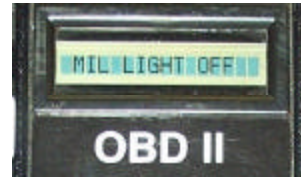


VCERTT



VERMONT 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.

OUR MISSION, YOUR EXPERIENCE

TECH TIPS
**CATALYTIC CONVERTERS

**DTCs

CASE STUDY

**MYSTERIOUS MAP SENSOR

TID-BITS

TOOLS

** SCAN TOOL UPDATES

TRAININGS
IN 8 LOCATIONS

*OBD II SYSTEMS & INSPECTION

*COMPREHENSIVE COMPONENTS DIAGNOSIS

HEATED OXYGEN SENSOR

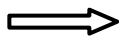
*HO2S DIAGNOSIS

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. You have to understand the amazing technology of today's vehicles and make the information understandable to your customers. This is an extraordinary challenge!

Our technical data and research, your knowledge and experience combined in a newsletter with bi-directional information will serve as another useful tool for your success in this dynamic business. We have knowledge of emission-related equipment, data about common OBD failures and repairs, and information about up-to-date training. You have live experience and information to add.

We can reinforce our mutual credibility with the public. We can strengthen our image as a well-trained group of professionals in a highly technical field. We can increase public awareness of our skills, our value, and our contribution to our communities. Together, we can increase and support your essential work in the automotive field and maintain and improve Vermont's environment.

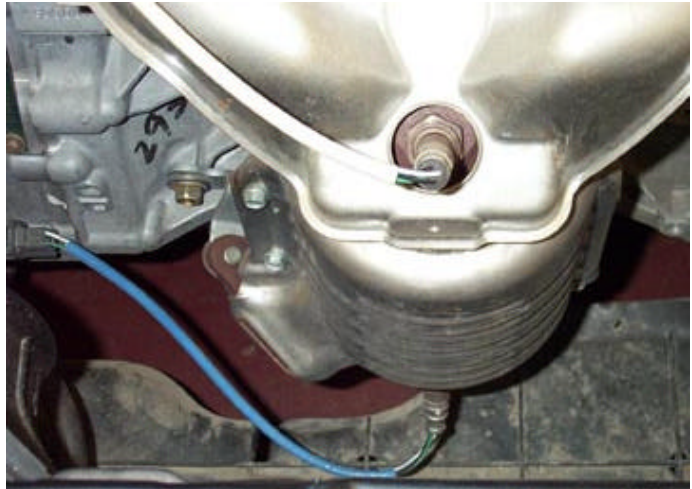
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CATALYTIC CONVERTERS

As OBD II vehicles age, DTCs for low catalyst efficiency are becoming more common. The OBD system may well pick out a failing CAT before the customer notices any driveability problems. When a vehicle's On-Board Diagnostic System checks the catalytic converter it performs a highly accurate mathematical method of determining the catalyst efficiency. A DTC P0420 requires a catalytic converter replacement. At the same time, it is critical to investigate the possible causes of converter failure. Some high mileage vehicles require converter replacement simply from extended use; but **most** converters are overheated to death. Worn spark plugs, wires, or coils can all allow a lethal dose of raw fuel into the CAT. Even if the vehicle does not have a "dead miss" it may still misfire often, or fire inadequately to support full combustion. A dirty air filter can rob the CAT of it's life: without oxygen the converter will die. Replace simple tune-up items, as needed, to prevent a premature "comeback" for another converter. A high mileage or faulty HO2S, Heated Oxygen Sensor, will provide incorrect information to the PCM, often delivering a rich mixture of fuel to the cylinders, which, over time may be deadly to the CAT. Most often a PCM will pick out a faulty HO2S and set a

DTC, but perform your own diagnostics as well. Take VCERTT's HO2S Diagnosis Course to accurately determine whether an HO2S is operating properly. This course will give you the confidence to replace a slow or skewed HO2S. Also, follow the manufacturers' service recommendations for replacement intervals. A blown headgasket or cracked head will quickly destroy an HO2S. Cracked vacuum lines or an exhaust leak can trick the HO2S enough to substantially increase the fuel delivery and eventually destroy the converter. Occasionally a skewed sensor such as an ECT, MAF or MAP, or IAT can send slightly inaccurate information to the PCM that can affect proper fuel delivery. Before letting that expensive CAT leave your shop, be sure it won't come back too soon. Prevent premature converter failures: check systems and components that affect air and/or fuel delivery.



DID YOU KNOW?

OBD II SCAN TOOLS can be an outstanding diagnostic tool!

- ** Not just a required tool for 1996 and newer VT State Inspections
- ** Extract DTCs – Diagnostic Trouble Codes on any OBD II vehicle
- ** Display Freeze Frame data – vehicle conditions at the time of the fault
- ** They start at less than \$300
- ** VCERTT offers trainings with a variety of these tools – see training offerings around the state on the last page

THE MOST COMMON DIAGNOSTIC TROUBLE CODES

1. P0440 EVAP System
2. P1443 Ford EVAP Control System Valve Failure
3. P0420 CAT Efficiency
4. P0141 HO2S Heater
5. P0133 HO2S B1S1 Slow
6. P0171 B1 System Lean
7. P0300 Multiple Misfire
8. P0401 EGR Low Flow
9. P0455 EVAP Leak
10. P0302 Cyl #2 Misfire

The box to the left shows the 10 most common DTCs, Diagnostic Trouble Codes, as surveyed on vehicles during the Vermont OBD Inspection since July 1999.

Vermont's OBD II Inspection Program is being used as a model by more and more states to meet the federal requirements for emissions testing and air quality controls. As the data begins to pile up, professionals throughout the industry will have more information about common DTCs and their causes. This data also reflects the data collected nationally from OBD Inspection Programs.

This data shows typical failures in an aging fleet. The CAT problems were primarily found in 1996-1997 vehicles. The Ford specific failure resulted in a TSB to replace a faulty valve. The rest of the failures are the result of normal wear and tear on a tightly monitored emissions system. Air filters become plugged, EGR ports become blocked, converters and HO2Ss wear out or are killed, and ignition components deteriorate.

All these DTCs lead to required service and maintenance work.

Remember that most vehicles warranty the Catalytic Converter and PCM for 8 years / 80 k miles, but the multiple HO2Ss, spark plugs, ignition coils, and even EGR and EVAP components are customer-pay parts and diagnosis typically after 3 years / 36 k miles. Don't send all cars to the dealer or just replace the warranted parts: an OBD II vehicle with a DTC should be fully diagnosed and repaired.

DID YOU KNOW THESE OBD II TIDBITS?

?? Have you pulled a diagnostic trouble code for a Misfire, but the car appears to be running well with just a bit of roughness reported by the customer when first operated after sitting overnight? Ask if spark plugs, or other ignition components, have been replaced recently – a fragile plug wire may have been damaged in the process, still passing sufficient voltage to fire the plug cleanly, except during that difficult initial cold start-up. And don't forget to look at a scanner's Freeze Frame data!



?? Similar intermittent electrical problems can result from piercing insulation with a test probe: this provides a route for corrosive moisture. Also, abused connectors, and missing shields or clips can cause rapid deterioration of wires.

?? Vibration of electrical connectors is a common problem – a bit of corrosion on the thin pins and sockets, a little vibration, a little thermal cracking of aging plastic connector bodies: this is the recipe for intermittent running problems and transient codes!

?? Poor PCM (Powertrain Control Module) grounds are a common problem – another example of what most techs find to be one of the basic truisms of repairs: “Start with the Basics First!”

?? Always bear in mind that a Diagnostic Trouble Code for a *sensor* may indicate a problem in the *circuit* which includes that sensor. Perform a quick test for proper supply voltage and ground to avoid repeated MIL illumination following sensor replacement. Our Comprehensive Components Course covers quick and easy checks for sensors and their circuitry.

WANT TO KNOW MORE? Some Ease, Kal-Equip and Snap-On scanners may need to be updated to correct communication problems with certain vehicles. These scan tools may read “Unable to Communicate” when connected. Contact Ease at 888-366-3273, KalEquip at 800-253-9880, Snap-On at 800-370-5290, your tool dealer, or the Air Pollution Control Division at the VT Department of Environmental Conservation (see Contact Information on last page).

WANT TO KNOW MORE? Not all vehicles will have all eleven components or systems which generic scan tools are capable of checking. Scanner messages of “not available” or “not supported” should not be confused with a fault in the vehicle being tested.

WANT TO KNOW MORE? A new PCM language, Controller Area Network, CAN, will be introduced on some 2003 vehicles. All new vehicles will be required to use only this language by 2008. Scan tools will require updates as this new language is phased in. Keep up-to-date in our next issues of the VCERTT Newsletter!

READY OR NOT?

Simply put, “Readiness” tells you whether or not a vehicle's OBD system has tested the items it checks at least once since the last time the PCM's volatile memory was erased (the memory is erased by clearing codes with a scan tool or from a disconnected or discharged battery).

If the status of a given component or system is “not ready”, the OBD system can't tell you if there's a problem with that item. When the OBD system tests a component or system, it sets the status of that item to “ready” – if there's a problem, the MIL comes on and a DTC is stored.

For state inspection, vehicles must have no more than two monitors “not ready” in order to pass the OBD check. But remember, there are some exceptions – these include new vehicles with less than 1000 miles, and some early OBD II vehicles, typically from 1996-98, including all '96 Subaru, certain '96 Chrysler models, and all '96 – '98 Volvos, Saabs, and Mitsubishi's. These vehicles may show more than two “not ready” monitors and still qualify for an Inspection Sticker. See your VT Inspection Manual for details.

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 Mysterious MAP, P0105, P0106

VCERTT researched a 1996 Subaru with a history of Manifold Absolute Pressure (MAP) Sensor failures. The vehicle had its first MAP DTC (P0105) at 119,000 miles during its first winter in Vermont. The first shop to attempt a repair simply cleared the code and sent the vehicle out. It returned a few days later, with the MIL on again. The shop then replaced the MAP sensor. The following winter, at 142,000 miles, the MIL came on, and the customer took the vehicle to another shop. This shop extracted DTC P0105 and cleared it. Of course the MIL came right back on, and the customer returned a few days later. This time, shop #2 looked for TSBs, Technical Service Bulletins, and found that Subaru had a problem with MAP sensors due to ice formation in the vacuum line. The MAP sensor was replaced, a filter kit and vacuum hose upgrade was installed, the code was cleared, and the vehicle was shipped out. It returned a few days later with the MIL On and MAP DTC P0106. At that point, shop #2 gave up, told the customer the "OBD system (was) no good," and the customer continued to drive the vehicle with the MIL on. For the next major service, 181,000 miles, the customer went back to shop #1 and reported the MIL On. Shop #1 performed the major service but "didn't have time" to take care of the MIL On issue. VCERTT intervened at this point. It seemed a mysterious problem, but we wanted to test our **Comprehensive Components Curriculum** so we followed our **Diagnostic Procedure** laid out in the manual, nothing fancy, an outline of most repair strategies:

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**



Our results showed the MIL was On. Using a generic Scan Tool, the familiar DTC P0106 appeared and the Freeze Frame Data showed that the MAP DTC was set shortly after a start-up. RPM was at idle speed and the ECT, Engine Coolant Temperature, Sensor showed a cool engine temp, 100°F. This did not appear to be an intermittent problem triggered by a series of strange events; the OBD system was able to pick up the fault quickly as soon as it had a chance to check the MAP sensor. We performed a thorough Visual Inspection and noted an unusual component in the MAP System, a Vacuum Switching Valve, VSV. We checked TSBs and found only the TSBs relating to the filter kit upgrade. That kit had been installed. We dug around for information about the VSV, finding only that it is in-line with both the MAP System and the EVAP System. We realized that the VSV has vacuum applied to it all the time. It is normally energized, allowing manifold vacuum flow to the MAP

VCERTT
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Sensor. When the PCM wants to perform a test of the EVAP System for flow, it shuts the manifold vacuum source down and allows the vacuum supply to come from the manifold, through the EVAP System, to the MAP Sensor. This allows the PCM to “see” the changes in pressure in the EVAP System to verify purge flow. After reviewing the system we proceeded to test the MAP Sensor and system. The MAP Sensor was not receiving a steady vacuum supply. We checked the routing on the Vacuum Routing Diagram under the hood, something we should, of course, have done during our **thorough** Visual Inspection. It appeared that the hose routing was backwards:

manifold vacuum was applied to the wrong port on the VSV. We switched the lines and proceeded to test the system. The MAP Sensor was receiving its 5 Volt reference voltage and ground from the PCM. With the vehicle running the signal voltage changed as expected from around 1 Volt at idle to nearly 4.5 volts at WOT, Wide Open Throttle. To verify our repair we changed the vacuum lines back to the position in which we had found them and, sure enough, the MAP Sensor readings were not correct. After our repair we drove the vehicle for several trips. We brought it back in and rechecked for DTCs and MAP Sensor System operation. We believed we had found the problem. To be sure, we followed up with a phone call to the customer a few days later.



WHAT WE LEARNED:

- 1. Just clearing DTCs doesn't work.**
- 2. Check TSBs, they really can help.**
- 3. Thorough Visual Inspections work:
Up to 75% of problems can be found visually.**
- 4. Verify your repair. Shop #2 almost fixed the vehicle properly, simply testing would have kept that customer!**

OBD and Vermont State Inspection can identify vehicles that are polluting excessively. But the environmental benefits of the program are really achieved by the repair industry through diagnosing the root causes of emissions problems and performing effective repairs.

ABOUT OUR ORGANIZATION:

VCERTT is a joint effort by Vermont Technical College in Randolph, and the Air Pollution Control Division of the Vermont Department of Environmental Conservation to provide free technical bulletins to Vermont automobile and truck technicians. Our earlier efforts have included collaboration on the Vermont OBD II check for State Vehicle Inspection, including preparation of training materials, and training of the instructors and individual Vermont technicians. In our labs and class rooms we have had an opportunity to review various aspects of emission-related technology, and hope to share some of these details with those of you in the field – you are on the front lines of the struggle to keep our environment clean.

SHARE YOUR EXPERIENCES . . . Please share your hard-won knowledge and tips, and give VCERTT feedback to share with others. Please call, write, or email us today!

UPCOMING TRAININGS FOR AUGUST AND SEPTEMBER

Trainings on the diagnosis and repair of OBD II vehicles are sponsored by VCERTT. They are offered at eight sites around the state. The \$40 fee covers tuition, manual, and certificate of completion. Please contact Amanda LaVallee at Vermont Technical College for further details, (802) 728-1386.

The OBD II Systems and Inspection course, covering the operation of the OBD II System and the OBD Inspection is offered on an on-going basis. Please contact VCERTT to sign up for the next session.

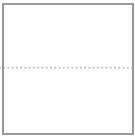
The Comprehensive Components Diagnosis Module on diagnosis and repair of OBD vehicles is now being offered. This curriculum covers operation and testing of a variety of sensors and outputs using a digital voltmeter and scan tools. The first classes offered received excellent evaluations: "The lab exercises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

A new module: H02S Operation and Diagnosis will be offered throughout the summer. The newest VCERTT module covers H02S (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 false codes and plugged converters. Learn how to accurately test the H02S to find the *real* cause of the DTCs.

ST. ALBANS	8/14 OBD	8/21 CC	9/9 CC	9/23 HO2S	
ESSEX	8/12 OBD	8/26 CC	9/10 CC	9/24 HO2S	
LYNDON	8/20 OBD	8/22 CC	9/10 CC	9/19 HO2S	9/24 HO2S
BARRE	8/15 OBD	8/22 CC	9/12 CC	9/19 HO2S	9/26 HO2S
RANDOLPH	8/8 OBD	8/22 CC	9/12 CC	9/24 HO2S	9/26 HO2S
BRATTLEBORO	8/13 OBD	8/20 OBD	9/10 CC	9/19 HO2S	9/24 HO2S
BENNINGTON	8/6 OBD	8/13 OBD	9/10 CC	9/24 HO2S	

ALL CLASSES RUN ONE EVENING 5:30 – 9:30 AT THE TECH CENTERS LISTED ABOVE
CALL AMANDA LAVALLEE @ 802-728-1386 TO SIGN UP TODAY!

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