Understanding Permanent Diagnostic Trouble Codes

Permanent-Diagnostic Trouble Codes (PDTC's) are not new, they have been part of OBD2 requirements since 2009. PDTC's were phased-in starting with model year 2010 and were fully implemented by model year 2012 and subsequent model years. Since 2012 model year, passenger and light duty vehicles with **gasoline** and **diesel** engines were required to support PDTC's.
This may not have had relevance in the past, but now with the new BAR requirements, this will affect all in the automotive industry.

Let's quickly review the different types of codes as per the governing legislation.
A Pending fault code is defined as the diagnostic trouble code stored upon the initial detection of a malfunction (e.g., typically on a single driving cycle) prior to illumination of the MIL.
A Confirmed fault code is defined as the diagnostic trouble code stored when an OBD II system has confirmed that a malfunction exists (e.g., typically on the second driving cycle that the malfunction is detected. Opens, shorts and grounds as well as fuel trim faults will set at the time of occurrence).
A Permanent fault code is defined as a confirmed fault code that is currently commanding the MIL on and is stored in NVRAM.
Non-volatile random access memory (NVRAM), is defined as a type of memory that retains its contents even when power to the on-board control unit is interrupted (e.g., vehicle battery disconnected, fuse to control unit removed). NVRAM can be made non-volatile either by use of a back-up battery within the control unit, but is most likely performed through the use of an electrically erasable and programmable read-only memory (EEPROM) chip.

What makes the Permanent-DTC uniquely different from regular-DTC's, is that Permanent-DTCs are stored in a memory that cannot be erased by human interaction, scan tools (generic, aftermarket, or manufacturer-specific) or by a loss of battery voltage. When a P-DTC is logged, it is written and stored to a non-volatile memory (NVRAM) before the end of the ignition cycle, and it can **only** be erased by the OBD system itself.

Extinguishing the MIL.
Once the MIL has been illuminated it may be extinguished after three subsequent sequential driving cycles during which the monitoring system or fault condition responsible for illuminating the MIL, functions and the previously detected malfunction is no longer present, and no other malfunction has been detected that would independently illuminate the MIL.

Erasing a confirmed fault code.
The OBD II system may erase a confirmed fault code if the identified malfunction has not been again detected in at least 40 engine warm-up cycles (evaporative system, misfire and fuel trim will take 80 warm-up cycles), and the MIL is presently not illuminated or commanded on for that malfunction.

Erasing a permanent fault code.
If the OBD II system is commanding the MIL on, the OBD II system shall erase a permanent fault code only if the OBD II system itself determines that the malfunction that caused the permanent fault code to be stored is no longer present and is not commanding the MIL on.

Clearing P-DTC's can only occur in one of any of the following three ways; OBD system replacement / reprogramming, **Self-Healing** and **Healed**.

Self-Healing - If a scan tool "code clearing" has ***not*** been requested, the Permanent-DTC will be erased at the same time the OBD system verifies the cause for the DTC is no longer present and has satisfied the requirements related to the similar conditions criteria. The MIL will be commanded off and the confirmed code cleared, when the OBD system detects that a fault is no longer present on three consecutive trips with similar conditions criteria experienced as the confirmed fault conditions

Healed - If a scan tool "code clearing" command was requested, (i.e. technician clears codes after repairing a fault) the Permanent-DTC will not be erased until the Monitor and/or condition responsible for setting that specific Permanent-DTC has run at least once and confirmed that the fault is no longer present under the same similar conditions criteria.
Code clearing function of the scan tool will also reset all Monitor status to incomplete, and reset all Service Mode $06 information as well as Service mode $01 PID 30 - number of warm-up cycles since last code clear and PID 31- distance traveled since code cleared will also be reset to zero. BAR is using both of these data PIDS for their enhancement to the Smog program. When these enhancement are implemented, there may be times when clearing codes may not be prudent. Why rebuild data when you can let the vehicle self- heal? Is it better to run **all** the monitors 2 times or **one** monitor 3 times?

The OBD system is designed to be able to store at least four P-DTC's at one time. Should a vehicle have more than one P-DTC currently commanding the MIL, then only the most current fault/s would be stored as P-DTC's and the oldest code will be dropped out.

Permanent-DTC's are read on a scan tool under the request of Mode Service $0A and regular-DTCs are read under the request of Mode Service $03. This is done to distinguish the difference between the two types of codes.

Permanent DTC's are being used to decrease the likelihood of vehicles passing vehicle emission tests that still have a problem or a condition that has not been corrected. Because the OBD system itself will clear the code, the likelihood that a vehicle with a fault condition clearing the PDTC is not very likely.

Running the vehicle in the similar condition of the original fault condition will now be the new norm.
The freeze frame information is needed to reproduce the similar fault condition so that the OBD system will then determine if the fault conditions still exist or not. If it does not still exist, then the OBD system will then clear the fault from its memory.

What will you do if you do not have the freeze frame information? Good luck.

To reproduce the same fault condition the following is the minimum requirements for similar conditions: an engine speed within 375 rpm, load conditions within 20 percent, and the same warm-up status (i.e. cold or hot) as the engine conditions stored in the freeze frame.

When there is no Permanent-DTC and all the monitors have run and pass, there is a higher probability that the vehicle currently **does not** have an unrepaired fault.
There are still a few scenarios where faults could be present without a Permanent-DTC stored: a history code, a recent reflash or reprogramming of the vehicle, or multiple sequentially monitored components that failed and has been disabled testing due to the first failure – Pending Code.
The presence of a Permanent-DTC and no Confirmed Fault code is a definite indicator that that the MIL was on, the codes were cleared and the vehicle has not yet run under similar conditions to determine if the fault is healed. Like unset readiness, the presence of a Permanent-DTC does not definitively confirm if the vehicle still has a fault or not. It just means that the vehicle did not yet operate in the condition to clear the code, a Confirmed fault is a sign of a problem.

Readiness monitors may not be run for multiple reasons, including unrelated emission faults and/or being suspended by outside influences. A skewed sensor that is suspending a monitor may or may not produce a code but will cause OBD monitor not to issue a judgement (non-decision zone). Using the Readiness Monitors to determine if the Monitor has run to issue a judgement will help determine if the vehicle has tested itself.

This is part one of a three part series. The next article we will discuss how to run monitors more accurately, in less time on the first trip. We will accurately show how to determine if you are operating in suspended monitoring condition

Your questions and comment are welcome. Let me know how this will work for you.