



VCERTT NEWS

VCERTT: VERMONT CENTER FOR EMISSIONS
REPAIR AND TECHNICIAN TRAINING
A PARTNERSHIP OF VERMONT TECHNICAL
COLLEGE AND THE VT DEPARTMENT OF
ENVIRONMENTAL CONSERVATION TO
PROVIDE OBDII INFORMATION AND
TRAINING TO VERMONT TECHNICIANS

FALL, 2003

VOLUME 2, ISSUE 2

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Our last issue of VCERTT News gave a brief introduction to the Air Fuel Ratio Sensors currently being used on several Asian vehicles and on some Cadillac models. The technology offers more precise measurements of air fuel ratios, especially outside of the narrow range that a traditional zirconia Oxygen Sensor can. They are sometimes called a Wide Range, Wide Band, Linear or Lean Air Fuel Ratio Sensor. It is likely that more and more manufacturers will begin to use these sensors on new products.

Here is a more accurate description of how these Air Fuel Ratio Sensors (AFRS) work. The traditional Oxygen Sensor (O2S) informs the PCM whether the air fuel ratio is higher or lower than 14.7 parts of air to 1 part of fuel, the theoretically perfect mix. The Air Fuel Ratio Sensor can accurately measure an air fuel ratio between roughly 12:1 and 22:1. The PCM can then command the air fuel mixture precisely to the desired ratio. The air fuel ratio no longer cycles slightly above and slightly below the target value. During steady state cruise, for example, the PCM can almost instantaneously command the air fuel ratio to a lean, fuel saving ratio of 22:1. And just as quickly it can adjust the ratio to 12:1 when the driver demands acceleration. So far, these Air Fuel Ratio sensors are only being used as a pre-catalyst air fuel sensor; downstream of the converter, a traditional O2S is still used.

The sensor itself is usually a four wire sensor (a few use five wires) that looks very similar to a traditional zirconia O2S. The heater circuit requires a power and ground, as

usual. The AFRS operates at a much higher temperature than an O2S. The PCM may provide over 6 amps to the AFRS heater circuit! It is often duty cycle controlled; the PCM turns the circuit on and off rapidly to maintain the correct temperature. The other two wires are signal wires and will show steady voltages. The PCM monitors the change in direction and level of current flow on each of these wires.

On a scan tool the signal from an AFRS usually shows a very steady voltage. If you thought it was an O2S you'd think it was dead. To determine which type sensor you are working with you can test the sensor wires. An AFRS will have two signal wires with slightly different, very steady voltages. The Toyotas, for example, use a 3.0 volt and a 3.3 volt signal wire. An AFRS looks slightly different than an O2S; the body is thinner. The photograph to the left shows an AFRS. You can also refer to service information; we know that some Toyotas, Hondas, Subaru, Hyundais, GMs and VWs use AFRSs.

A whole new series of diagnostic trouble codes are now used. DTCs P2237 through P2256 describe faults specific to the Air Fuel Ratio Sensor. Your first test for these sensors should be for perfect connections; they are very susceptible to faults caused by improper terminal fit. For a thorough discussion of testing the sensor operation, please come to our updated Oxygen Sensor and AFR Sensor Operation and Diagnosis course, offered this fall and winter at sites around the state.



ABOUT VCERTT NEWS:

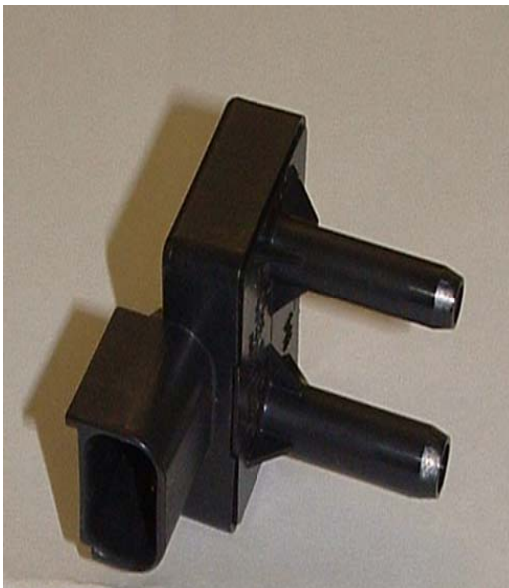
The purpose of this newsletter is to provide specialized information to the front line: you, the technicians, service advisors and managers in the field handling repairs and customers. The OBD Inspection Program is now over three years old. While the inspection itself is an easy addition to the VSI we know that repairing OBD II faults 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 particular vehicle or a scan tool, give us a call. We may be able to help and we can pass along relevant information. We're always 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.

CALL US AT: 802-728-1387 - OR EMAIL US AT: OBDNEWS@VTC.VSC.EDU

FORD DTC P0401 OR P0402

There is a technical service bulletin that applies to: 2000-02 Taurus/Sable; 2001-02 Crown Victoria, Focus, Mustang, E-Series, Escape, Expedition, Explorer, F-150, Ranger, Windstar, Town Car, Cougar, Grand Marquis, Mountaineer

The Fords listed above may come in with the MIL on and DTC P0401, P0402, P1400 or P1401 stored. They may also have a drivability concern of rough running, low power, surge and poor fuel economy. Ford says this indicates a problem with the Differential Pressure Feedback EGR (DPFE) sensor on the EGR system. The DPFE sensor has been a common problem for years on many Ford models. It has two lines connected to exhaust ports, one to the exhaust stream and the other to the EGR exhaust feed. The DPFE generates a 0 to 5 volt signal based on the difference between the two pressures. When EGR is flowing, that pressure will drop and the signal reading will be high. It is a typical three-wire sensor with a signal, a 5 volt reference and a ground supply. Check for cracked or brittle lines before condemning the sensor. If the vehicle has a tube-mounted DPFE sensor and one of these codes are present, the bulletin instructs to install a new sensor, P/N 2F1Z-9J460-AA. The DPFE is shown below.

**VW/AUDI MISFIRE DTCS**

A large number of Volkswagen and Audis have had a problem with misfire caused by faulty coils. For a long time the supply of replacement coils was insufficient. Dealerships were replacing one coil at a time only to have the customer return soon after with another concern. The manufacturer had previously published a technical service bulletin (TSB) acknowledging the problem. Now they have upgraded the problem to a recall. The recall affects all 2001 to 2003 Volkswagen and Audi vehicles. The dealer will replace the coils free of charge. The service is supposed to take less than one hour. If a customer has already replaced a coil they may be eligible for reimbursement.

Symptoms of the coil faults are pretty typical; rough idling, reduced power, hesitation and bucking under load, and an illuminated MIL. In our experience we have often been able to see and hear arcing at the coil after spraying the coils with water. Time will tell what affect these episodes will have on the life span of the catalytic converters. It is definitely worth bearing in mind if a VW/Audi also comes in with a DTC P0420, low catalyst efficiency. Misfiring caused by a faulty coil can definitely degrade a converter.

VCERTT: NEW TRAINING FORMAT

VCERTT has made some important changes to our training format this fall. You will notice that there are fewer offerings of each class, but we will run every class. That's right, no more waiting to see if the class will run. If you call to register for the class, you will be able to attend the class on the night it is scheduled.

We will also provide more effective administration of our phone line. Call our new number 802-238-3211, leave a message, and we will call you back by the following day, guaranteed!

Check out our new training schedule included with this newsletter. Our latest offering, Misfire Monitoring and Diagnosis, offers a thorough discussion of the possible causes of misfire along with several key diagnostic procedures. Listen to what people said about the preliminary run of our new misfire training:

"The depth of instruction was excellent."

"The on car testing was really valuable."

"The instructor's knowledge and presentation made the course great."

"Learned new skills, course was super."

CALL TO REGISTER TODAY!

802-238-3211

VCERTT CASE STUDY: P0303 AND P0420 MISFIRE AND INEFFICIENT CATALYST

Misfire is a failed combustion event; it may be a full or partial misfire. It is a common drivability issue that often triggers a DTC (P0300 through P0312), and illuminates the MIL. The most frequent cause of misfire is an ignition system fault, but plenty of misfires are caused by the fuel system and engine mechanical problems. Faulty spark plugs, wires, coils, injectors or their o-rings and low compression or sticking valves are examples of the causes of misfire.

This summer a vehicle was brought to us with a customer concern for bucking and hesitation. The MIL was on. We extracted Diagnostic Trouble Codes (DTCs) and found P0420 (catalyst efficiency below threshold). We road tested the vehicle to try to duplicate the drivability concern. Under normal driving conditions we could feel nothing. Under heavy load in too high a gear, however, the misfire became very pronounced. As a matter of fact, the malfunction indicator light started flashing. This occurs only when there is a catalyst-damaging misfire.

We brought the vehicle back into our lab and checked again for DTCs, now P0303 (misfire in cylinder number 3) had been stored. We recorded our freeze frame data and cleared the DTCs. We began our diagnosis by testing the ignition system. The platinum plug looked fine, but most do. Then we swapped the #3 and #1 plugs and road tested the vehicle again. Under load, misfire started occurring and the MIL came back on. The DTC was again P0303 so we knew the spark plug was not the culprit. Next we checked the resistance of the #3 plug wire. It was reasonable (about 3,000Ω) and similar to the reading of the other wires. We sprayed the wire with water to try to check the insulation, and snapped the throttle hard but could see or hear no arcing, snapping, or misfire. Just to be certain we swapped the plug wire with cylinder #1. We cleared the DTC, drove the vehicle, and came back to find P0303. The coil pack was one assembly, so we couldn't swap the coil. With the coil primary wires (small gauge) disconnected, we measured the coils' primary resistances between the coil B+ terminal and the other two terminals on the coil pack. Both resistances were 1.1 ohms, within the general specification of .8—2.0 ohms.



Next, we measured the secondary resistance between the two high output terminals on the suspect coil. We compared the two coils' resistances and they were nearly the same. Unfortunately, this testing is not conclusive, the coil could still be faulty. To test coil output we used a wide gap spark tester and compared the #3 spark to the others. They all showed a strong blue and yellow spark. So we decided to check the fuel system next.

We knew the #3 injector was being pulsed because the vehicle only misfired under heavy load. We figured that the fuel filter, pressure and volume were OK or we'd have a P0300 DTC for random misfire. We cleared the codes and swapped the injector from the next cylinder. We carefully inspected the injector o-ring to be certain it was not causing a vacuum leak to cylinder #3. Another drive produced the same P0303 DTC.

To check for mechanical problems we performed cranking and running compression tests on cylinder #3. The cranking compression was a healthy 165 psi. With the compression gauge installed in cylinder #3 we ran the vehicle. We released the cranking compression pressure and saw about 75 psi at idle and 45 psi at 2500 rpm. Those are the generic specifications. Another cylinder showed similar results so we concluded that cylinder #3 was mechanically sound.

After eliminating the most common causes of misfire, we remained suspicious of the coil because the misfire felt so much like an ignition miss. It only occurred under a heavy load and produced quite strong bucking from the engine. We replaced the coil pack and the vehicle ran perfectly. We drove the vehicle under a heavy load for an extended time; no more misfire. The P0420 DTC (low catalyst efficiency) did eventually return, however, after the OBD system again had a chance to run the catalyst monitor several times. Undetected or unrepaired misfire will cause the converter to degrade. We replaced the converter. Those two repairs have kept the MIL off for six months now.

Our newest VCERTT training module, Misfire Monitoring and Diagnosis, will be offered this fall and winter at sites around Vermont. We will cover the tests briefly described here as well as offer more thorough diagnostic procedures for the many possible causes of misfire. Call Betsy, our new VCERTT coordinator, at 802-238-3211. Please let it ring until voicemail picks up. We *will* return your call by the following day.

INTERNET INFORMATION SOURCES

VCERTT: VERMONT CENTER FOR EMISSIONS REPAIR AND TECHNICIAN TRAINING

VCERTT

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Using the internet for technical support either during or after the work day makes sense for many technicians. Great technical articles, tech service bulletins, technical support and OEM service information are all available on the web. Much of the information is free. Here is just a partial listing of some of the helpful websites available for automotive technicians:

IATN—International Automotive Technicians' Network @ www.iatn.net

This network of over 45,000 automotive technicians is pulled together in a terrific website. Basic membership is free to seasoned technicians. It offers a technical help forum where you can pose a specific vehicle problem and technicians from around the globe respond with their experience and suggestions. Possible solutions are sent to you; many posts receive dozens of replies within hours. Particularly helpful in identifying pattern failures that we do not always experience in our small state. Sponsoring members have access to extensive archives of vehicle faults and fixes. The site also offers a fine technical resources section with free training and service materials from GM, Ford and Toyota. A current list of all generic OBD II DTCs defined is available in the technical resources section.

SERVICE INFORMATION RULE:

All manufacturers must make emissions repair related service and training information available on the web. The results are now useable; manufacturers have launched websites with loads of service information. Most websites are reasonably priced (a few are even free!) with access typically \$10 -\$20 per day and \$50—\$300 per month. Materials can be downloaded and printed. For a full listing check out the NASTF contact list available through IATN's technical resources. Here's a partial list:

AUDI: www.erwin.audi.de/

BMW: www.bmwtechinfo.com

CHRYSLER/DODGE/EAGLE/JEEP/

PLYMOUTH: www.techauthority.com

FORD/LINCOLN/MERCURY: www.motorcraft.com

**GM/BUICK/CADILLAC/CHEVROLET/GEO/
GMC/HUMMER/OLDSMOBILE/**

PONTIAC/SATURN: www.gmtechinfo.com

HONDA/ACURA: www.ServiceExpress.Honda.com

HYUNDAI: www.hmaservice.com

ISUZU: www.isuzutechinfo.com

JAGUAR: www.jaguartechno.com

KIA: www.kiatechinfo.com

LANDROVER: www.landrovertchno.com

MAZDA: www.mazdatechno.com

MERCEDES-BENZ: www.startekinfo.com

MITSUBISHI: www.mitsubishitechno.com

NISSAN/INFINITI: www.nissantechinfo.com or
<http://www.infinititechno.com>

PORSCHE: www.techinfo.porsche.com

SAAB: www.saabtechinfo.com

SUBARU: www.subaru.com, click on "home", then
"technical information".

SUZUKI: www.suzukitechno.com

TOYOTA/LEXUS: www.techinfo.toyota.com or
www.techinfo.lexus.com

VOLKSWAGEN: www.erwin.vw.com

VOLVO: www.volvovira.com for service informa-
tion subscription or www.volvotechinfo.com for TSBS

NUTZANDBOLTZ @ <http://www.nutzandboltz.org/>

This is a smaller site, similar to IATN. Membership starts at \$11.95 per year. It is a good source for recall, secret warranty, and technical service bulletin information.

CAR-STUFF @ www.car-stuff.com

Find many links to books, magazines, clubs, parts, enthusiasts.

HOWSTUFF WORKS @ <http://auto.howstuffworks.com/>

Offers explanations of automotive systems and cutting-edge developments.

NEW YORK TIMES @ www.nytimes.com/library/auto/autonav.html

Provides links to everything and good general articles on automotive topics.

AUTOPEdia @ <http://autopedia.com/>

This is a good site for links to a variety of automotive specialty sites. It has links to all automobile manufacturers worldwide.

SAE—Society of Automotive Engineers @ www.sae.org

The SAE site provides access to current research, technology and international news. Some information is free and other requires membership.

STS—Service Technicians Society @ www.sts.sae.org

STS is the automotive technician's arm of SAE. The website provides articles and links geared toward techs.

AUTOSHOP @ <http://www.autoshop101.com/>

This is a good source for free technical articles and free online instruction manuals.

BRADSITE @ <http://www.bradsite.com/auto.htm>

This is another source for technical articles and links to free pages of automotive magazines.

MOTOR @ www.motor.com

Motor offers information resources for the professional technician. The site offers free online viewing of Motor Magazine, an excellent publication highlighting new systems, diagnostic information and tool reviews.

BABCOX @ www.babcox.com

Babcox publishes several magazines for professional repair technicians including Underhood Service, Import Car, Tech Shop, Brakes and Front End. View these magazines online or sign up for your free subscriptions.

MOTOR AGE @ www.motorage.com

Another excellent magazine available for viewing on line or sign up for a free subscription.

WEBER STATE @ <http://autocenter.weber.edu/OBD-CH/>

Offers information on OBDII as well as links to technical resources.