

June 2025



Technicians Service Training

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Editor

"G" Jerry Truglia

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"Importance Of Strategy Based Diagnostics"

The first place to start is by interrogating the driver of the vehicle. A good Q & A session may lead you to looking into an area that you may have not checked without the information they provided. The next step is to use the best tools you own; your brain, eyes, ears, nose and hands to check the problem out. After a preliminary "look see", research the problem using your service information (SI) source, followed by investigating Technical Service Bulletins (TSBs) that may be related to the issue. With so many variations on even the most routine system, you have to know the particulars of the system you are working on before you even pick up a wrench. Information on iATN, Identifix, Alldata, Mitchell, Autodata, MotoLogic or even Google & YouTube can be very helpful identifying if the vehicle you are working on needs a reflash or has a silver bullet problem. Remember, when looking at a silver bullet solution always check and test the components and the system before replacing anything. After performing the previous procedure, connect one of the best tools to use to diagnose problems, the scan tool, since it's easy to use and provides us a great deal of information in the shortest period of time.

(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.*
- *Provide training seminars for a reasonable price.*
- *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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TST membership includes special pricing on weekday night seminars and the occasional full Saturday seminar. With a **\$99.00 yearly individual or shop \$299.00 membership**, the simulcast are only **\$20.00**. **TST seminars are NOT sales or product seminars.** The instructors that TST brings in are all “hands-on” industry experts with up to date, cutting edge knowledge that you can use in your shop the next day. That’s 99 dollars for a seminar in which you are able to learn something useful, for fixing those tough jobs that we all see on a regular basis. Our instructors are masters at making the complex understandable. Membership also includes a newsletter full of real world technical articles, diagnostic case studies, and solutions to the kinds of problems you see in your bays each week.

The following are some of TST’s regular instructors:

Bernie Thompson of ATS

John Thornton of Autotrain Inc.

Wayne Colonna of ATSG

Jorge Menchu the “Labscope Guru,” AES Wave

John Anello of Auto Tech On Wheels

Mark Warren of World Pac / Motor Magazine

Brandon Steckler of CTI & Motor Age Magazine

Peter Meier of Motor Age Magazine

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"Importance Of Strategy Based Diagnostics" (con't from p. 1)

This should be followed by using either an Associated, MidTronics or other battery/starter/alternator tester that will ensure that you are starting with good a good electrical foundation. Most shop-level scan tools today provide for a full system scan that queries the entire vehicle's computer system and all related control modules (ECUs) to find any system faults. Sometimes a fault in one system can affect another system. For example, our shop once had a Dodge Dakota that had a complaint of a hard 1st shift. The shifting problem turned out to be caused by a PO136 (O2 Sensor Bank 1 Sensor 2 heater malfunction). After Wayne Colonna (transmission guru extraordinaire and ATSG / ETE Reman technical director besides turned us on to the correct diagnostic path, we found the connection between the O2 heater to the shifting problem.

So before we start to diagnose a vehicle we need to have a game plan just like a coach or manager of a major league sports team. Your game plan needs to start with a plan on where and how to proceed in diagnosing the problem at hand. We all have different ways to diagnose a problem vehicle but there may be a better route to follow. After listening to the owner concerns or looking at a failed inspection report you should do the following; visual inspection, check TSBs, check information in Identifix, Iatn, Google or YouTube and read up on the system, along with component information and theory. Next try starting your diagnostic procedure by testing from the basics up, finding out what's right and what's wrong, just like the big box scope analyzers did for year gone past. The good thing about the old big box analyzers was that they forced us to start at the battery, starter, alternator, engine mechanical condition, emission gas readings, ignition, fuel systems and scan data. Knowing what is good prevents us from replacing a good component and allows us to focus on what bad. Remember, that if you miss checking the basics you may just miss the problem. If we were going to diagnose a sagging roof, you should not install a new roof without checking the walls and the foundation first. In diagnosing an engine performance or OBD II

(Con't on page 5)

"Importance Of Strategy Based Diagnostics" (con't from p. 4)

problem we need to start with the basics. After checking the battery and making sure that it's good you should check the engine mechanical condition which is often overlooked. Checking the mechanical condition of an engine is so important that at least two OE scan tools have a built in scan tool test to make sure that the mechanical condition of the engine is good or bad. The reason why Ford and Toyota installed these tests on their scan tool is that they have seen too many parts, sensors or actuators, thrown at a problem by their own technicians with no solution or fix achieved. The root cause of the problem in many cases stemmed back to something basic from a bad battery to a mechanical problem. Many engines that we are working on today have some form of variable valve timing. The use of the wrong oil can cause the variable valve timing system to portray a mechanical problem. The cam phasers will not be able to adjust to the proper settings if the wrong viscosity oil was use due to improper oil flow. More on variable valve timing with be covered later in this manual.

Strategy based diagnostics and diagnostic routines should be used when the MIL is on since there is at least one DTC stored in the PCM.

The PCM turns on the MIL if on-board tests indicate a problem that might result in increased emissions (1.5 times the test standard). Caution: A DTC may be stored even though there is no driveability symptom. OBD II may turn on the MIL before emissions actually increase to save the engine, components or the catalytic converter.

The PCM controls the MIL and turns on the MIL for a fault. The PCM can also turn off under the right circumstances. If we turn off the MIL without repairing the problem that stored the DTC, the PCM will just turn the MIL back on again.

We need to know what the PCM is thinking and seeing, *(Con't on page 6)*

"Importance Of Strategy Based Diagnostics" (con't from p. 5)

so that's why we need to connect our scan to interpret the data properly. For instance you should also check STFT and LTFT (Short and Long Term Fuel Trim), engine temperature, BARO, Calculated load, RPM, MAP or MAF and the O2 / AF sensors on every vehicle you test. You should always start your diagnosis by using the Generic/ Global section on your scan tool even if you have the factory information available. The reason why is that Generic/Global OBD II PID (Parameter ID) data is limited to a select number of the most important data that the PCM can provide for emissions / OBD II. Another reason is that Generic / Global PIDS are the same on every vehicle so weather it's a GM or a Porsche, the data PIDs are all the same and not confusing to understand. The other thing is that Generic/ Global will not substitute a PID value as the Enhanced data will display. Of course as you can expect in the automotive field there is an exception, which concerns the Air Fuel Ratio / Wide Range/Band sensors. Some scan tools will display a Toyota AF sensor voltage at approximately 0.685 volts, when in reality it's at 3.3 volts in the Enhanced side of the scan tool.

When diagnosing an illuminated MIL do not erase the DTCs unless the OE states in their service information to do so to run a Monitor. In most newer vehicles you do not have to erase the DTC, the PCM which illuminated the MIL, will check for three consecutive passes in the failing system and turn off the light. If you erased the DTCs you just cleared all the evidence. It would be like a detective going to a crime scene, bleaching and washing the evidence away. It make no sense to clear anything from the PCM without printing, screen capturing or writing down all the PID information along with the DTC, Freeze Frame, Pending DTCs, Mode 6 data and Monitor status. Using the information on when and what speed, temperature, load, etcetera is very important in helping us diagnosis the problem.

PCM Strategies for OBD II

(Con't on page 11)

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"Importance Of Strategy Based Diagnostics" (con't from p. 6)

One-Trip and Two-Trip DTCs

ONE-TRIP (Type-A faults) Catalyst-damaging misfire is an example of a vehicle problem that will store a DTC in a single trip. A condition exists that requires immediate attention. These are called One-Trip, or Type-A faults.

TWO-TRIP (Type-B faults)

The PCM must detect the fault condition on two consecutive trips to store a Type-B DTC. A first-time occurrence of a fault for a two-trip DTC is called a Pending DTC, but won't turn on the MIL.

If the same fault is seen by the PCM on the next consecutive trip, the fault matures into a full-blown DTC that is stored in memory and turns on the MIL.

DTCs and the MIL

If the engine is started and the vehicle is driven in such a way that the Enabling Criteria are met, the Monitor(s) will run. Each will get a passing or a failing grade (in Mode 6) when the Monitor is complete.

If a Monitor detects a failure of a one-trip DTC (Type-A), it will store a DTC and turn on the MIL. If a Monitor detects a failure of a two-trip DTC (Type-B), it will store a Pending DTC in memory and test again the next time the Monitor runs.

If the fault is detected again on the next consecutive trip when the Monitor runs, the Two-Trip fault matures into a DTC. The DTC is stored in memory and the MIL comes on. If it's the first DTC stored, Freeze Frame data is stored at the same time.

If an extreme misfire is detected that's likely to cause catalyst damage, the MIL may actually flash on and off ***(Con't on page 12)***

"Testing Computer Sensors" (con't from p. 11)

as an added warning that immediate repairs are needed. Or, it may simply come on and stay on.

Similar Conditions Window (Fuel and Misfire DTCs)

Similar Conditions is a potentially confusing term that applies only to Fuel and Misfire DTCs. Fuel and Misfire codes are in a special category all by themselves. There's a reason for this. The PCM will go to great lengths to protect the catalytic converter, and it knows that excessive fueling or extreme misfire will turn the inside of the catalyst into a burned-out chunk of useless garbage. The PCM doesn't want these catalyst-damaging conditions to continue for too long.

- If a first trip fault related to fuel or misfire is detected, the PCM records this information on an electronic scratch pad in the PCM's memory. Even if the fault doesn't occur on the next consecutive trip, the PCM will continue to watch for a similar failure during the next 80 trips.
- If the problem happens again with engine load and speed similar to those recorded on the scratch pad, a DTC will be stored, and the MIL comes on. The "window" where load and RPM are similar to what they were when the fault was detected is called a Similar Conditions Window. We'll use this concept again in a minute when we discuss how the PCM can turn the MIL off, if it decides the fault has truly gone away!

•

How Does OBD II Know if There's a Problem?

It knows if inputs and outputs fail. It monitors circuits electrically. It uses various sensors to check for things like:

- Misfire (using the crankshaft and other sensors)
- EVAP leaks (using control valves and pressure sensors) ***(Con't on page 13)***

"Testing Computer Sensors" (con't from p. 13)

- EGR operation (by comparing manifold pressure or oxygen sensor voltage to EGR opening to see if EGR operation changes manifold pressure or exhaust oxygen content).

What Types of Tests Does the PCM Run?

- Passive: Just sits and looks for problems
- Active: Activates a component to see if it works
- Intrusive: This is a special Active Test that may affect the way the vehicle runs. (Intrusive tests may cause some brief "weird" symptoms such as a slightly rough idle. These minor symptoms are not to be confused with a true vehicle failure.)

•

Example of Active Test

The PCM may open the EGR during closed throttle deceleration when the engine is under NO load. Opening the EGR should allow exhaust gas into the intake manifold causing a brief increase in manifold pressure. MAP voltage should increase briefly to indicate exhaust flow. If the engine is not equipped with a MAP sensor, the O2 sensor will be used to see if the EGR system is working. When the EGR valve is opened the O2 sensor voltage should drop down below 450 mV if the valve and passages are working properly. This is an example of a sensor being used to test an actuator on the engine.

When troubleshooting OBD II Don't Forget the Paperwork! Keep accurate records. Good record keeping controls a diagnostic sequence to ensure a lasting repair. It also covers your butt when something goes wrong. The following is an example of what you should be printing out, taking a picture of with your smart phone or writing it down. Use the Evaluation sheet below or make one up yourself.

*Article by "G" Jerry Truglia
TST Founder- President - ASE Master Technician*

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