TomcoTechtips
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“Ported” EGR Valves

In 1955 the Department of Health, Education, and Welfare did a study on the “brown haze” over selected cities in the United States. This haze was named “Photochemical Smog”.

Photochemical Smog was a by-product of the operation of the internal combustion engine. Hydrocarbons (HCs) or fuel vapors, oxides of nitrogen (NOx), and sunlight were combining to produced the smog. Since this smog was found to be hazardous to us and the environment, the production of HC and NOx had to be controlled.

NOx was found to be produced when combustion chamber temperatures exceeded 2500°F. A system had to be designed to control combustion chamber temperature. This system was known as the Exhaust Gas Recirculation (EGR) System.

The EGR system's main component was the Exhaust Gas Recirculation Valve. The main function of this valve was to recirculate exhaust gas into the combustion cycle. The gases in the exhaust system are inert (they don’t combine easily with other gases.) The recirculated exhaust gas occupied some of the space in the combustion chamber, reducing the amount of air/fuel mixture intake. This reduced charge caused a lower combustion chamber burn temperature, reducing the production of NOx.

The first style EGR was known as the “Ported” EGR (Fig. 1). This valve consisted of a closed chamber diaphragm with a vacuum port, a pintle and a seat. When vacuum was applied to the valve it would lift the pintle off its seat and allow EGR flow.

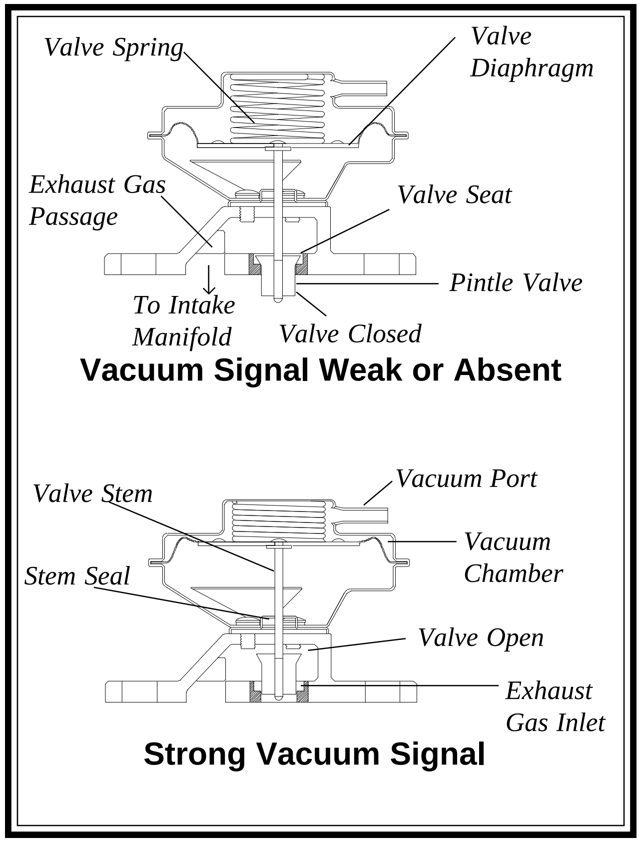

Figure 1

Vacuum, in many cases, is controlled to the Ported EGR by a *Ported Vacuum Switch (PVS)* (Fig. 2). The new name for this valve under OBD II is *Thermal Vacuum Valve (TVV).*

A TVV is a simple device that has a temperature sensitive *wax* pellet in its base. As the temperature increases the wax expands and pushes up on a control valve. As this valve

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1985 Ford Mustang Possible I/M Failure

A 1985 Ford Mustang was brought into our shop after failing the Missouri State Emission test. This test consists of a 90 second exhaust sampling with the car at an idle. Hydrocarbons (HC) and Carbon Monoxide (CO) are the two gases that are checked. The HCs cannot exceed 220 ppm and the CO is limited to less than 1.20%. This vehicle had over 600 ppm of HC and about 4% CO.

We hooked the car up to an ESP FIC 6000 and ran it through a complete check up. The ignition system, fuel system and compression all looked fine. We hooked up a Snap-On® scan tool and proceeded with a Key-On-Engine-Off (KOEO) and a Key-On-Engine-Running (KOER.) Three codes came up: 45, 72, 95.

Codes 45 and 95 both lead to the identical test procedure in the Ford "H" Manual. The code 72 was Manifold Absolute Pressure (MAP) response. A new MAP Sensor was installed by a prior technician, and since the MAP sensor was right out in the open we backprobed the center wire and checked the frequency output verses pressure. The frequency output was exactly what it was supposed to be. We then checked supply vacuum and found it to be sufficient. At the present time the MAP sensor was functioning properly and we went looking for the real cause of this code.

The code 45/95 is an Air Management fault. These particular codes are used for the Thermactor Air Diverter (TAD)/Thermactor Air Bypass (TAB) valve system (Fig. 3). In following the diagnostic tree we were to first check for vacuum lines that could possibly be broken or disconnected. One line was found disconnected. We also discovered that this particular vacuum line got its source vacuum at the same place the MAP sensor did. This leak, we believed, was the cause of the erratic readings that set the MAP sensor code 72.

At this point the codes were cleared and the emissions were checked. The emissions were lower, but not good enough. And a code 95 was still present. We continued with the diagnostic tree and determined that the diverter valve was not at fault. We entered the output state check and cycled both the TAB and TAD solenoids on/off. They both worked correctly. Finally, we

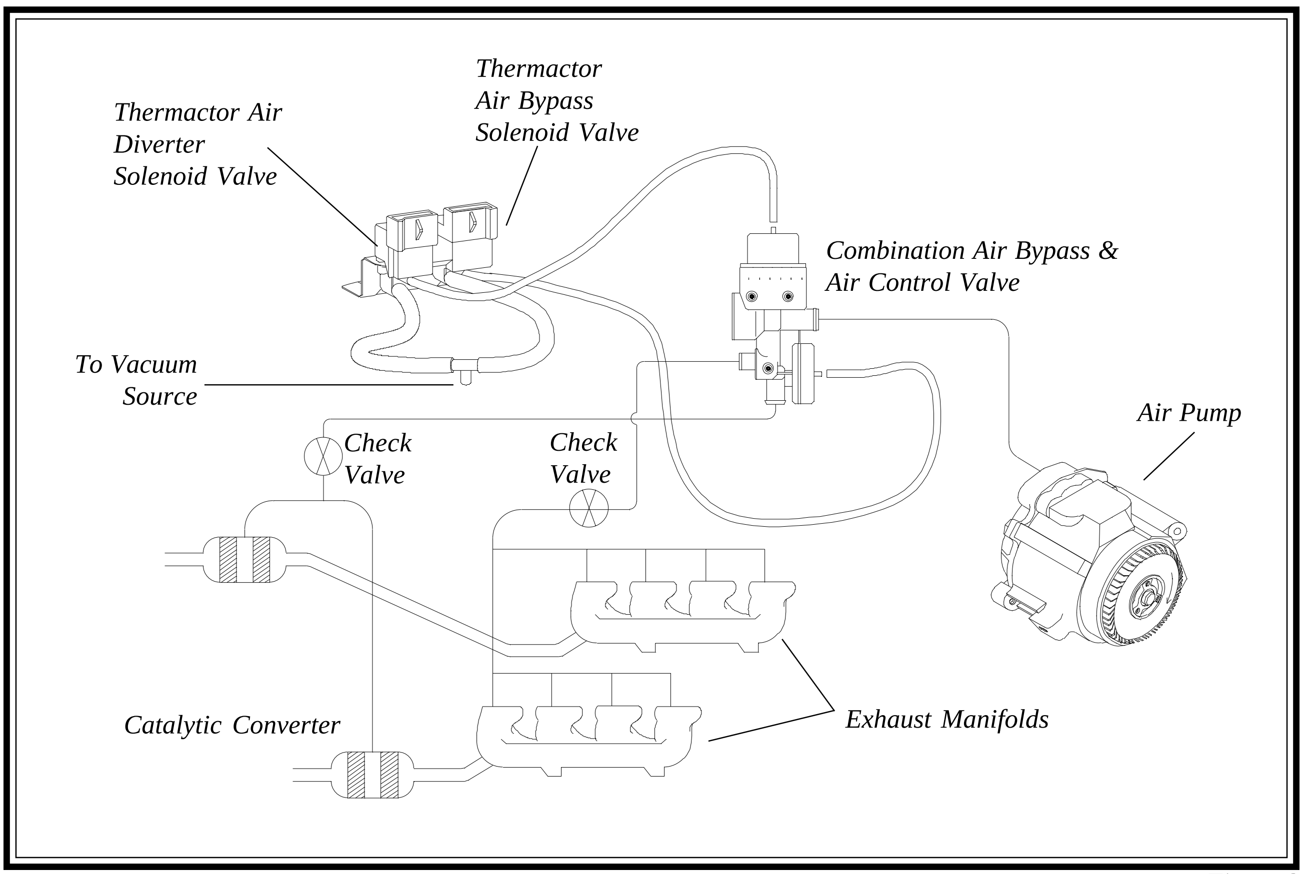

Figure 3

supplied vacuum to the solenoid to make sure that the vacuum did not leak down. The TAD solenoid would not hold vacuum. It slowly bled off. We replaced the solenoid.

We then performed a KOEO and KOER test. No codes were present and emissions looked excellent. HCs were averaging about 97 to 112 ppm, and the CO was down around .2%.

We concluded that the emissions readings were being affected by the vacuum bleeding off of the TAD solenoid. This allowed vacuum to be applied to the diverter valve at the TAD portion continuously. This resulted in the air always being diverted to the manifold before the oxygen sensor. The oxygen sensor would read lean, because of the extra oxygen, and therefore the computer would enrich the mixture. This is why the vehicle failed emissions.

The customer returned to the inspection station after repairs for a reinspection and the vehicle passed on all accounts.

These are the types of repairs technicians will be seeing as the Inspection and Maintenance (I/M) tests are initialized throughout the United States. The simple “unplug the light if it does not affect your vehicle’s performance” is not going to work any more.

More technician training and informative resources will be needed. To stay on top of the industry, the technician of the 90s has to be able to use all the resources available, including books, computers, and technical lines.

Electronics 101: Transistors in Applications

This issue lets look at another automotive application of transistors. In Figure 4 we have a DIS module configuration from a 3.8L SC Ford. As you can see there are three transistors in this section of the DIS module. Each one of these transistors controls one of the three ignition coils in the system.

As with any other ignition coil, the battery is used to supply power to the positive side of the coil. The ground path for the coil is supplied by the transistor. The ground is connected to the collector side of the transistor. The emitter side of the transistor is connected to the DIS module ground. The base of the transistor is controlled by the DIS module.

When the DIS module sees a trailing edge of the Spark Output (Spout) signal, it supplies a current to the base of the transistor. This turns the transistor on and allows current to flow through the collector emitter junction, thereby energizing the coil. When the DIS module sees the leading edge of the Spout signal it turns current off to the base of the transistor, which stops current flow through the coil. This collapses the magnetic field in the primary coil, inducing a voltage in the secondary side of the coil, which fires the plugs.

With the next trailing edge of the Spout signal the DIS module energizes the next coil. The DIS module then looks for the next leading edge of the Spout signal to turn the transistor off and fire the coil. This procedure continues for each of the coils.

In this application the transistors are being used to control the primary circuit of the coil. The use of transistors allows a more precise control of the ignition firing of the vehicle.

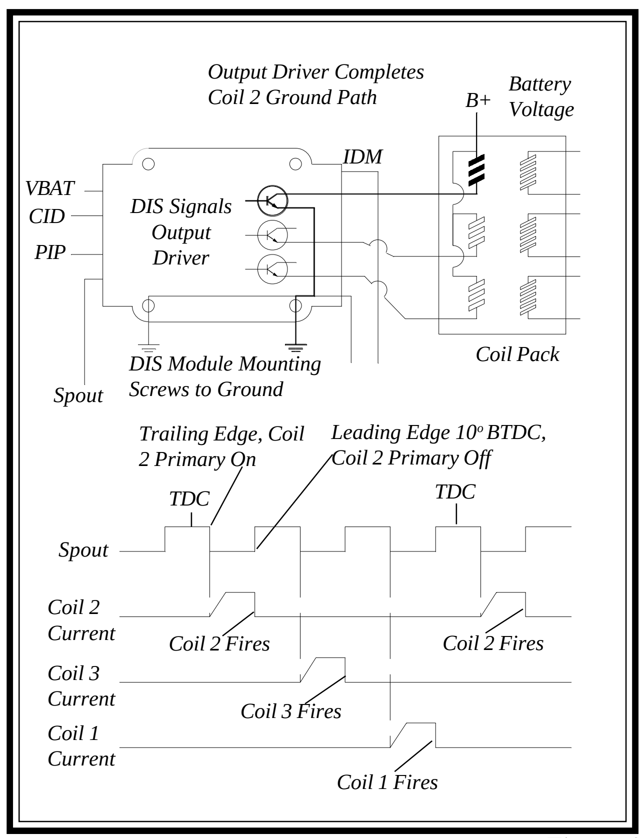

Figure 4

"Ported EGR Valves" (continued from page 1)

moves, it opens and closes certain ports, allowing vacuum to be routed to the EGR Valve. The TVV does not allow ported vacuum to be applied to the EGR Valve under a certain temperature. Since ported vacuum also varies with throttle position, vacuum applied to the EGR Valve is dependent upon throttle position.

Some of the problems experienced with the EGR system are pinging, rough idle, hesitation and emission failure. Pinging may be experienced when the valve becomes clogged with carbon. This restricts EGR flow, allowing the engine's combustion temperature to increase. This increase in temperature causes the detonation or "pinging".

Pinging may also be experienced when the TVV is broken, fails to open or opens too late. This delays or inhibits vacuum flow to the EGR valve causing combustion temperatures to rise. Either carbon clogging or TVV failure can cause engine damage due to overheating.

Rough idling or hesitation may be caused by the EGR Valve pintle hanging open on a piece of carbon. This allows exhaust gas flow into the combustion cycle during idle or during acceleration. This dilutes the air/fuel mixture, causing rough idle or hesitation.

The TVV can also open too soon. This would allow vacuum to be applied to the EGR valve before the correct operating temperature, once again causing a rough idle or hesitation.

The TVV can be damaged when the engine is overheated. To check the TVV simply apply vacuum to its closed port and heat the bottom of the valve until the port opens. Note the temperature and check it to the specifications on the bottom of the valve.

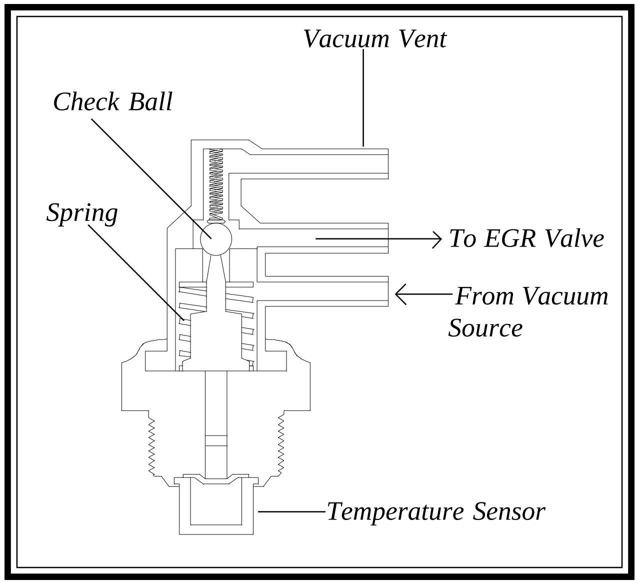

Figure 2

High emissions, probably the most important result of EGR failure, can be caused by any one of the above conditions.

The ported EGR Valve provided an effective way to reduce NOx, but it was found that EGR is really only needed under loaded conditions. The ported EGR had no accurate way of knowing what the load was on the engine. Therefore a different style valve was needed.

General Motors developed what are known as the "positive and negative" backpressure EGR valves. In future issues of Tech Tips we will discuss these two valves and the problems that were experienced with them.