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Volume 1, Issue 2

VCERTT

VERM ONT CENTER For EMISSIONS REPAIR & TECHNICIAN TRAINING

A Joint Effort by Vermont Technical College, Randolph and the Vermont Department of Environmental Conservation to provide free technical assistance and networking to VT technicians.

TECH TIPS

**CATALYTIC CONVERTER REPLACEMENT

**CAN IS HERE

CASE STUDY

**ELUSIVE EGR SYSTEM DTC P0400

DTCs

** VW P1128

YOUR HARD WORK, OUR ASSISTANCE

The purpose of this newsletter is to provide specialized information to the front line: you, the technicians, service advisors and managers in the field handling repairs and customers. The OBD Inspection Program is now over three years old. While the inspection itself is an easy addition to the VSI we know that repairing the OBD II faults found may not be as simple. The success of the OBD Inspection Program falls largely on your ability to perform effective repairs. VCERTT is committed to trying to help. We offer this newsletter to provide information and a forum for discussion. We ask you to call or email us with your questions or suggestions. When you have a troublesome vehicle repair related to OBDII, we'd like to hear about it. If you have problems with a scan tool or a particular vehicle, give us a call. We may be able to help and we can pass along relevant information. We're still looking for test vehicles for our Case Studies - let us take your problem vehicle and attempt a repair, no charge for our time, just help for everyone.

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TECH TIPS

⇒ CATALYTIC CONVERTER REPLACEMENT

As OBDII vehicles age and DTCs for catalytic converter efficiency (PO420-P0439) become more common, a quick review of the regulations covering converter replacement may be helpful.

If the vehicle is under warranty, OEM converters are the only legal replacements. What are the warranty requirements for converters? A model year 2000 or newer vehicle up to 6000 pounds GVWR sold in Vermont and meeting California emissions standards has a converter warranty of at least 7 years/70,000 miles. Vehicles meeting the Federal (EPA) emissions standards have converter warranties of 8 years/80,000 miles. Check the under-hood Vehicle Emissions Control Information Label to determine which emissions standards apply. Some manufacturers may have special additional warranty programs – check with the dealer, or advise your customer to do so. ***All this may sound complicated, but the important point to remember is that converter warranties are at least 7 years/70,000 miles!***

If the vehicle is no longer under warranty, new aftermarket and certified used (also known as "remanufactured") converters are available – the supplier must provide appropriate documentation that the converter is certified. ***It is illegal to install a used converter (from a junk yard, parts car or anywhere else) unless it has been tested and certified!***

New aftermarket converters are required to have a minimum 25,000 mile warranty for converter performance (which in Vermont means passing the OBD II check), and a minimum 5 year/50,000 mile defect warranty for the physical integrity of the external shell and connecting pipes or flanges.

Certified used converters are not required to have a performance warranty, but must have the same 5 year/50,000 mile physical defect warranty.

Repair facilities are required to maintain invoices for converter replacements for 6 months, and to keep replaced and appropriately tagged converters for possible EPA inspection for 15 days.

VCERTT TRAINING CAN BE ANOTHER USEFUL DIAGNOSTIC TOOL

WHAT THE TECHS SAY:

"This is exactly the sort of training we need in the field. I learned stuff I used the next day!"

"I've been to each of VCERTT's classes and I learn a ton every time. Thanks, and keep them coming!"

**** The OBD Course covers OBD Operation and OBD Monitors**
**** The Comprehensive Components Course offers proven test procedures for commonly used sensors and solenoids**
**** The Oxygen Sensor Course will teach you to effectively diagnose those frequently failing O2 sensors**
**** The courses are only $50 for four hours and include a manual**

DTCS

VW: DTC P1128

1997-2000 VW models with gas engines, usually the 1.8 and 2.0 liter four cylinder engines, but occasionally aVR6, may illuminate the MIL for the manufacturer-specific code of P1128, "Long Term Fuel Trim Too Lean" (LTFT). Drivability issues are mild if reported at all by car owners. Freeze frame data reported by techs shows LTFT over +20%. Engine load is moderate and vehicle speed ranges from low to over 80mph, but usually corresponding to rpm below 3500. ECT data shows the vehicle warmed-up. To diagnose the cause of the DTC, start with a visual inspection for possible vacuum leaks. Carefully check for cracks in the air boot. A disconnected or broken vacuum hose is a common culprit. Check in particular for a broken hose from the manifold to the fuel pressure regulator. Clean the MAF and check the snow screen in the intake snorkel for clogging. If an Oxygen Sensor code is present as well, the O2 sensor function should be verified first. When no other DTCs are present and vacuum leaks have been eliminated as a possible problem, technicians report common failure of the Mass Air Flow, MAF, sensor. The MAF sensor is the most important sensor in the PCM's calibration of fuel delivery. When the MAF sensor provides inaccurate information to the PCM, the PCM responds by providing inappropriate fuel mixtures. The PCM, over time, will see the conflict in information. If the O2 sensor has passed its tests, the PCM will set a fuel trim DTC, P1128 LTFT Too Lean. A large number of technicians report that this is precisely what is happening on the

majority of vehicles with a single DTC, P1128. Techs report that obtaining a clearly defective MAF signal is unlikely. If there are no O2 sensor codes, no vacuum leaks, correct fuel pressure is available, LTFT is +20% or greater, and the MAF assembly is clean; replace the MAF sensor. VW recommends MAF harness replacement as well, though many techs report skipping this step after verifying terminal and harness cleanliness and integrity. Defective MAFs have become such a common problem that VW has lowered the price of a MAF from over $350 to around $50. Following replacement of the MAF, the vehicle should be driven for 10-15 minutes at part-throttle cruise for the PCM to relearn baseline adaptive strategies.

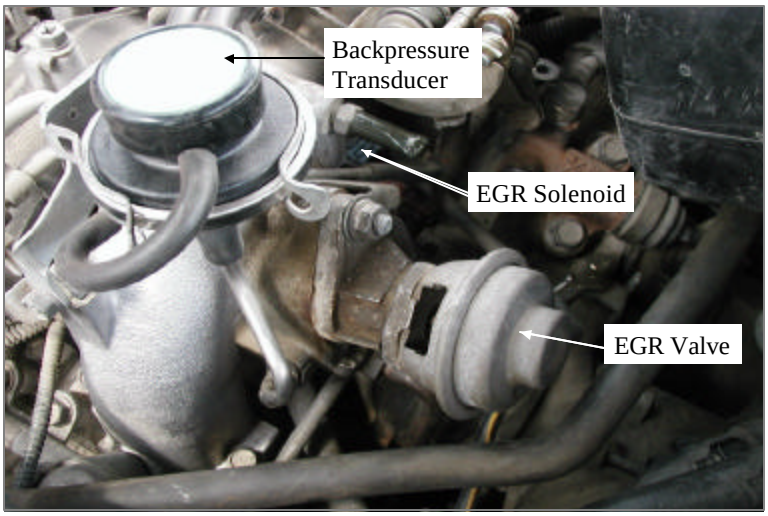
CASE STUDY:

VCERTT provides training and research to assist in accurate and effective repairs on OBD II vehicles. In each VCERTT Newsletter we will report on an unusual, tricky, or impossible repair. If you've had a strange OBD II vehicle problem, or if you have a question, let us know. We know it's not always the easy things that go wrong, our purpose is to help you fix the simple and the serious. We take in a few customers' cars with repetitive or "unfixable" faults and dig until we find the source. Do you work on one of those cars? Let us know; call with your story, we'd like to hear about it, try to help, and pass it along as appropriate.

The Elusive EGR, P0400

This Fall we tackled another problem vehicle, a '97 Subaru Legacy with a repeated customer concern. This story starts early in the year 2000 when the MIL came on and the owner took the vehicle to an independent repair facility, which we'll call Shop #1. No drivability issues were reported at the time. Shop #1 extracted the DTC P0400, EGR Flow Malfunction. The shop ordered an EGR backpressure transducer, cleared the code and returned the vehicle to the customer. On the way home, the MIL came back on. Once the part arrived, the customer returned to Shop #1 to have the backpressure transducer installed. After the part was installed, the code was cleared and the vehicle returned to the customer. The MIL came back on again on the way home from the shop. The customer took the vehicle back to Shop #1; they inspected the system and informed the customer they couldn't find the problem. The vehicle then went to a Subaru Dealership, we'll call Shop #2. The customer encouraged them to call Shop #1 to find out what work had been performed, but unfortunately that didn't happen. Shop #2 installed a new backpressure transducer, cleared the code, and returned the vehicle to the owner. The MIL came back on shortly after picking up the car. The customer made another appointment with Shop #2. At this visit they replaced the EGR valve with a used one, cleared the code, and returned the vehicle to the customer. Again, the MIL came back on soon after picking up the car. The customer then brought the vehicle back to Shop #1. This time Shop #1 cleaned the EGR valve and the tubing to be sure it wasn't partially blocked and limiting flow. They confidently cleared the code and returned the vehicle to the customer. The MIL was back on not long after the vehicle was picked up. The customer next brought the vehicle to a different Subaru Dealer, we'll call Shop #3. Although encouraged to do

1997 Subaru Legacy 2.5L



so, Shop #3 did not contact the other repair facilities about the previous repair attempts. They inspected the system, ordered a backpressure transducer and returned the vehicle. The customer returned to Shop #3 and had the third new backpressure transducer installed. The code was cleared, the customer picked up the vehicle, and, you guessed it - the MIL came back on shortly after the attempted repair. At this point, after eight trips to three different repair shops, three new backpressure transducers and a replaced EGR valve, and the MIL still on, the understandably frustrated vehicle owner contacted VCERTT.

We reviewed the repair history with the customer and took the vehicle to our lab. First, we looked the EGR system over to determine how it worked. The EGR (Exhaust Gas Recirculation) system helps to control exhaust emissions of nitrogen oxides (NOx) by admitting a carefully controlled amount of exhaust gas back into the intake system. This exhaust gas lowers peak combustion temperatures, which reduces NOx emissions. The EGR system on this vehicle, typical of many Asian vehicles, consists of an EGR valve, EGR solenoid valve, backpressure transducer, and associated hoses and wiring. When ported vacuum from the throttle body reaches the EGR valve, it opens to allow exhaust gas to flow into the intake manifold. The solenoid valve either blocks or allows ported vacuum to reach the EGR valve, and is controlled by the PCM. The backpressure transducer modifies the amount of vacuum that goes through the solenoid valve to the EGR valve, based on the levels of ported vacuum and exhaust backpressure.

We used VCERTT's generic **Diagnostic Procedure** as outlined in the **Comprehensive Components Curriculum**:

1. **Verify the Customer Concern**
2. **Check DTCs and Freeze Frame Data**
3. **Perform a thorough Visual Inspection**
4. **Check Technical Service Bulletins**
5. **Review and Test System or Component**
6. **Repair as needed**
7. **Verify Repair**

We began our diagnosis by verifying that the MIL was on. We connected an OBDII generic scan tool and found DTC P0400, EGR Flow Malfunction present. The Freeze Frame data, stored when the code was set and the MIL turned on, showed: Engine RPM was 2,288, Engine Coolant Temperature was 183?F, Manifold Absolute Pressure was 15.4 inches hg., Vehicle Speed was 52 mph, Engine Load was 18.8%, and the Fuel System was in Closed Loop. This indicated that the problem was detected as soon as the OBD system ran the EGR monitor. Next, we performed a thorough visual inspection and checked the vacuum routing of the system. The vacuum lines appeared to be in good shape and they were all connected appropriately. There were no Technical Service Bulletins relating to this concern. We began testing the system by trying to get the EGR valve to operate by warming up the vehicle and raising the rpm while watching for EGR valve movement. The EGR valve never moved. We then applied vacuum directly to the EGR valve while the vehicle was running. We could see the EGR valve pintle move and the vehicle began to stumble, as it should with EGR applied at idle. That proved that the EGR valve was OK and that the exhaust gas passages weren't blocked. Next we tested the backpressure transducer. Backpressure transducers can have a high failure rate. The transducer was receiving plenty of pressure from the exhaust gas pressure port on the bottom. It was also receiving a healthy dose of ported vacuum from the throttle body; vacuum was barely noticeable at idle and increased steadily as the throttle was opened (remember, this is ported vacuum, not intake vacuum). Vacuum out of the transducer to the solenoid valve was also appropriate; there was no vacuum output at idle, a moderate vacuum was felt with moderate throttle, and when we heavily revved the engine strong vacuum was felt. Finally we tested the EGR solenoid valve. First we back probed the wires to look for power and ground supply. Power is supplied all the time. To complete the circuit, ground is provided by the PCM whenever conditions are appropriate (e.g., the vehicle is fully warmed up). We had power and ground supplied to the solenoid valve. We ran the engine at around 3000 rpm and checked to see if the solenoid valve was allowing vacuum through, and out to the EGR valve. We found that the solenoid valve was not allowing any vacuum to

Many manufacturers modify EGR flow through computer controlled solenoid operation. The PCM determines how much the EGR valve should open based on the Throttle Position Sensor signal, the Engine Coolant Temperature Sensor signal, The Vehicle Speed Sensor signal, and the Manifold Absolute Pressure Sensor or Mass Airflow Sensor signal. The PCM then provides a changing duty cycle signal to the EGR solenoid to effect a variable flow depending on conditions. This type of EGR control seems to be the trend for domestic and European manufacturers, while Asian manufacturers commonly use the vacuum controlled EGR systems similar to the one described in this case study.

the EGR valve despite the fact that it was electrically turned on. We then removed the solenoid valve for bench testing. That process was a bit awkward and probably explained the hesitation of other shops to test the last component in the system. We tested the resistance of the solenoid and found 33 ohms, well within specs. Finally, we applied 12 volts and ground to the solenoid valve. We didn't hear or feel the expected click, and we could not blow air through it. The solenoid valve did not open as it should have. Remember that a solenoid valve is an electro-mechanical device. Electrically, this solenoid valve was OK, but mechanically, it had failed. At this point we were fairly certain that we had found the culprit. Given all the misery the customer had endured we went ahead and sourced a new EGR solenoid valve (a $60 part) and bench tested it. We heard that familiar click as we applied power and ground, and could easily blow air through it. We installed the new solenoid valve, reassembled the vehicle, and checked for proper operation. Sure enough, once the vehicle had warmed up again, we revved the engine and watched the EGR valve pintle move. To fully verify our repair we cleared the code and road tested the vehicle. We brought the vehicle back in and checked the Readiness Status of the EGR Monitor. The monitor was completed: the test had run and passed; our repair was successful. Several months and several thousand miles later, the vehicle owner happily reports that the MIL has not come back on.

LESSONS LEARNED:

- ✍✍ Quick and simple testing of the EGR valve and back pressure transducer would have shown those parts to be OK. That left only one more component – the solenoid valve. None of the repair shops checked out the solenoid valve.
- ✍✍ Remember that a solenoid valve is an electro-mechanical device. To operate properly, both the electrical and the mechanical functions have to work.
- ✍✍ No matter how many times a part is replaced, if it's not the right part, it won't fix the problem!

CAN IS HERE!

A new vehicle communication protocol, Controller Area Network (CAN), has recently been approved for use on OBDII vehicles. Basically, a communication protocol is the language used by the vehicle's on-board computer for communicating with off-board devices like scan tools. There are four other communication protocols currently in use on OBDII vehicles, so with the addition of CAN, there are now five. CAN is being phased in over the next five years - it's now being used on a few 2003 vehicle models, and each year more new vehicles will switch to CAN. By model year 2008, all new vehicles must use only CAN, and the other protocols will no longer be used.

Why the change? CAN is a much more robust protocol, and allows much more information to be transferred at a much faster rate, making OBDII even more useful to technicians for diagnosing and repairing vehicles. Why didn't the OBDII regulations require only CAN right from the beginning? While that certainly would have been simpler in some ways, there was a need to accommodate the fact that vehicle manufacturers were already using several different communication protocols when the OBDII regulations went into effect. By gradually phasing in to only CAN, automakers have time to plan and make production changes without it being too disruptive.

2003 Vehicles Using CAN
Ford Excursion w/ 6.0L diesel engine
Ford Focus w/ 2.3L engine
Ford Thunderbird w/ 3.9L engine
Lincoln LS w/ 3.0L and 3.9L engines
Mazda 6
Nissan 350Z
Saab 9-3 sedan w/ 2.0L engine
Saturn Ion

Will scan tools need to be updated to communicate with vehicles using CAN? Yes – right now, no scan tools (except for the dealer tools) will communicate with those few 2003 vehicles that are using CAN. The scan tool manufacturers will be integrating CAN into their tools over the next year or so. Some scan tools will be able to be updated to support CAN as early as the end of this year. How scan tool makers will update their products will vary depending on the tool – some will require only software updates and a new cable, some will require both software and hardware changes, and some will need to be traded in for a new model. Talk to your scan tool manufacturer's rep for specifics.

What should you do if you get one of the few 2003 vehicles using CAN before your scan tool can be updated? Chances are, independent shops won't see many of these vehicles this year, because the first inspection for most new vehicles is done at the dealership. However, until your scan tool is upgraded to support CAN, you'll have to refer those vehicles to the dealer. While this transition may cause a little confusion at first, in the long run, the switch to CAN will make life easier for automakers, scan tool makers, and most importantly, technicians.

VCERTT
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TRAININGS FOR NOVEMBER, DECEMBER, JANUARY & FEBRUARY

Trainings on the diagnosis and repair of OBD II vehicles are sponsored by VCERTT. They are offered at seven sites around the state. The $50 fee covers tuition, manual, and certificate of completion.

The OBD II Systems and Inspection module, covering the operation of the OBD II System and the OBD Inspection, is offered on an on-going basis.

The Comprehensive Components Diagnosis and Repair module on diagnosis and repair of OBD vehicles is also being offered. This curriculum covers operation and testing of a variety of sensors and outputs using a digital voltmeter and scan tool. The first classes offered received excellent evaluations: "The lab exercises were great." "This is the kind of information I can use every day, thanks!"

A new module: H02S Operation and Diagnosis is now being offered. This newest VCERTT module covers HO2S (Heated Oxygen Sensor) Operation and Testing procedures using a Scan Tool, a Digital MultiMeter, DMM, and a lab scope. Heated Oxygen Sensors are a wear item and can cause many other problems from poor fuel economy to plugged converters. Learn how to accurately test the H02S to find the *real* cause of the DTCs.

ESSEX	11/12	11/21	12/3	12/18	1/9	1/28	2/11	2/26
ST ALBANS	11/18	12/9	1/20	2/17				
LYNDONVILLE	11/12	11/21	12/10	12/19	1/14	1/23	2/11	2/20
BARRE	11/6	11/13	12/4	12/18	1/15	1/29	2/5	2/19
RANDOLPH	11/13	12/4	12/12	1/16	1/23	2/5	2/20	
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