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Proper Air/Fuel Ratio **How Do We Get It?** **Part III**

In parts I & II of ‘Proper Air/Fuel Ratio’ we discussed getting Fuel and Air to the combustion chamber. Now we will see how the computer pulls it all together and how this all affects our diagnostic routines.

If you have been to one of my classes, you have heard the discussion on what is needed to get an engine started and keep it running. There is spark, fuel, air (in and out) and lastly having all of it at the right time. For the most part this is where the PCM comes in.

Much of the basic timing comes from the mechanical timing of the engine. Spark, air and fuel injection are all subject to piston movement and valve timing. This set-up works well in one RPM range, such as idle, but in order to be effective the engine must operate through the entire rpm range and conditions.

The PCM operates in 5 basic modes: Start-up, Warm-up, Acceleration, Open and Closed Loop. The PCM continually modifies fuel based on various inputs. Coolant temperature, throttle position and load are considered primary inputs while air temperature, vehicle speed and EGR might be considered modifiers. When diagnosing a car, open and closed loop should become your focus; knowing if the PCM is in fuel control is the key to getting to the proper diagnosis.

As the vehicle comes up to temperature and the Oxygen sensor reaches an operating temperature of 600°F, the PCM goes into closed loop, aka, fuel control. This control will be reflected in the fuel trim numbers (refer TB80010). During this time you must be aware of each and every other input to the PCM and how it will react to them. Remember the computer is only as good as the information it receives and sometimes the culprit is mechanical not electrical. Let’s look at some examples:

- A stuck open EGR will create a vacuum leak that increases the amount of oxygen in the system creating a lean condition.
- A cracked fly wheel affects the Crank sensor output which causes an unstable rpm signal which affects fuel input.
- Blown diaphragm in a fuel pressure regulator causes fuel to leak into the intake manifold causing a rich condition.
- Customer constantly tops off fuel tank when filling up. This causes the purge system to draw raw fuel into intake creating an intermittent rich condition.

When you look at these carefully one can conclude that each one of these scenarios can affect the efficiency and life of the catalytic converter. The main point is that every component is part of a system, including the converter, and they are all interrelated. When diagnosing a problem we must look at the whole system rather than individual parts.

Cleaning up the environment...one converter at a time

Gary

