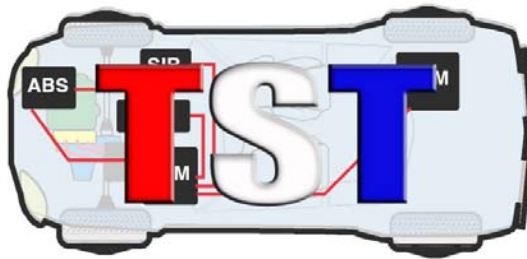


January 2015



Technicians Service Training

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Upcoming Seminars: TST Big Event

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Editor

"G" Jerry Truglia
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"Toyota Highlander with 4 DTCs"

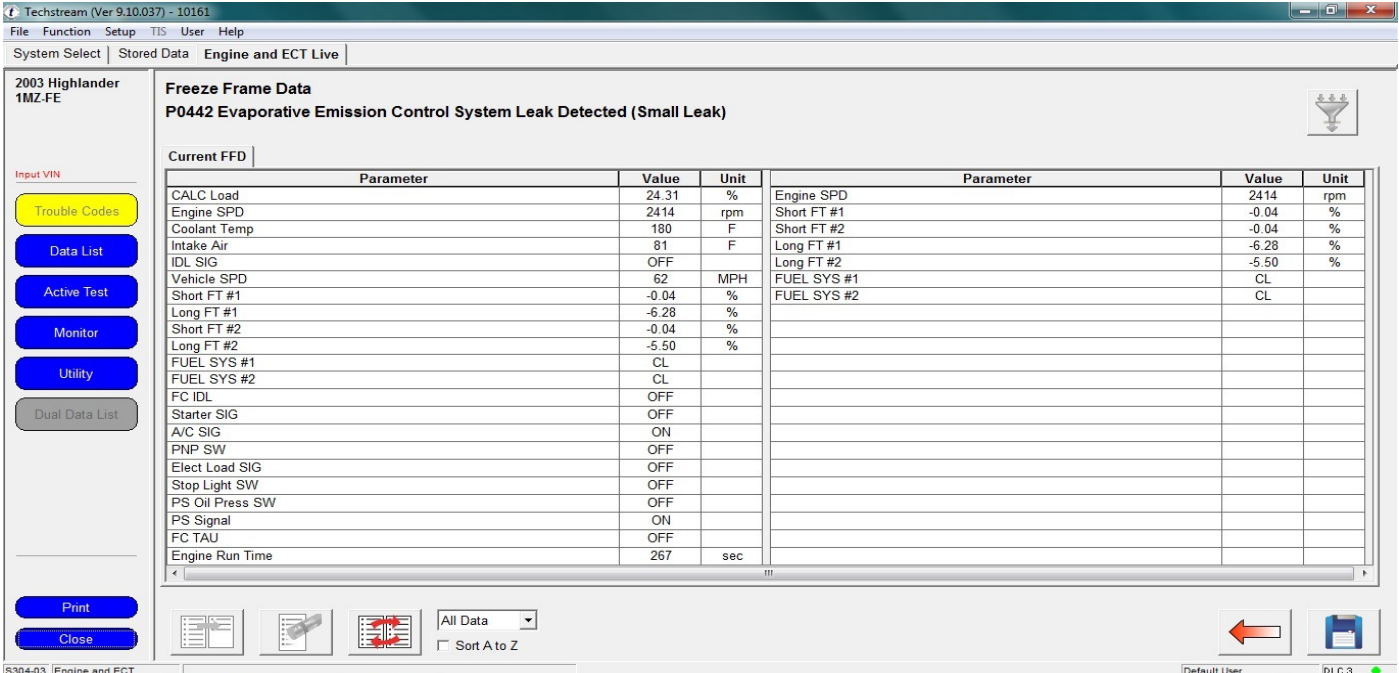
A 2003 Toyota Highlander 3.0L V6 came in with a few DTCs, P0420 (Catalyst Efficiency Below Threshold Bank 1), P0441 (EVAP Emissions Control System Incorrect Purge Flow), P0442 (EVAP Emissions Control System Leak Detected – Small Leak) and P0446 (EVAP Emissions Control System Vent Control Circuit). So where do you start when you have these many DTCs? Our first step was to take a look at Freeze Frame data to check out when it happen. Freeze Frame data usually provides us with good information such as engine temperature, vehicle speed, throttle position, Fuel Trim data and more. On our problem Toyota Freeze Frame data was only helpful providing information on the P0420 DTC since this code has priority over the others.

System	Monitor Status	DTC	Cntr	Pend	Hist	Perm	Calibration
Engine and ECT	Com	P0420	X	X	X	X	14841001
		P0441	X	X	X	X	14841002
		P0442	X	X	X	X	
		P0446	X	X	X	X	
ABS/ESC/TRAC	-						-
SRS Airbag	-						-
Body	-						-
Combination Meter	-						-
Driver Door	-						-

(Con't on page 3)

"Toyota Highlander with 4 DTCs" (con't from p. 1)

We started with the P0420 DTC since it would be the most expensive repair. As general practice our next step was to checkout TSBs, Identifix, Iatn, Alldata and Google making sure we don't miss anything that is related to our problems. Information is always a good place to start especially if you not 100% familiar with the system. When working on so many different vehicles it becomes difficult to know every system inside and out. The easy stuff to remember is that the purge valve is normally closed and the vent valve is normally open, but not knowing where they are located or what they look like can make your diagnosis difficult. In this case Toyota labeled the purge and the vent by different names making it more confusing. So reading up on the system before you dive into it is a real good idea since it provides you with a better understanding on how the system fails and sets a DTC. This vehicle had over 100, 000 miles / 160,934.4 km on it and was well maintained and documented in the owners log book that detailed all of the service work that had been performed.



Freeze Frame Data
P0442 Evaporative Emission Control System Leak Detected (Small Leak)

Current FFD

Parameter	Value	Unit	Parameter	Value	Unit
CALC Load	24.31	%	Engine SPD	2414	rpm
Engine SPD	2414	rpm	Short FT #1	-0.04	%
Coolant Temp	180	F	Short FT #2	-0.04	%
Intake Air	81	F	Long FT #1	-6.28	%
IDL SIG	OFF		Long FT #2	-5.50	%
Vehicle SPD	62	MPH	FUEL SYS #1	CL	
Short FT #1	-0.04	%	FUEL SYS #2	CL	
Long FT #1	-6.28	%			
Short FT #2	-0.04	%			
Long FT #2	-5.50	%			
FUEL SYS #1	CL				
FUEL SYS #2	CL				
FC IDL	OFF				
Starter SIG	OFF				
A/C SIG	ON				
PNP SW	OFF				
Elect Load SIG	OFF				
Stop Light SW	OFF				
PS Oil Press SW	OFF				
PS Signal	ON				
FC TAU	OFF				
Engine Run Time	267	sec			

We started our testing by performing a few test including, battery, starter, relative compression, ignition, fuel, Fuel Trim and back pressure test, to make sure that all of them had a passing grade.

(Con't on page 4)

What is TST?

TST is a group of dedicated technicians and instructors committed to the continuing education of our fellow technicians. We provide training seminars to technicians at a reasonable price. TST brings our members nationally known instructors and state of the art training.

Our Goal & Mission Statement

- *Keep our fellow technicians up to date with the latest technology.*
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- *Deliver information that the technician can use now.*
- *Keep technicians informed of information affecting our industry.*
- *Increase consumer awareness of what a good technician is.*

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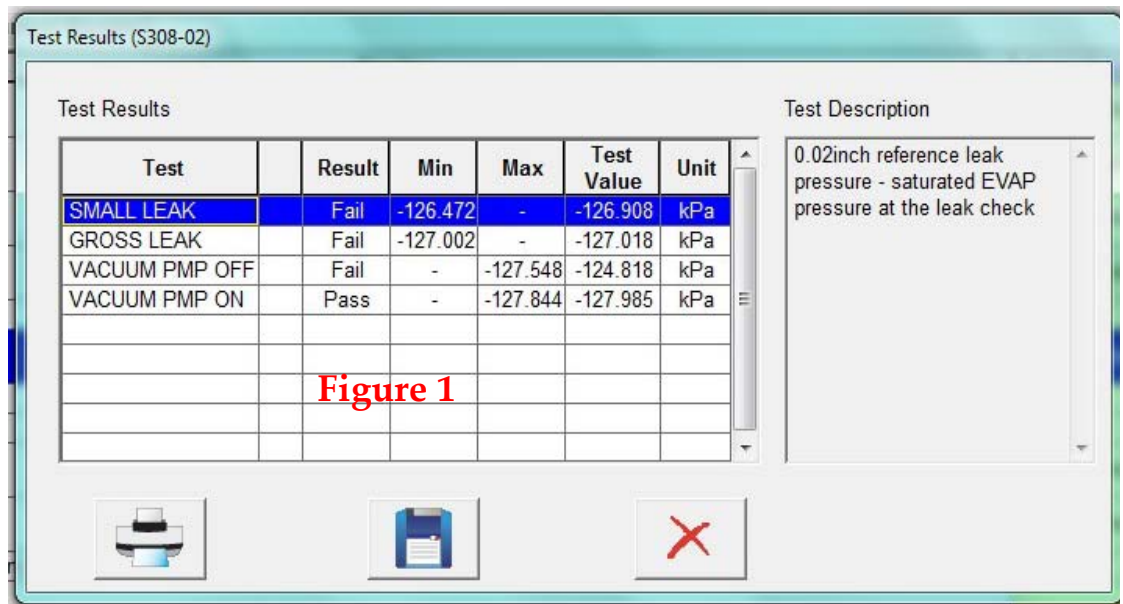
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“Toyota Highlander with 4 DTCs” (con’t from p. 2)

Since they all checked out OK, and the converter was not physically damaged, we knew that the catalytic converter had lost its ability to work properly and could use a fuel system cleaning. Before we recommend a fuel system cleaning we need to make sure that the converter is able to actually clean up and begin to function properly. We confirm that the converter was able to clean up by viewing Mode 6 catalyst data on the scan tool, comparing the reading’s we captured before and after the procedure that we performed. The first procedure we always recommend involves removing and grounding one spark plug wire while running the engine at 2500 rpms for 2 -3 minutes. After completing the procedure our Mode 6 numbers improved making us confident to recommend a fuel system cleaning that would make the converter operate better. The fuel system cleaning brought the converter back to life and the Mode 6 number now all had passing grades. The good news for the vehicle owner was that the fuel system cleaning did extinguish the P0420 MIL, but the bad news was that there was still the three EVAP DTCs to diagnosis.

With three different EVAP DTCs it’s a good idea to read the code setting criteria carefully in order to move in the right direction. Maybe there is something in common with the DTCs or maybe not, but the more information the better. Don’t



just replace parts when a DTC appears, since it’s not always a bad part that is causing the problem.

(Con’t on page 4)

"Toyota Highlander with 4 DTCs" (con't from p. 4)

Take a look at the EVAP Mode 6 data (**Figure 1 on page 4**) that failed in three different areas, Small Leak, Gross Leak, and Vacuum Pump Off. A first glance at the DTCs looks like there is one real big problem brewing. In this case it's not a real big problem but rather one that is solved with one easy fix. Remember what I said it's not always a part that is going to fix the problem. On this vehicle while I performed my visual inspection I found the EVAP problem.

Take a look at the picture (**Figure 2**) to see what I found. My visual inspection fixed all three of the DTCs with one

simple connection. Looking at the picture you will notice that there is a metal tube next to the air clean box that is missing a vacuum hose. Sometimes it the simplest things that fixes a vehicle, always use a thorough visual inspection as part of your diagnostic game plan. If you are curious how the hose wound up being off the tube as I was, then you will like to know how it



happened. After reading the owner log book I found out that the vehicle was taken in for a quickie oil change where he was also sold a new air filter. Most likely the oil change tech was in a rush as he pulled off the air cleaner housing and the vacuum line from the air box came off. If you are not paying attention to details, problems such as the one we described will occur. The owner did not notice the MIL illuminate right away nor did he connect the illuminated MIL to the oil change and air filter replacement. There are a few reasons why the MIL did not illuminate immediately; one is that the MIL will not illuminate for this problem until a few Drive Cycles or Enable Criteria are completed, two could be that the vehicle did not have the proper amount of fuel in the tank that prevented the diagnostic Monitor from running, and three was that this vehicle was their spare that they did not use all the time. So the fix for this vehicle was very simple, just reinstalling the missing vacuum hose and driving the vehicle that extinguished the MIL.

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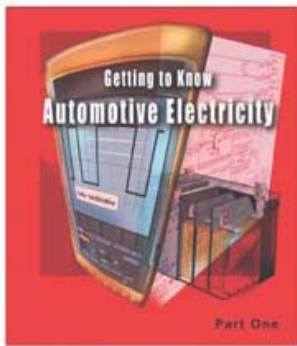
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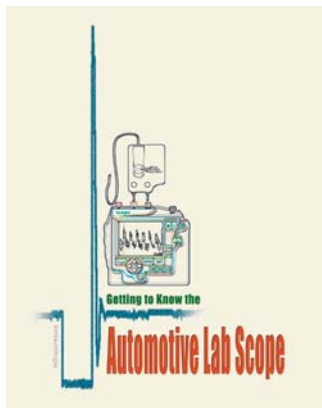
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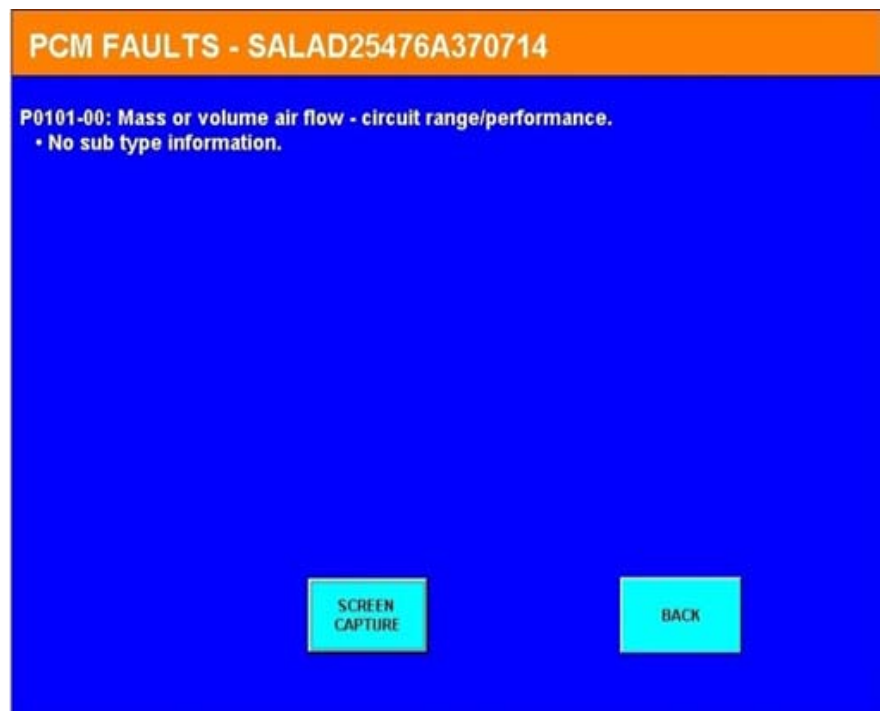
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“Why New Codes Appear After Performing Repairs”

New DTCs appearing after a repair is more common than you think. The reasons why this may happen is; 1. Not all Monitors are Ready, 2. Pending DTCs were not addressed, 3. Mode 6 failures were not checked. Below we will provide you with a few examples that will shed some light, while helping you better understand why it's so important to perform a complete and thorough diagnostic procedure on an OBD II vehicle.

The screen captures to the right is from a 2006 LR3 with a 4.4 L V8 engine that came in the shop with MAF Sensor P0101



DTC along with not all of the Monitors Ready. While performing my diagnosis procedure on this vehicle I could have made the ultimate mistake by getting tunnel vision and just concentrating on the MAF DTC. But looking at the Monitor status I could see that there were two Monitors (O2 and EVAP) that were Not Ready. The one that I was really concerned with was the O2 Monitor since the O2 sensors are used to check other systems on the engine. I looked up the Drive Cycle criteria for the O2 Monitor that seemed easy enough to run (see O2 Drive Cycle).

(Con't on page 9)

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“Why New Codes Appear After Performing Repairs” (con’t from p. 7)

We should always start with the easiest procedure first. Before checking or repairing the MAF circuit I took the vehicle for a ride to see if the O2 Monitor would run. Since the engine was already hot I knew that the EVAP Monitor would not run until the vehicle cooled down. The EVAP Monitor can also be affected by the O2 Monitor not being Ready. It’s a good idea to read up on how the system and components function, in this case we need to know how the EVAP Monitor is being checked by the PCM. The O2 sensors are used to check if the EVAP system is actually purging HC vapors on this vehicle. When dealing with computers and components there are always checks and balances or sense, compare and adjust. The EVAP purge valve (normally closed) is commanded open by the PCM which is looking for a change in O2 voltage to make sure the EVAP system is working properly or not. Understanding how the system functions is a smarter and quicker way to precede. My next step was to drive the vehicle for 15

minutes to see if the Monitor would be Ready or Not.

Unfortunately the Monitor did not set to Ready. Now I had no

Monitor: HO2S (Upstream O2 Sensor) Monitor

Notes:

Step 1: Connect a scan tool.

Step 2: Start the engine and bring to normal operating temperature of 180 degrees F.

Step 3: Drive the vehicle at more than 1500 rpm for five minutes.

Step 4: Stop the vehicle and idle for more than 60 seconds.

Step 5: Check the monitor status. If the monitor is not completed, repeat Steps 2 through 4.

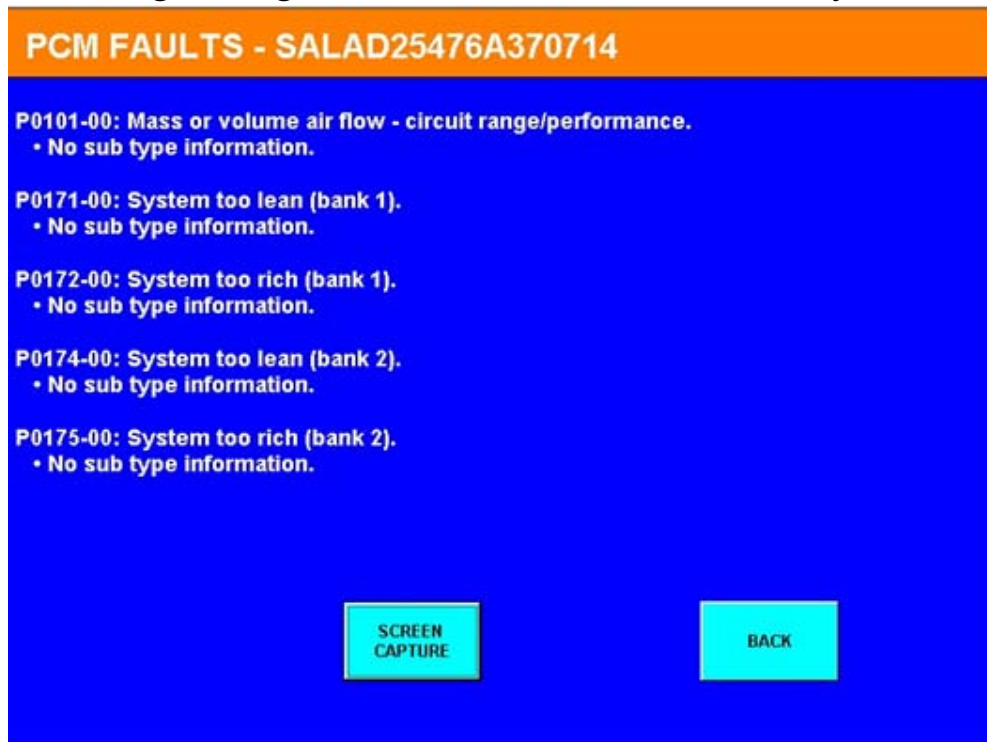
choice other than performing a complete diagnostic procedure on the vehicle to see what was good and what was bad. While performing the diagnostic procedures I found a few problems that prevented the Monitor from running. The first problem that needed to be addressed was a cooling system issue. The thermostat, coolant sensor and overflow bottle all need to be repaired or replaced. I installed a new thermostat, gasket, coolant sensor, coolant bottle, level sensor and bleed the cooling system. I followed the repair with checking the O2 sensors with a labscope, confirming that they were working properly. Both O2 sensor voltages were going down under 150 mV and above 850 mV during testing. If the sensors are testing good and the all the basics were good, the Monitor should now run, and it did.

(Con’t on page 10)

“Why New Codes Appear After Performing Repairs” (con’t from p. 9)

The O2 Monitor was Ready and now I was able to test the system. Take a look at the DTCs that came up as a result of the Monitor now being Ready. As you can see the PCM now displayed 5 DTCs instead of 1 that had been previously displayed. Since the O2 Monitor was now Ready it confirmed the P0101 MAF sensor DTC. The O2 sensors were sensing failing conditions that were caused by a

cheap aftermarket MAF sensor. As you are reading through this case study you can see how very important it is to have the Monitor status set to Ready. Monitors that are Ready are a great way to confirm your repairs. Remember if the Monitor is Not Ready it cannot see a problem, but when it's Ready the sensors or ac-



tuator for that Monitor are ready to do their job and report back on anything that is failing while illuminating a MIL. The check engine light tells the vehicle owner if we suck or not. The vehicle owner expects when they bring their vehicle in for a repair that the light is out and going to stay out. This is why it's important to check all Mode 6 and Pending DTCs data, while making sure that all Monitors are Ready.

After the engine cooled down the next day I test drove the vehicle making sure the MIL was out and the Monitors were Ready confirming my repairs.

Example: A vehicle has MIL ON Code P0300 Misfire and a Pending DTC P0130 HO2S. If we only repaired the P0300, the MIL may come back on when the Pending DTC for the O2 sensor matures. The MIL will re-illuminate for the new DTC and the (unhappy) customer will return.

(Con't on page 11)

"Why New Codes Appear After Performing Repairs" (con't from p. 10)

The PCM doesn't like running tests if there's a problem that might ruin the test results. Instead, it waits until the problem is fixed before running the Monitor. This explains why you can repair one problem, erase DTCs, and have the MIL come on again for an entirely new problem. Fixing a problem allowed another Monitor to run, and it failed, storing a new DTC.

A Monitor that had been Suspended due to a DTC you just fixed may run following your repair and store a new DTC. A MIL-ON the day after a repair is not good for customer relations.

"P0401 EGR Insufficient Flow"

The customer came in with a complaint that his "Check Engine" light was on. A quick scan easily showed the reason for the complaint. A P0401 (Exhaust Gas Recirculation (EGR) Insufficient Flow) (**Figure 1**) code was found when I checked using Global OBD II's Mode \$03. Certainly by now, you know that I don't stop there!

My next step was just a few cursor clicks away, checking if any "Pending" codes were stored. Sure

Code	Description
DTC Codes:	
P0401	Exhaust Gas Recirculation Flow Insufficient Detected
Pending Codes:	
P0300	Random/Multiple Cylinder Misfire Detected
P0308	Cylinder 8 Misfire Detected

Figure 1

enough, two Pending codes were found; a P0300 (Random Misfire) and P0308 (Cylinder 8 Misfire). If the Engine Control Module saw either one of those again (in succession), they would move over to "hard code" status and show up later in Mode \$03 and turning the Malfunction Indicator Lamp back on. I made a note to share this information with the customer to make sure he knew there were other problems that may need attention soon, especially since they may or may not be corrected with the EGR flow fix that the vehicle was in for today.

(Con't on page 13)

"Automechanika Sign Up Information"

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"P0401 EGR Insufficient Flow"(con't from p. 11)

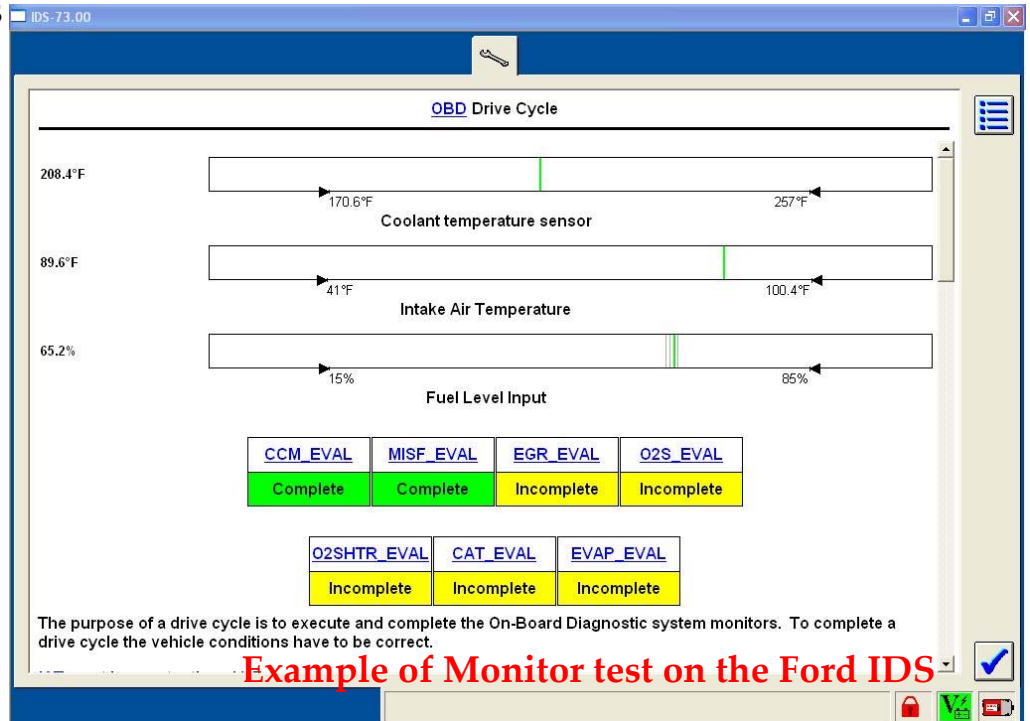
If you understand OBD II testing strategy basics, then you know there was one more step I needed to make before I was ready to tackle the P0401. Here is where I would verify what onboard Monitors (or system self tests) had been completed and which ones may still be pending completion.

Why is that important? Monitors often share systems or individual system components. When any code sets, related Monitors may be temporarily suspended pending repair of the failed system or component. There's a bit more to how Monitors work and interact, more than we can tackle in this article, but do a little reading and you'll find plenty of help in understanding it all. For now, I'm looking for any Monitors that are listed on my scan tool as "Incomplete" or "Not Ready", indicating that testing for those Monitors have been temporarily suspended or that the conditions they needed to complete have not yet been met. In either case, it is possible that they will find a problem and turn the MIL light back on after I send the vehicle home. And unless I make my customer aware of that, I'm the one that's going to look bad!

Looking at the Monitor status, I noticed that both the Catalytic Converter Monitor and the evaporative emissions (EVAP) system Monitors were "Not Ready". I wasn't too concerned about the EVAP Monitor.

They can take a while to run, especially on

an older vehicle like this Expedition. The Catalyst Monitor, however, was a bit more concerning. Misfire codes, for sure, will suspend this Monitor on most all makes. To be safe, I took a snapshot of the screen information to share with the owner and to keep in my shop's records.



Example of Monitor test on the Ford IDS

(Con't on page 15)

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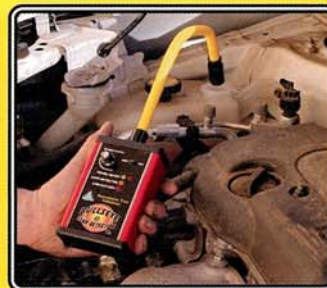
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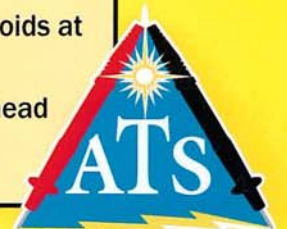


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"P0401 EGR Insufficient Flow"(con't from p. 15)

Remember that I had two Monitors that were "Not Ready", one of them being the Catalyst Monitor. This information is telling me that it is a very real possibility that a P0420 and/or P0430 (Catalyst Efficiency Below Threshold) DTC may crop up and illuminate the MIL. I also need to look at another problem on the list that you can see is failing (highlighted in red) TID \$25 (EVAP System 0.040 Leak Check), CID \$00

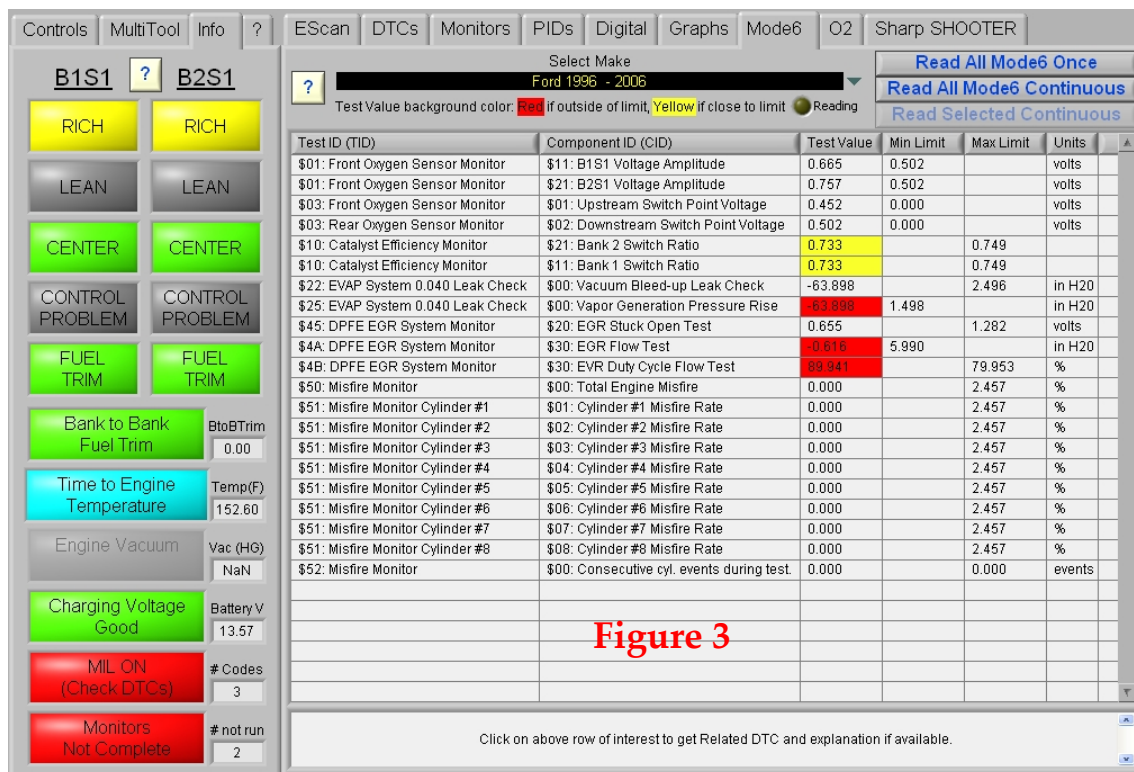


Figure 3

(Vapor Generation Pressure Rise) has a Test Value of -63.898 and a Minimum Limit test value of 1.498, also in units of in/H₂O. Once again the Monitor is "Not Ready" and there is another strong possibility of a DTC when this Monitor completes its testing.

With the information provide in Mode \$06, I now know exactly what I'm looking for in the EGR system and it's time to see why the EGR has no flow. Usually no flow indicates that the EGR valve is either not opening up, the EGR passages are clogged or there is a sensor issue. This EGR system uses a Differential Pressure Feedback (DPFE) sensor and a vacuum controlled EGR valve that uses a solenoid to control the vacuum flow to the valve. A quick visual inspection found that the vacuum line nipple going to the valve was cracked.

All Articles in this newsletter by

"G " Truglia TST President and Triple Master ASE L1 Technician

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*Analysis of 2008 California Smog Check data.

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