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

As promised we will continue this month with our in-depth look into **Air/Fuel Ratio**. In the last bulletin we discussed the fuel component and all variables involved in maintaining good fuel flow. This issue will concentrate on Air Flow to the cylinders. We'll reserve the subject of exhausting the air for another article.

As noted in our fuel discussion we have also seen many changes in air flow since the days of carburetion. The focus on low emissions and good fuel economy has brought about the need to move from just putting air into the cylinder, to an exact accounting of every factor and property of that air. Temperature, density, speed and ease of flow have all become vital in getting the proper **Air/Fuel Ratio**.

Let's start with Flow. Historically, carburetion was the primary system for getting the air/fuel mixture into the combustion chamber. With each throttle plate movement a volume of air was rammed into the cylinders followed by a predetermined amount of fuel. There was very little ability to modify any of these factors through the various RPM ranges. Technology coupled with the need for lower emissions and higher fuel mileage standards changed all that.

Fuel injection opened up a whole new world of intake manifold designs. As the air enters the engine past the throttle plates, many of its characteristics are controlled now through intake design. Factors such as speed, volume and turbulence can be affected by runner shape, size and length. Intake manifold runner controls can move the air through different passages based on RPM, providing the precise amount of air ready to flow into the cylinder when the intake valve opens. Turbo and Super Charging added yet another positive variable that aided performance.

Along with hardware designs, computerized engine controls give us the ability to precisely monitor the condition of the air entering the engine. Attributes such as temperature, density and volume can now be measured. The computer takes this information and makes the necessary changes to fuel flow. As an example, let's look at temperature. Cold air is more dense than hot air. Consequently, the PCM will inject more fuel when the air is cool and less when it is warm. Altitude is another factor that will change fuel delivery based on the density of the air and it is monitored through the Baro Sensor. IAT, Baro, MAP, MAF and VAF are all inputs used by the PCM to monitor air flow and modify fuel delivery.

IAT (Intake Air Temp) – Sensor that measures the temperature of the air
Baro (Barometric Pressure) – Atmospheric Pressure Sensor (altitude)
MAP (Manifold Absolute Pressure) – PCM uses this to calculate load
MAF (Mass Air Flow) – Measures the mass of the air
VAF (Vane Air Flow) – Measures the volume of the air

In an effort to achieve cleaner, more fuel efficient vehicles that also perform well, the industry continues to explore any and all factors that affect **Air/Fuel Ratio**. All of this change directly affects the operation of the Catalytic Converter therefore, look for a continuation of this discussion in 2011.

Cleaning up the environment…one converter at a time

Gary