TomcoTechtips™

ISSUE 24

Understanding I/M 240

I/M 240 is the new buzz word in the automotive industry. Everyone is talking about it. Some shudder at the mere mention of the words. Some feel it is the answer to all our emissions problems. Still others don't understand it at all. Lets take the mystery out of I/M 240.

Where did "I/M" come from?

Since the Clean Air Act (CAA) of 1970, the Environmental Protection Agency (EPA) has had oversight and policy development responsibility for Inspection and Maintenance (I/M) programs. The implementation of I/M programs in the CAA of 1970 were optional for improving air quality.

In 1977 the law was amended and I/M programs were required for areas that had long term air pollution problems. Over the years these programs have fallen short of today's pollution reduction requirements. So the law had to be amended again.

The Clean Air Act Amendments of 1990 were developed by Congress to overcome these shortcomings. These amendments give states and the EPA special directives in implementing I/M programs. The EPA had to develop different performance standards for Basic programs, and develop performance standards for new programs called Enhanced I/M programs.

Basic I/M Programs

Basic I/M programs were required in moderate ozone non-attainment areas and marginal ozone non-attainment areas with existing I/M programs.

"Non-attainment areas" are defined as regions that fail to meet Federal air quality standards as set by the Clean Air Act.

Basic I/M programs usually consist of a static emissions test at idle or at idle and 2500 rpm. The emissions are read on a 4-Gas analyzer and the vehicle passes or fails. Basic I/M tests are performed at centralized or decentralized sites depending on the requirements of the state.

Centralized testing stations are test- only stations. This means that the test station is allowed only to test and not to repair the vehicles. They are state-run, or the state hires a contractor to run them. If the vehicle fails the emissions test the owner takes it to a repair facility (in some states it has to be a certified repair station) to have the vehicle repaired.

Decentralized test stations are test and repair stations. They can test and/or repair the vehicles that fail the emissions test.

In some non-attainment areas, Basic I/M programs will not be effective enough to reduce pollution to the CAA requirements. This has lead to the development of Enhanced I/M programs, as required by the CAA.

Enhanced I/M Programs

Enhanced I/M programs were required in serious, severe, and extreme ozone or carbon monoxide (CO) non-attainment areas.

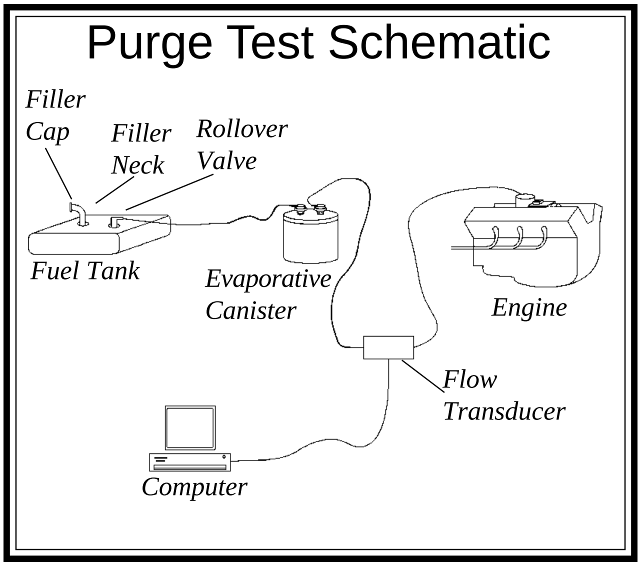

Figure 1

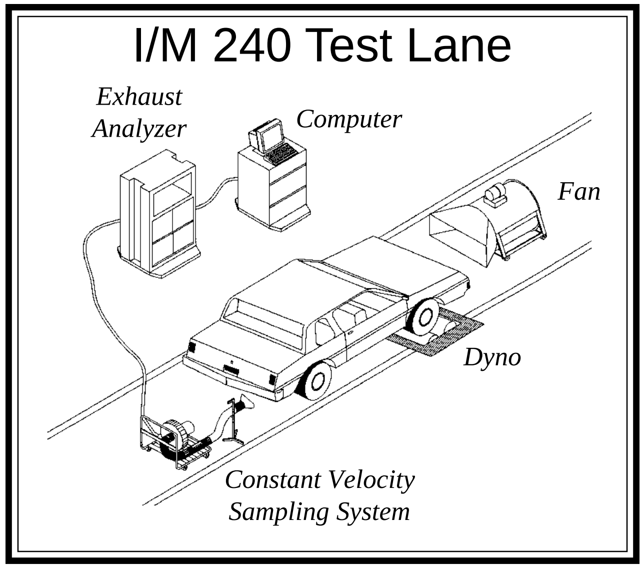

Figure 2

The EPA feels that the static emissions test used in the Basic I/M programs has some shortcomings. It believes that this test does not accurately depict the emissions seen as the vehicle is driven. Also, with today's technology, the computer tries to compensate for problems. These problems may not show up at idle, but may show up as the vehicle is driven.

For this reason the EPA believes that the Enhanced test should contain a dyno emissions test. This will simulate driving conditions which will more accurately calculate emissions. The enhanced I/M program will also contain a two part test of the evaporative emissions system. The evaporative emissions system will be checked for its ability to purge fuel vapors and for leaks within the system.

The EPA also feels that the decentralized test stations have not done an adequate job of finding, reporting, or correcting failures. So the EPA is looking to have centralized test-only programs. They feel this will result in a greater number of correctly failed vehicles.

These two factors have lead the EPA to propose the I/M 240 centralized testing program. By law a state does not have to follow this program if it can develop and prove an alternative that will reach the same emissions reductions the EPA says the I/M 240 program will produce.

So what is "I/M 240"?

I/M 240 gets its name from the 240-second duration of the dyno portion of the test. This 240-second dyno trace was taken from certain portions of the Federal Test Procedures (FTP). The FTP is the emission test the OEMs are required to pass to certify their vehicles to be sold in the USA. The whole test procedure contains a number of segments. Lets go through an I/M 240 centralized procedure test, so you can get a feel for what it is.

We will start by pulling up to the test lane. The vehicle is inspected for exhaust leaks (since this will effect emission readings), tire condition (since the car is to be driven at high speed on a dyno) and for being at operating temperature. Any accessories are turned off at this time.

Next a transducer is installed in the vehicle's evaporative purge system (Fig. 1). This will be used during the dyno test to monitor the amount of vapors purged from the evaporative emissions system.

The vehicle is now driven onto the dyno (Fig. 2), which has been preconditioned. A constant velocity sampling system (CVS) is attached to the tailpipe (Fig. 3). This is different from the typical tailpipe probe. The CVS collects all the gases and will measure them over the course of the dyno run. These collected gases

Continued on page 4

Electronics 101
Transistors as Variable Controls

Theory

Last issue we looked at how a transistor could function as a relay. Transistors have several advantages over relays. Transistors are smaller, lighter, faster and can be operated with much smaller currents. There is still another advantage to a transistor - it can be used to *vary* the current flow in the secondary circuit. A relay is used merely as an on/off switch. The transistor can be used either as an on/off control or as a variable control.

The relationship between the current flows in the transistor states that the emitter current flow (I_E) is equal to the base current (I_B) plus the collector current (I_C). It is mathematically stated as $I_E = I_B + I_C$. From this equation we can see that if we increase the base current, the emitter current will be increased.

The flow of the current can be compared to the flow of water. In Figure 6 the base current is depicted as the faucet handle. The water inlet is the collector current, and the water outlet is the emitter current. When the handle is opened (current flow is increased at the base) more water comes out the faucet (collector/emitter current is increased).

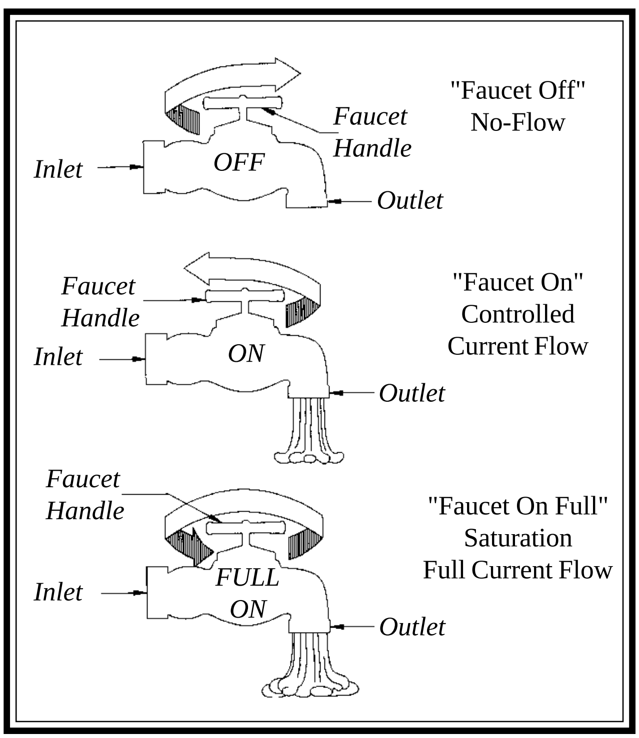

Figure 6

This allows us to control the amount of current from the collector/emitter by the base current applied. This can be useful in many applications.

Practical Use

In Figure 7 we have a NPN transistor that is being used in a variable manner. In this circuit a variable resistor (a dimmer control) is located in the base/emitter circuit. Battery voltage is applied to the collector/emitter and the base/emitter circuit. A light is connected in the collector/emitter circuit.

As the resistance of the variable resistor is decreased more current will flow through the collector/emitter circuit, causing the light to glow brighter.

As the resistance of the variable resistor is increased less current will flow through the collector/emitter circuit, resulting in a dimmer glow from the bulb.

Using a transistor in this manner allows us to control not just the presence or absence of current, but the *amount* of current through our secondary circuit.

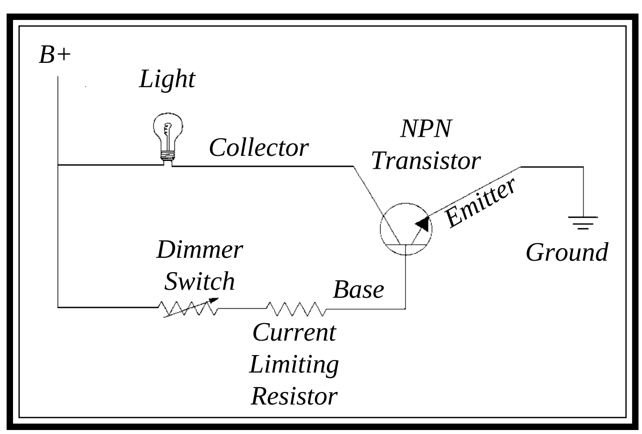

Figure 7

Understanding I/M 240 (continued from page 2)

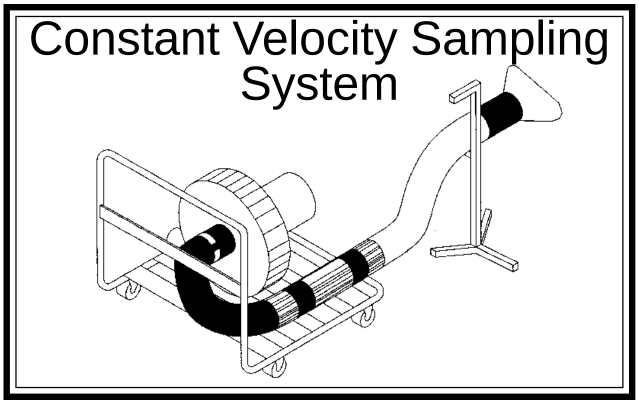

Figure 3

will be calculated in grams per mile of pollutants at the end of the test.

The operator then starts the dyno test. The operator will follow a trace on a monitor (Fig. 4). He must stay on this trace (with limited deviation) for the test to be valid. The trace is a series of accelerations and decelerations with speeds of up to 58 M.P.H..

During this 240-second test the evaporative system must purge at least one liter to pass the purge test. Also, the exhaust is captured by the CVS system and the readings are calculated. The emissions levels must fall within the specifications required by the state.

Next the evaporative system is checked to see if it has any leaks. This is done by installing a pressure transducer and pressurizing the system to see if it will hold pressure (Fig. 5). The system must be able to hold pressure for two minutes.

The final step is to open the gas cap to release the pressure. All the test equipment is

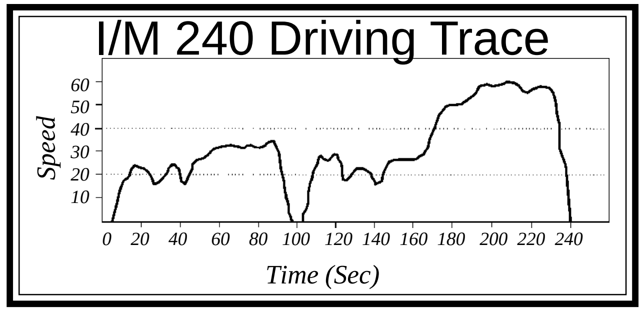

Figure 4

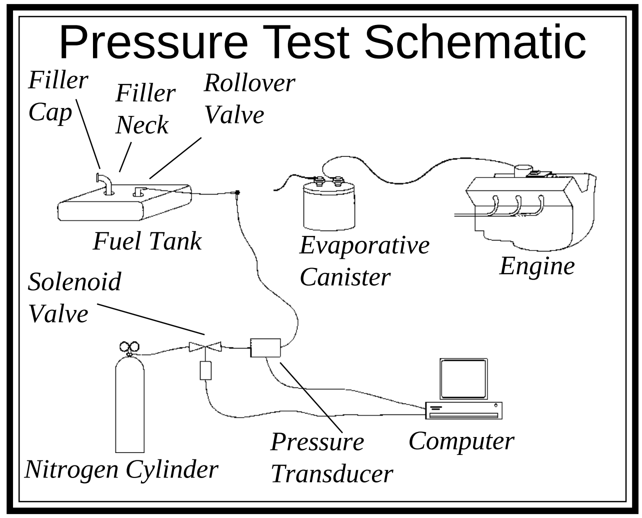

Figure 5

disconnected from the vehicle.

The vehicle then receives a pass or fail rating for evaporative system purge test, HC, CO, NOX emissions, and evaporative system pressure test.

I/M 240 only *detects* emissions failures. The real emissions reductions come in *repairing the vehicle correctly*. In today's advance technology, training will be essential for finding and repairing these emissions failures.