eSCAN®
Intelligent Power Scan
Training

eSCAN Volumetric Efficiency (VE)

by Bernie Thompson

The volumetric efficiency (VE) chart in the eSCAN is a way to measure how much air the engine is actually pumping. An engine is an air pump that pumps air from the intake to the exhaust. If the liter capacity of the engine is known, the RPM are known and the barometric pressure is set correctly then the VE, or how much air the engine is capable of pumping, can be calculated.

The volumetric efficiency tables are used to determine the mass volume of air entering the engine. The yellow trace on the chart is the grams/sec. that the mass air flow sensor is reporting to the PCM. The red trace on the chart is the calculated VE based on the engine size. The table to the right is used to show the difference between actual and calculated. If the table is green the engine is pumping to its expectation. If the chart is orange and red the amount of air entering the engine is either higher or lower than the expected calculation.

Since an engine is a mechanical device, if a problem exists the engine will be unable to pump the same amount of air, thus, the VE readings will be lower than calculated. In this condition, the fuel trim tables will be green. This is due to the mass air flow sensor reading the air flowing into the engine correctly. This will also apply to a restricted exhaust or a mechanical problem with the engine. In these conditions, the mass air sensor will correctly read the volume of air passing through it which will turn the fuel trim tables to green.

If the mass air flow sensor is reading out of calibration, the VE reading on the table will be incorrect and the fuel trim table will have large changes in order to compensate for the mass air flow sensors readings. If the VE reading is correct and the table is green, this indicates; the engine is in good condition, camshafts are in time, the intake is unrestricted, the exhaust is unrestricted, and the mass air sensor is reading correctly.

If the fuel trim table is colored yellow, orange and red, and the VE is reading correctly; the problem could be; the sensors, fuel pressure, or injectors. By checking the PIDs it can be determined whether or not the sensors are operating within their parameters. The fuel pressure and the injectors can then be checked. If the VE is reading low and the fuel trim charts are colored yellow, orange and red; this is an indication that the mass air flow sensor is reading incorrectly or the intake is restricted. If the mass air flow sensor's wheatstone bridge is out of calibration; all of the fuel trim cells will be equal.

Example, all cells from low load to high load will be very close to +18. With this indication the MAF sensor would need to be replaced. If the fuel trim cells start at a negative number and move to a positive number it is an indication that the MAF sensor is dirty and needs to be cleaned. The way in which the fuel trim cells are filled will indicate what type of problem exists with the power plant. The VE table and fuel trim chart can easily be filled by a test drive around the block. During the test drive the throttle plate will need to be greater that 50% in order for the VE reading to be taken accurately.