TomcoTechtips
TM
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FORD EGR VALVES

Ford has used several different types of EGR valves on their vehicles. These include the Ported style; the Backpressure style; the Sonic style; and the Pressure Feedback style. We have already studied the operation of Ported and Backpressure style EGR valves in earlier Tech Tips.

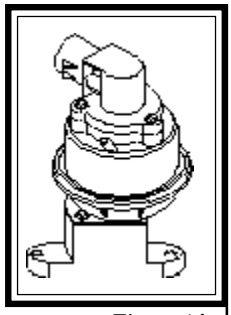

Figure 1A

The Ford Sonic EGR Valve is a vacuum operated EGR Valve with an EVP (Exhaust Gas Recirculation Valve Position) sensor (Fig.1A,B). It has been used as early as 1978/79 on the Lincoln Versailles 5.0L with EEC I system and the 1979 Mercury 5.8L and 1979 Ford California 5.8L EEC II systems. It has been used as late as 1993 on many Ford vehicles.

There are two different physical configurations of the Sonic EGR valves. One style has two openings in the base (Fig. 1A). This style receives its exhaust gas from an exhaust passage in the intake manifold. The second style receives its exhaust gas from a tube that comes from the exhaust and screws onto the valve exhaust inlet (Fig. 1B). Since both styles operate the same with only slight differences in physical appearance, we will describe the operation of only the first style.

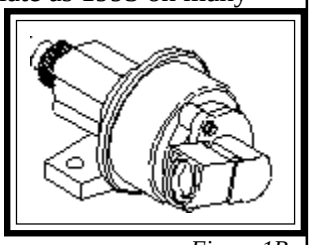

Figure 1B

The Sonic EGR valve is made up of the base assembly, the EGR pintle assembly, the diaphragm assembly, and the EVP sensor (Fig. 2).

The EGR base assembly consists of the base and the base plate gasket (Fig. 3). The base has a calibrated orifice on the exhaust inlet side, which establishes the calibration for the valve. The other orifice is used to channel the exhaust gas to the intake manifold. The base plate gasket helps seal the exhaust gases into the base of the EGR valve. The base also contains the two mounting holes for the EGR valve.

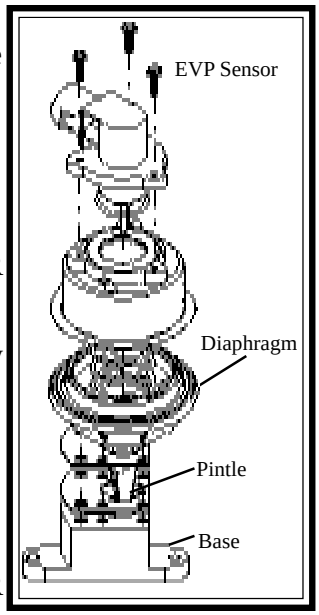

Figure 2

The pintle assembly consists of the EGR pintle, the EGR pintle shaft, the EGR baseplate and a seating plate (Fig. 4).

The EGR pintle shaft goes through the EGR baseplate, through the diaphragm housing, through the diaphragm, where it is secured to the cup-like seating plate that rests in and on the diaphragm. This seating plate is what the EVP pintle rides on. On some valves the seating plate may have a small metal button cap on top of it, where the EVP would then rest. The EGR pintle is located in the calibrated orifice of the base.

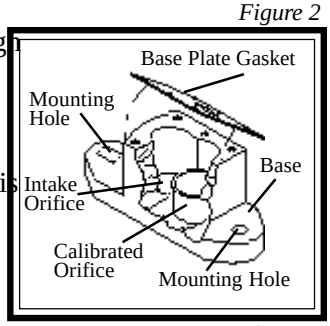

Figure 3

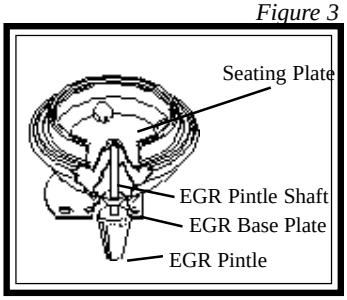

Figure 4

The diaphragm assembly consists of the upper and lower diaphragm housing, the diaphragm and the diaphragm return spring (Fig. 5). The diaphragm rests in the lower housing and around the cup-like pintle plate. The diaphragm return spring is centered in the cup-like pintle plate. The spring is used to assist the pintle to return to a closed position.

The EVP sensor and its gasket seal the upper portion of the vacuum chamber (Fig. 5).

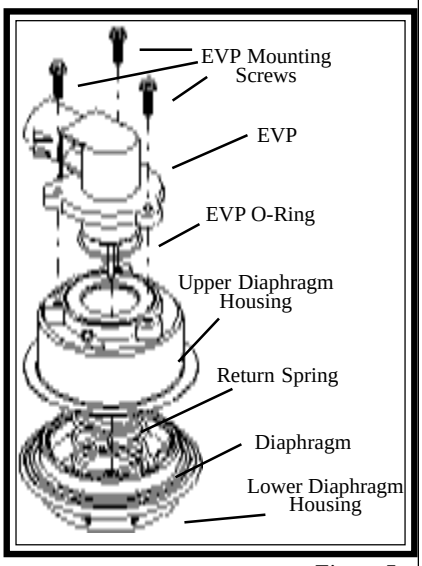

Figure 5

The opening and closing of the pintle is controlled in a number of ways by a vacuum signal from a vacuum solenoid or solenoids. These solenoids are controlled by a signal from the PCM. The solenoids used depends on the application. Some use a pair of solenoids called the EGR Control Solenoid (EGRC) and the EGR Vent Solenoid (EGRV). The most recent, used on vehicles starting in 1985, is a single solenoid called the Electronic Vacuum Regulator (EVR). Others contain a single solenoid called the EGR Shutoff Solenoid.

Let's look at each one, starting with the EGRC/EGRV solenoid combination (Fig. 6).

<u>EGRC/EGRV</u>

The EGRC controls the vacuum to the EGR valve. This solenoid has three vacuum connections. One connection goes to the intake manifold or ported vacuum source. A second connection goes to the EGR Valve. The third connection can be a separate connector or can be teed off the connection that goes to the EGR valve from the second connection. This third connection goes to the EGRV. The solenoid also contains a plunger that opens and closes a passage inside the solenoid.

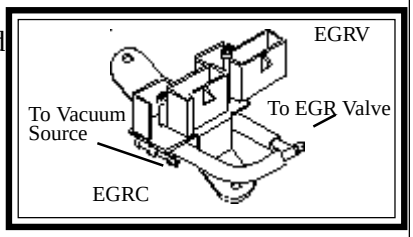

Figure 6

The EGRC is a normally closed solenoid. This means that when the solenoid is deenergized the plunger is blocking the passage in the solenoid so no vacuum will flow. When the solenoid is energized the plunger will be lifted, so vacuum will flow through the passage in the solenoid to the EGR valve.

The EGRV controls the vacuum bleed or venting of the system vacuum. This solenoid has a vacuum connection to the EGRC as stated earlier and a vent to the atmosphere. It also contains a plunger that opens or closes the passage to the atmosphere.

The EGRV is a normally open solenoid. This means that when the solenoid is deenergized the plunger is not blocking the passage to the atmosphere, so vacuum will vent to the atmosphere. When the solenoid is energized the plunger is lifted blocking the passage to the atmosphere so vacuum will be trapped in the solenoid.

Both the EGRC and the EGRV are supplied battery voltage (VPWR), typically from the EEC relay (Fig. 7). The solenoids are grounded inside the PCM through Quad drivers. The PCM sends a variable duty cycle signal to the solenoids through the driver. This causes an electromagnetic field to be induced, which moves the plungers in the solenoids.

When the PCM senses a need for increased EGR flow it will energize both the EGRC and the EGRV (Fig. 8). This opens the vacuum path to the EGR valve through the EGRC and closes the vacuum vent through the EGRV. This allows vacuum to be applied to the EGR valve opening the pintle, allowing exhaust gas to flow through the valve into the intake manifold.

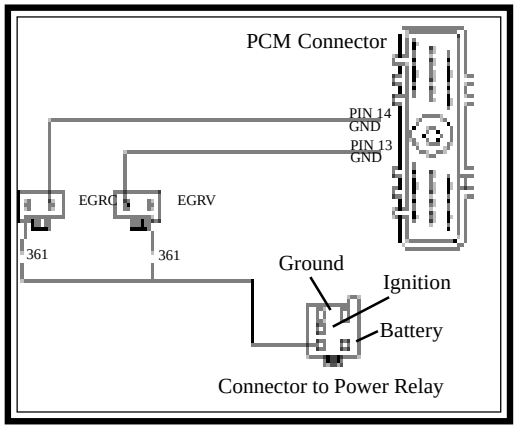

Figure 7

If the PCM senses a need for decreased EGR flow, it will deenergize both the EGRC and the EGRV (Fig. 9). This closes the vacuum path to the EGR valve through the EGRC, while opening the vacuum bleed on the EGRV. This allows vacuum to be bled off, decreasing the vacuum signal to the EGR valve.

When the PCM wants to maintain the current EGR flow it will deenergize the EGRC and energize the EGRV (Fig. 10). This closes the vacuum path to the EGR valve through the EGRC and closes the

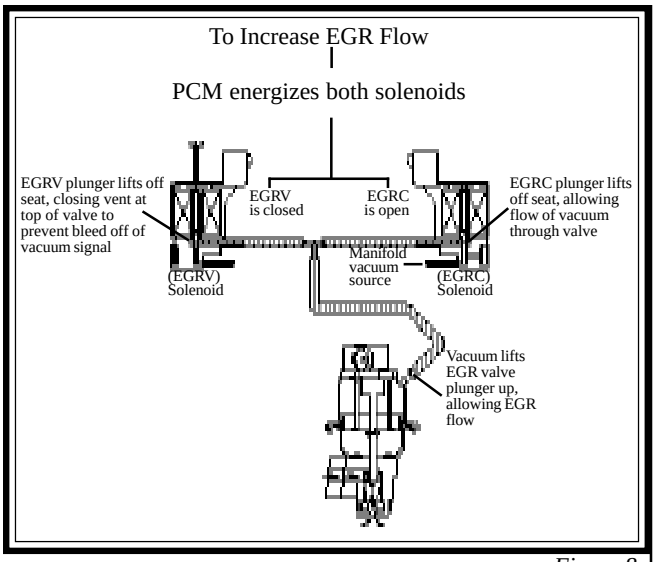

Figure 8

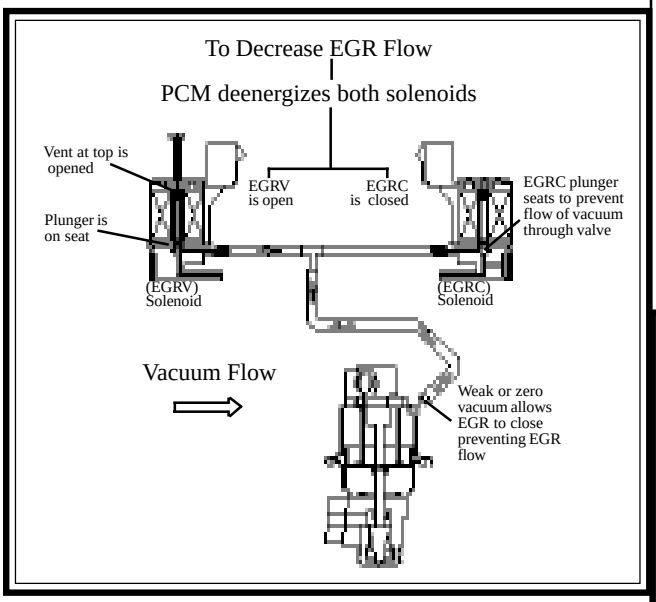

Figure 9

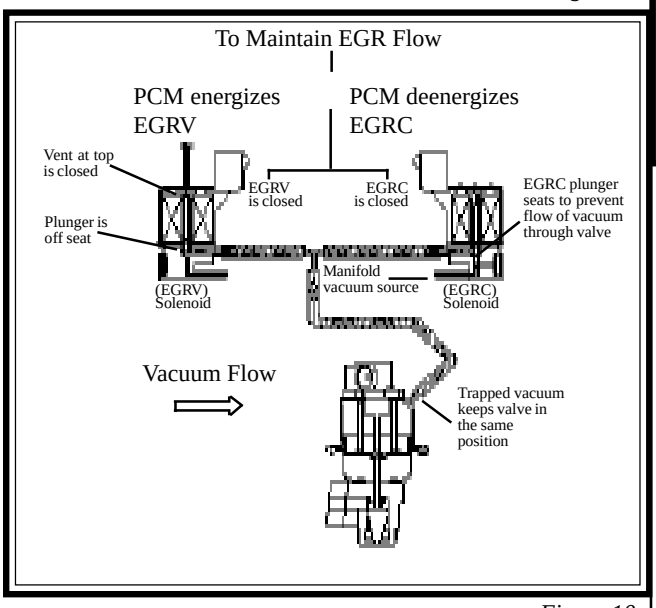

Figure 10

vacuum vent through the EGRV. This traps the vacuum in the line and allows a constant amount of vacuum to be applied to the EGR valve, keeping it at its current position.

We have described the EGRC and the EGRV in an on/off condition. In reality, these solenoids are constantly being cycled to achieve the desired EGR flow. They receive a variable duty cycle signal that causes them to dither (constantly being turned on and off).

EVR

The EVR performs both the functions of the EGRC and the EGRV in one solenoid. This solenoid has a vacuum connection to the intake manifold or ported vacuum to supply engine vacuum, and one vacuum connection to the EGR valve. The EVR contains a passage that vents to the atmosphere. There is a disc inside the solenoid that is moved by an electromagnetic force, that opens or closes the passage to the atmospheric vent (Fig. 11).

The EVR is a normally closed solenoid. This means that when the solenoid is deenergized the position of the disc allows the vacuum to be vented

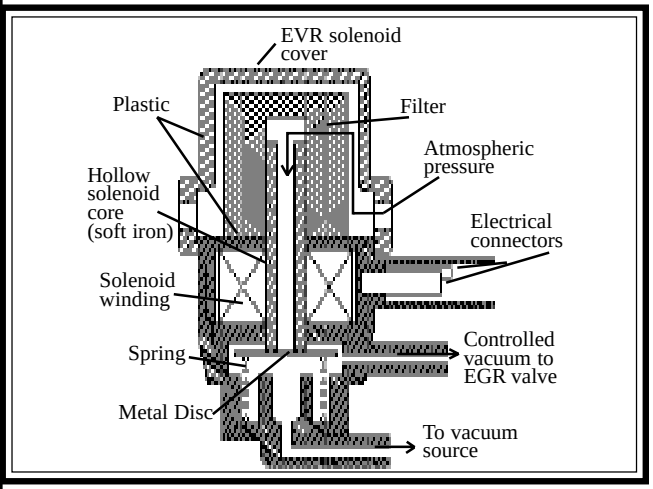

Figure 11

to the atmosphere. When the solenoid is energized the disc is lifted which seals off the vent and allows vacuum to flow through the solenoid to the EGR valve.

The EVR is supplied battery voltage from the PCM (Fig. 12). The solenoid is grounded inside the PCM through a Quad driver. When the PCM senses a need for EGR flow it sends a pulse width modulated signal to the EVR through the driver. This signal causes an electromagnetic field to be turned on and

off, which raises and lowers the disc. This movement opens and closes the vent passage allowing the correct amount of vacuum to be applied to the EGR valve.

As with the EGRC and the EGRV, if more EGR flow is required the duty cycle is increased, allowing more vacuum to go to the EGR valve. If less EGR flow is needed, the duty cycle is decreased, decreasing the amount of vacuum to the EGR valve. A duty cycle of 86% is equal to approximatley a 6 in.hg vacuum signal. A duty cycle of 33% is equal to approximately a 1 in.hg vacuum signal.

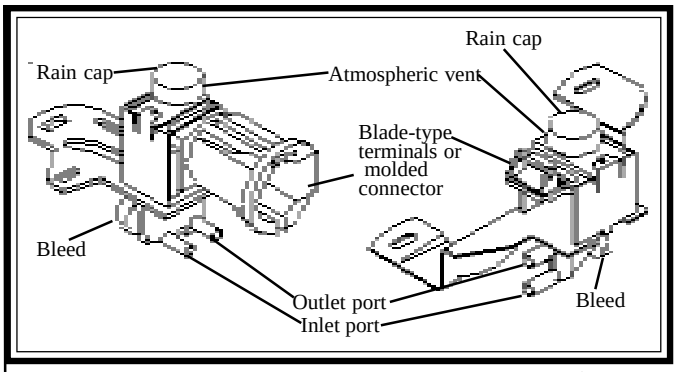

Figure 13

We will continue our discussion of Ford EGR systems in the next issue.

EGR SHUTOFF

The EGR Shutoff solenoid is the last control solenoid we will look at (Fig. 13). This solenoid has also been called the EGR On/Off solenoid. This is a normally closed solenoid. When this one solenoid is used with an EGR valve that has an EVP sensor, it functions much like the EGRC/EGRV solenoid pair. When the solenoid is deenergized, vacuum is vented to the atmosphere, and when it is energized it allows vacuum to be applied to the EGR valve. Once again this signal is modulated to achieve the desired amount of vacuum.

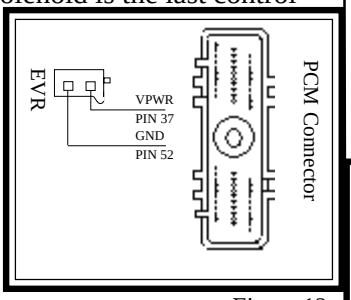

Figure 12

When the EGR Shutoff solenoid is used with an EGR valve that does not contain an EVP sensor the solenoid is just an on off solenoid.

The EGR Shutoff solenoid is typically supplied battery voltage through the EEC power relay and is grounded by the computer (Fig.14).

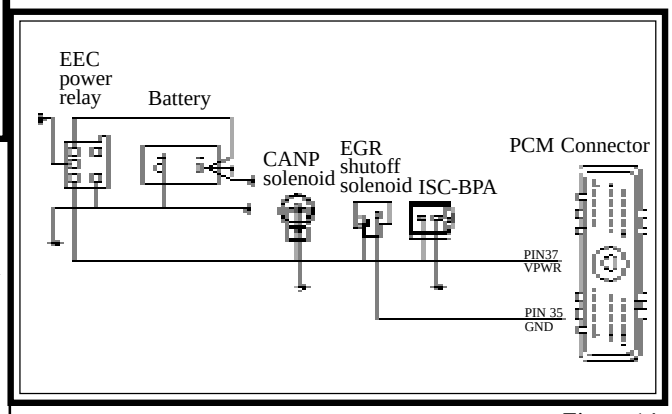

Figure 14