

October 2025



Technicians Service Training

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"Importance Of Strategy Based Diagnostics"

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Editor

"G" Jerry Truglia

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"Electricity Is Electricity"

Once you know how to diagnose electrical problems, you can do so on any kind of vehicle.

Many technicians may believe that hybrid and fully electrified vehicles are more complicated than gas or diesel-powered ones. Now, they are more complicated; however, there are many basic electrical tests and diagnostic strategies that can be shifted over from the standard 12-volt systems to the high-voltage systems. Electricity is electricity, and if you know how to diagnose electrical problems on non-electrified vehicles, you can (with the proper training and equipment) complete a proper diagnosis of hybrid or electrical vehicles.

2007 Toyota Highlander - "No Start"

Our first problem vehicle towed in was a 2007 Toyota Highlander Hybrid with 146K miles on the clock and a complaint of a no start. Upon our basic checks, we found the "Ready" dash HV light illuminated, but the engine would not run. The Highlander had a crank, no-start problem that could be caused by many different issues, mechanical or electrical. All the dash lights lit up like a Christmas tree, along with the

(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.*

Why join TST?

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

Ken Zanders of Illinois Air Team

"G" Jerry Truglia of A.T.T.S. Inc.



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Information contained in this newsletter is intended for use by professional auto repair technicians familiar with approved vehicle repair procedures. The authors are not responsible for physical injury or property damage resulting from the incorrect application of information or procedures outlined in this volume.

Currently there are **TST chapters in Connecticut, Massachusetts, New Jersey, New York** and membership continues to grow. For more information you can call **TST** headquarters at:

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"Electricity Is Electricity" (con't from p. 1)

odometer, which displayed the following messages: Check Hybrid System, Check AWD (All Wheel Drive) System and Check VSC (Vehicle Stability Control) System.

Now those are some serious issues that need to be checked out carefully. We needed to contact the shop that towed the vehicle into us so we could find out some background on this no start issue. The shop responded by saying that the vehicle owner said, "It was running one day, but would not run the next." Since the shop was not sure where to start their diagnosis (because it was a hybrid vehicle), they towed it to us. Some techs get diag-shy when it comes to hybrid/electric vehicles because they may not have the training and the correct equipment. It's somewhat understandable, but we all need to update our skills or we will be left out in the cold. Today's shop owners and technicians need to invest in their careers and future, starting with a commitment to getting up to speed in electrical diagnosis followed by investing in hybrid equipment and most importantly hybrid/electric classes. The shop owner (from where this Highlander came) always made excuses that he was too busy to analyze hybrid vehicle problems. Some of you may agree with sending a problem vehicle out to be diagnosed and repaired while you make money doing what you do. Agree or disagree, as shop owners we need to make decisions that work for us. The Highlander did have a check engine light illuminated, which provided a starting point for diagnosis, but the shop decided not to be bothered with the vehicle.

With the Highlander hybrid vehicle in my shop, it was up to us to diagnose the problem. I always say we need a game plan before attacking any problem vehicle. That being said, we performed a quick visual inspection followed by the next best place to start - connecting a scan tool. Our choice, especially when it comes to hybrid/electric vehicles, is using the factory scan tool. Since this vehicle is a Toyota, we connected the Toyota Techstream and then selected Health Report, which performs a full vehicle scan of

(Con't on page 5)

"Electricity Is Electricity" (con't from p. 4)

all the systems. Once the Techstream health check was complete (**Figure 1**), the results would be analyzed to decide which path to take. The results in order are the following:

1. P0A0F Engine Failed to Start
2. P0351 Ignition Coil "A" Primary/Secondary Circuit
3. C1241 Low or High Power Supply Voltage
4. C1259 HV Control System Regenerative Malfunction
5. B1248 AVC-LAN Communication Impossible

(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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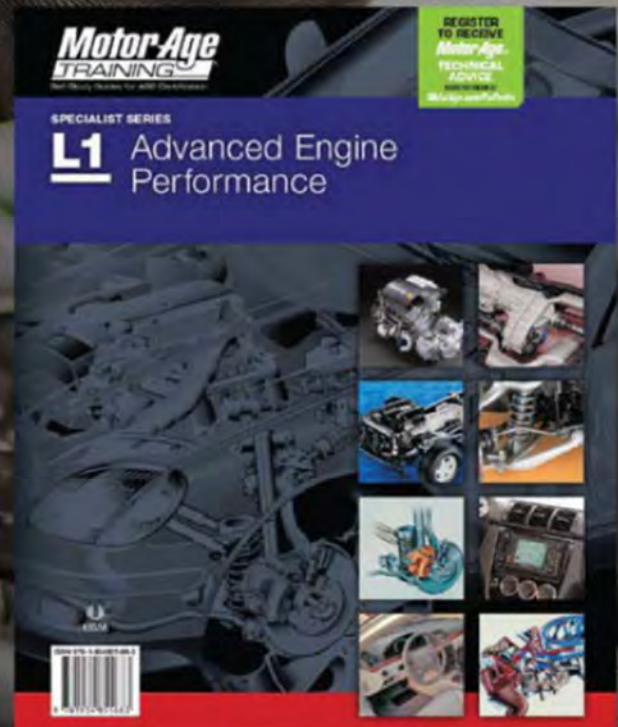


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"Importance Of Strategy Based Diagnostics" (con't from p. 6)

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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WE ARE LOOKING FORWARD TO 2026!

Welcome!

Technicians Service Training (TST) was spun off from the Society of Automotive Engineers (SAE) automotive technician service group, Service Technicians Society (STS). TST, which produces an annual daylong training program called the "Big Event," is a 501(c)(3) educational non profit organization that functions as a "not-for-profit" entity devoted to the following since its inception:

- Keeping our fellow technicians up to date with the latest technology.
- Providing quality training seminars and educational materials at a reasonable price.
- Delivering practical, useful repair information.
- Keeping technicians informed of industry trends.

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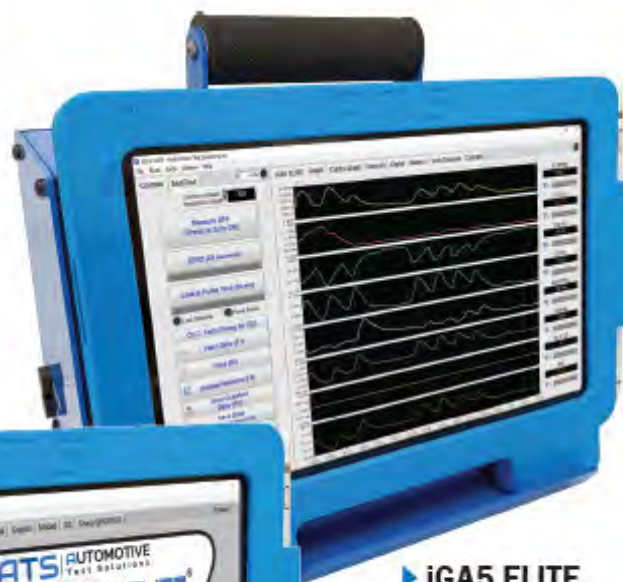
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