing an issue like this and all you end up doing is hitting brick walls. The year is 2012; the computer and the age of communication are here to stay. You should have two tools at your fingertips that you know how to use. These tools are a computer with an internet connection and a telephone. If you haven't considered these tools by now, you need to step up and pull yourself out of denial.

There are many no-cost telephone calls you can make to manufacturer helplines. The reason they are there is to help you through just about any problem. Make a list of these phone numbers, keep it by the phone, and most importantly, use it.

If you have trouble working your way around a computer, ask someone for help. Your children or grandchildren are probably more than willing to help you get started. You learn how to use a computer by using it, and yes, at times this means making mistakes. But you are not going to kill the computer, so stop making excuses. There is a wonderful informative world out there and you need to be a part of it. It needs you to be a part of it!

Within five minutes of the call David made to our tech line, his question was answered. Remember, he had spent more than a week of frustration prior to making that call. Where did we find the answer? On the internet, of course, on a very helpful website run by Identifix.

David was told to check for excessive AC voltage from the alternator and guess what? The spec is no more than .5 AC volts and he was reading nearly 8 AC volts. He replaced the alternator and the problem was solved.

Let me close with this. Perhaps you find it difficult to justify the time and money spent on learning. Perhaps you need to adjust your thinking. What is a week's worth of work worth to you?

Last issue's *Fine Tuning* question concerned a 2004 Ford Mustang 3.8L, VIN 4. The Check Engine light (CEL) is on, and a DTC P0340 (camshaft position sensor circuit malfunction) has been stored in memory. The cam sensor was replaced and the code cleared. However, the CEL popped back on during a short test drive and the P0340 reset. A second cam sensor replacement yielded the same result. The reader wondered if he needed to install an OE sensor or if something else could be wrong.

A: This cam sensor produces an AC wave signal. This is the same type of signal, at a different frequency, that the alternator generates, before the signal goes through the diode bridge and rectifier. If a diode in the alternator is failing, the vehicle's charging and electrical system will be subjected to unwanted AC voltage ripples. These unwanted signals can find their way into the computer system, either through the charging system or through inductance. When this occurs, algorithm confusion can take place in the on-board computer system, causing the computer to illuminate the CEL and store a trouble code. To verify this is the issue, disconnect the alternator, clear the code and go on a short test drive. If the code does not return, the alternator is the cause.

Result: Jim disconnected the alternator and the code did not return. He replaced the alternator and the problem was solved.

The first *CounterPoint* readers with the correct answer to this diagnostic question were:

Tim Heiden
Tim's Auto Care
Freeport, IL

Gary Lipschutz
Tires Plus
Philadelphia, PA

Diagnose The Problem Win A Shirt

I am working on a 1997 Ford F150 with a 4.2L engine. The engine runs great at idle. When accelerated to around 1000 RPM while power braking, cylinder number 5 misfires. I have checked cylinder number 5 and it never loses spark. I have changed the fuel injector and even moved the new injector to a different cylinder and installed a known good injector into cylinder 5. I have also checked both cranking and running compression and it looked good. The vacuum gauge is steady so the engine appears to be mechanically sound. What could be causing this misfire?

Steve Ayers
Ayers Auto Electric
Wrightsville, PA

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My Hot Links

Follow Wells Vehicle Electronics on:

In this space, we provide addresses of helpful websites we've encountered during our travels on the internet. We hope you find these links to be of value.

OBD-II Diagnostic Trouble Codes
www.obd-codes.com
If you type "P0440" in a Google search, this is the first site listed in the search results. This site provides DTC definitions, forums, as well as links to Wells Vehicle Electronics videos.

Wells Vehicle Electronics on YouTube
www.youtube.com/user/Wellstech
The videos found here are brought to you through the efforts of the Wells Technical Services Department. It is our goal to bring you comprehensive automotive diagnostic and repair information you can put to use today. WELLS

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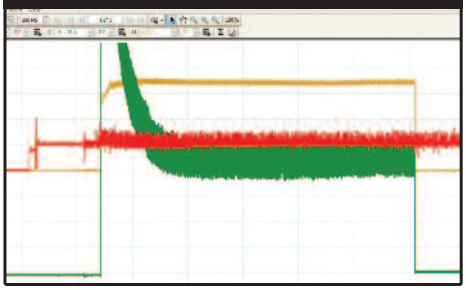
Stratus Head Case

concerns with my boss, and she authorized replacement of the air pump and one-way valve.

Figure 1: *The gold trace indicates the PCM is sending power to the relay. The pump current pattern indicates the relay is engaged and the pump is running. MAF increased only slightly, to under 1.0 volt.*



Phase Two

The one-way valve was replaced, along with the air pump (there was a severe current fluctuation in the original) and relay (as recommended by the manufacturer when the air pump is replaced). The screen capture in Figure 3 in the next column was taken after this repair.

This time, I added a channel to include battery voltage. This allowed me to identify the point on the capture when the key was turned on, the engine started, and then shut off again. The information shows all is working as it is supposed to, but still only 0.10 volt change in MAF with the pump running. It looks like there is still a restriction somewhere.

Figure 2: *How did this valve get so corroded? And why is the current flow on the motor higher with the restriction removed?*

The air pump on this system is controlled by a relay, which in turn is powered by the ECM. The scope capture confirms that the ECM's command is being carried out. Air is drawn in through a filter located just below the intake manifold, then through a dedicated MAF sensor to the pump.

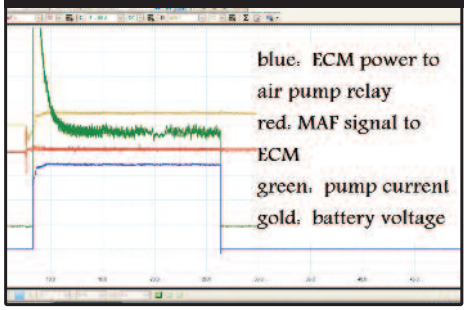
Disconnecting the line at the one-way valve caused the MAF voltage to increase to 5.0 volts, which confirmed the MAF signal.

From the pump, the air flows through a nylon line up to the rear of the cylinder head to a one-way valve located on the exhaust manifold. This is where I originally thought the restriction was occurring, but I was wrong.

This time, I removed the valve with the line attached and ran the engine again. Air flowed just fine. This is how I learned that even though the valve was very hard to blow through, the spring pressure was normal and the pump was more than capable of opening the valve. The restriction had to be on the exhaust side, and that meant removing the manifold.

After passing the one-way valve, the air enters a separate chamber cast into the cylinder head. From there, individual ports are drilled into each exhaust port. This is similar to the individual EGR ports you would find on the intake side of some engines. These ports should not be clogged, considering the engine only had 39,000 miles on it. But all the evidence indicated they were.

Figure 3: *The magnetic reluctance CKP is producing a sine wave AC voltage pattern, but noise in the signal may indicate a problem with the sensor.*

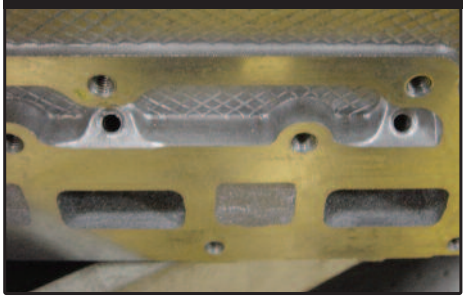


The ports were not clogged, because there were no ports to clog! Somewhere in this car's past, the cylinder head had been replaced with a Federal emissions head, and the ports were never drilled through. The tech who did the work was smart enough to know this wouldn't work, and double gasketed the exhaust manifold after cutting passages of his own in the gaskets themselves (Figure 4).

Figure 4: *There were no air injection ports to clog. Double gaskets were used during a previous repair, with slots cut out where the ports should have been.*

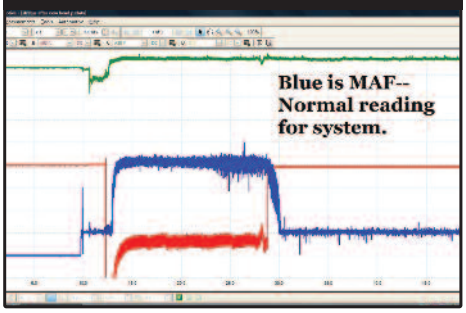
I should have removed the valve with the line the first time around to confirm the fault, but let the vehicle's low mileage cloud my judgment. I don't feel too bad. At least I didn't install the wrong cylinder head.

Figure 5: *This photo of the California-spec cylinder head clearly shows the needed air injection ports. One of these heads isn't that easy to come by.*



Finishing this job took some doing. There isn't much demand for new cylinder heads for the California version of the 2.4L engine. Our dealer originally ordered a reman head for us but when it arrived it was a Federal-style head, just like the one I wanted to replace. The final solution was to order a brand new bare head casting and swap everything over.

Figure 6: *Running a scope test after completing the head replacement allowed me to verify the repair and also provide known-good patterns for future reference.*



As you can see, the Federal head has no ports for the secondary air injection system (Figure 4), while the California head does (Figure 5). The Federal head does, however, have an EGR port that the California head does not. On this job, the previous tech had tried to thread the port and install a bolt to seal the hole.

As a last step, I hooked up my scope to verify the repair (Figure 6). I only watched the motor current and MAF signal, since I'd already confirmed that the system was working. I wanted to know what a normal system would look like with no restrictions in case I ran into something like this again. Hope you enjoyed the tale! WELLS

This case study was provided by Pete Meier, Technical Editor of *Motor Age* magazine. *CounterPoint* looks forward to continued contributions from Pete, as well as other driveability instructors. Thanks, Pete for this great case study.

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Hot off the Wire

Wells Vehicle Electronics Online

Are you looking for ways to stay up-to-date on tech tips? Do you want to stay informed about the latest industry news? Do you think there are too many days between *CounterPoint* issues?

If you answered "yes" to any or all of these questions, you need to find and follow Wells Vehicle Electronics online. In addition to our corporate website at *www.wellsVE.com*, Wells Vehicle Electronics also maintains a strong presence in the social media realm. Be sure to check the following sites for a wealth of useful information:

www.facebook.com/WellsVehicleElectronics
www.twitter.com/WellsVEcom
www.youtube.com/Wellstech

An example of the kind of information Wells shares on its Facebook page is found below.

In today's rapidly growing auto industry, there are more new vehicle models being introduced each year. To obtain accurate repair information, the vehicle's ID information must be correct.

Often a manufacturer will use variations of the same engine size for different models in the same year. This is why it helps to note the 8th digit of the VIN to clarify engine application, as well as the 10th, which will verify the year of manufacture. Whether you are looking for information or parts, what you receive can only be as accurate as the information you provide. WELLS

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