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MAGNAFLOW Performance EXHAUST

INTERPRETING FUEL TRIM DATA

Gary Stamberger – Training Director
Car-Sound/Magnaflow Performance Exhaust

OBD.TunerTools.com

This month we take the discussion of Oxygen Sensors to yet another level. In recent discussions we talked about the role these sensors played in closed loop fuel control. What exactly does that mean, "Closed loop fuel control", and what role does it play in maintaining a good working converter?

When a vehicle is started cold there is a warm up period which is referred to as, "Open loop". It's during this time period that the engine is polluting the most. Consequently, getting to closed loop fuel control is a top priority. The PCM has an internal clock that restarts on each start-up and it knows, based mainly on temperature, how long before all components are operating and it is ready to enter closed loop. To this end, many elements have been added to the systems. Oxygen sensors have built in heaters to speed the warm up process. The PCM can detect when the engine is taking too long to come up to temperature and will set a code P0125, "Insufficient temperature for closed loop fuel control" which typically means the thermostat is stuck open.

Once the conditions are met and the PCM gains fuel control the goal then becomes maintaining it. The oxygen sensor is referred to as a, "Voltage Generator" and reports the content of oxygen in the exhaust stream to the PCM ranging between 100mv (Millivolts) and 900mv. When the oxygen content is high, (Voltage is low, near 100mv) the PCM sees this as a lean condition and its response is to add fuel. When the sensor reports back that there is little oxygen in the exhaust stream (high voltage, near 900mv), a rich condition is sensed and the PCM pulls fuel away. A technician can monitor this data on a scan tool as, "Short Term Fuel Trim" or STFT. A positive percentage indicates the computer is adding fuel while a negative number says it is taking fuel away. If the PCM is in fuel control, monitoring the direct relationship between O2 and STFT scan data will confirm it.

Adapt Short Term	-1	%
O2 Sensor 1/1	0.73	V

The next step then is to look at Long Term Fuel Trim (LTFT) percentages. These numbers give us a history of what the PCM has been doing with fuel trim over the long haul. As with STFT, positive percentages tell us the tendency is to be adding fuel (compensating for a lean condition) while negative numbers indicate the PCM is pulling fuel back, (Overcoming a rich condition). If either of these conditions exists for a prolonged period of time and the LTFT percentages exceed the PCM's parameters a fuel trim code will set (P0170-P0175) and Check Engine light illuminated. The example below shows us that although the PCM appears to be in fuel control there is evidence that it has been adding fuel over time.

Adapt Long Term	5	%
Adapt Short Term	-1	%
O2 Sensor 1/1	0.73	V

Our concern when looking at fuel trim is what it may be telling us about engine efficiency and whether the computer has been compensating for other fuel related problems. If the engine has been over-fueling the question is…WHY? A leaking fuel injector, fuel pressure regulator, lazy O2, or bad Mass Air Flow (MAF) would be some of the considerations. The same issue exists if it's too lean. Here an air leak, clogged injectors or fuel filter, or miscalculated air flow could be the cause. Any Fuel Trim condition that persists will eventually take its toll on the catalytic converter and must be addressed by the repair technician before installing a new one.

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Cleaning up the environment…one converter at a time

Gary

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