

EONV - What, Why, and How?

Striving to make the best possible training aid available, we again implemented several changes to the EVAP trainer (model 640) that was featured in the September 2008 newsletter. One change was the addition of an Engine Off Natural Vacuum (EONV) test. This test was a bit of a programming nightmare, but the end result was worth the pulling of hair and gnashing of teeth. At the moment, almost all of the automotive manufacturers are using some form of this leak detection in their vehicles.



GM started using EONV in its 2003 year model trucks and Ford followed in 2005 with its own version EONV.

DaimlerChrysler began in 2002 with its Natural Vacuum Leak Detection (NVLD) on its LH platform vehicles. Toyota, Mazda and others have all jumped on the band wagon, so to speak, with their Key-Off Vacuum, but no matter what you call it, it is here.

GM developed this system of detection to take advantage of the natural physical properties of fuel and fuel vapors to expand and contract with temperature changes. As a vehicle is driven the fuel is slightly heated and at rest, as it cools, it contracts, thus causing a small negative pressure in the fuel tank. This negative pressure, or vacuum, is monitored by the PCM for some time after the key is turned off. The vacuum that is developed is very minimal at around 3.5 inches of water, give or take an inch or so. This corresponds with around 0.13 psi. That is pretty small, but even a leak as small as .020 inches will prevent this vacuum from forming and the PCM will detect it as an EVAP problem.

You may ask, how does the fuel heat up during the drive cycle? Well, if you took Physical Science in middle school you will remember learning about the transference of heat energy and its sources as radiation, convection, and conduction. Radiation from the sun will add heat energy, as will heat from the road, exhaust heat, airflow and ambient temperatures from convection and conducted heat from the fuel pump, the returned fuel and exhaust system. This temperature differential is minimal, but it is enough to cause the expansion and contraction that is required for the EONV.

Now, we have driven the vehicle through a normal drive cycle and parked the vehicle for the evening. There are some enabling criteria before the EONV can take place. On a GM vehicle there are several. First, you must have driven the vehicle for a sufficient amount of time to warm up the fuel tank. Next, Diagnostics analyzes ambient temperatures, fuel level, run time, coolant temperature, and distance traveled. Then it analyzes whether it was a cold start so that the pres-

sure sensor is properly zeroed and lastly it compares the time since the last completed EONV with a calibrated amount of time. This last one is due to battery life constraints and will only do one complete test per day and no more than two attempts. Remember that the PCM will stay active to monitor the EONV for forty minutes or longer after the engine is shut off. This is extremely important if you are attempting to run any “parasitic draw” tests on a vehicle that is equipped with EONV.

The new ATech EVAP trainer (model 640) gives us all of the current diagnostic features found in most late model vehicles and all tests can be accessed via the built in scan tool function or by using a Tech 2. All of the components used are from the actual vehicle, are easily identified, and can be controlled with the Scan Tool. On the vehicle the EONV may take forty minutes or longer due to the fact that liquid cools at a much slower rate than just air and this test cannot be initiated with a scan tool. On the ATech Evap trainer this test can be initiated by the operator and monitored through its complete cycle in only ten minutes from start to finish.

To activate the test on the trainer, **ignition must be on while the engine is not running.**

Make sure that no fault is currently inserted into the trainer. Turn on the trainer. Then turn on the ignition. Do not start. Change the keypad display to scan tool mode (switch up).

The display will show three options:

Press **3** to select Engine Off Natural Vacuum test.

```
1 EVAP INFO—2 DTC INFO
3 ENG OFF NAT VAC TEST_
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Raising the tank air temperature

```
EONV FUEL TANK HEATING
74F - 29S P: 1.5V 0.0
```

| Temperature | Elapse time in seconds | Tank pressure sensor voltage | Tank pressure in inches of water |
|-------------|------------------------|------------------------------|----------------------------------|
|-------------|------------------------|------------------------------|----------------------------------|

Upon activation of the EONV test, the ATech EVAP trainer will turn on a pair of light bulbs in the tank for 5 minutes (300 seconds on the keypad display). This simulates the tank temperature rise while the vehicle is in operation. With the vent valve opened and the lights on, the temperature of the air in the tank will rise while the pressure remains at outside pressure (0 inch of water difference).

EONV—What, Why and How?, Cont'd

Cooling off

After 5 minutes, the lights are turned off and the vent valve is closed. The purge solenoid is not on and remains closed during the whole exercise. The air in the tank is then allowed to cool for five minutes. With the tank sealed, as the air cools down and contracts, vacuum is building up. This is similar to the condition after the vehicle is parked and the engine is turned OFF.

EONV test over

At the end of five minutes, the air temperature in the tank will be down to near ambient and the vacuum between 3 and 5 inches of water. This verifies that the trainer EVAP system does not leak. During the exercise, the keypad display shows the time count in seconds, the tank temperature in Fahrenheit, the Fuel Tank Pressure sensor measured voltage and the tank pressure in inches of water. Press “*” to exit.

Be aware that the temperature sensor used in the tank on the trainer is not intended to be lab quality and thus the temperature displayed should be used only as reference to the direction of temperature change, increase or decrease.


The ATech Evaporative Emissions System (EVAP) trainer emulates the GM enhanced EVAP system from a 2003 Chevrolet Impala with all of the functions and controls available on that vehicle. This vehicle **does not** come with EONV, but we felt that the need for the addition of this particular demonstration outweighed the need for year, model correctness.

Remember, this test is for demonstration purposes, and that there will be some variance from trainer to trainer. This, however, does not take away from the fact that it is a very useful tool in trying to explain **what** EONV is, **why** it is used, and **how** it all takes place.

Jeff B. Bogue, ATech Training, Inc.

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Is Joe Really #1?

The powers that be, have spun the Wheel of Funding and it has landed on your department this year. Oh, and by the way, you have three hours to decide how to spend it.



What should Joe do?

- Instructor A knows a guy that sells this stuff
- Instructor B saw an ad for equipment
- Both
- Neither

This scenario happens more often than you realize. So, Joe has to plan before this situation occurs.

Define Program Needs and Prioritize

You want to address your biggest headache first. Where can you use the most help? What can free you up to allow you to spend more time where you are needed? Many programs tell us the beginning of the program is the hardest. You have X # of eyes looking at you and you don't know the students well enough to focus your efforts. Typically this is BEE (basic electricity and electronics) and this will require multiple trainers to effectively deliver.

Gather Information

When inquiring, remember to consider the source. Beware the vendor that promises everything and bashes the competition just to get the sale. Their reputation should include product quality, service, and support. Are products made in the USA and/or are they outsourced? Do they offer references you can actually contact?

Evaluate Options

Does the vendor listen to your needs and concerns? Do they offer to assist with your planning? Can they provide detailed specifications? Will they send the actual curriculum in question for review? Do they charge extra for software licenses? Are they CASE certified to assist with **your** needed training?

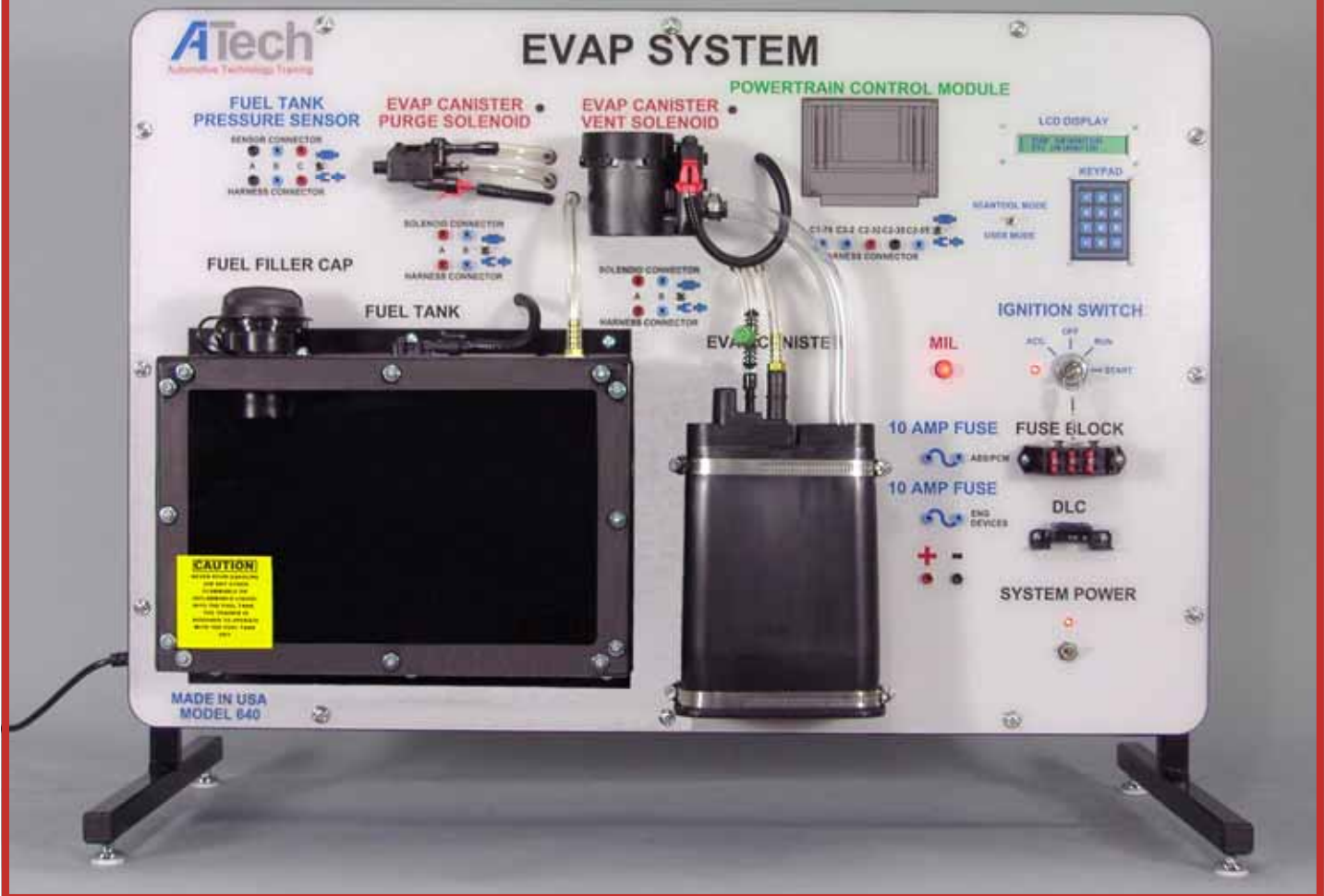
Decide

To make an informed and intelligent choice is difficult. Weigh your options. Discuss your choices and choose your equipment wisely. Remember, you are going to have to teach with this equipment for a long time before the Wheel of Funding points at you again.

As always, your vendors are your only true resources and Joe should be getting as much assistance and information from his vendor as possible. After all, is he or is he not #1?

***Others talk about great product quality and service....ATech delivers them.
Ask our customers.***

Evaporative Emissions System—Model 640



This A-Tech trainer presents the live operation and study of a late-model General Motors Enhanced Evaporative Emissions (EVAP) system. Clear hoses allow the use of a smoke machine to visually demonstrate system operation. The trainer will run the GM Service Bay EVAP Test using either its built-in scan tool or a Tech 2. Realistic EVAP system faults, **including system leaks**, can be inserted via a built-in keypad, a local computer or via the optional A-Tech Network System (ANS) to give students troubleshooting practice. Students follow manufacturer's diagnostic procedures when troubleshooting system faults. System leaks can also be diagnosed using a smoke machine. Tech 2 and smoke machine are not included with the trainer. Includes courseware.

ACTIVITIES INCLUDE:

- Description and operation of the EVAP system trainer
- Analyzing and interpreting schematics and manufacturer's troubleshooting and service procedures
- System diagnosing and troubleshooting
- Engine Off Natural Vacuum test demonstration



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2009

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