The Analyzer

THE WISCONSIN VEHICLE INSPECTION PROGRAM

WIVIP HELP LINE
(866)623-8378

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Waiver Repair Cost Limit To Increase July 1st

The repair cost limit for all model year vehicles subject to emissions testing will increase from $896 to $918, effective July 1, 2019. This figure is adjusted annually by the DNR per NR 485.045.

Vehicles subject to emissions testing that continue to fail may be eligible for a cost waiver if actual costs of emission related repairs exceed the repair cost limit. Only repairs that are related to the vehicle's cause of failure can be used to apply for a cost waiver. Costs covered by any warranty or costs to repair/replace emission control equipment that has been removed, modified or disconnected are excluded.

The owner must have emission related repairs on the vehicle done at a recognized repair facility to qualify for waiver consideration.

A list of recognized repair facilities can be found on the program website: www.wisconsinvip.org. Trans 131.02(39) includes franchised NEW car dealerships as recognized repair facilities.

Inside this issue:

Catalyst Monitor Completion Requirement

Vehicles that fail for catalyst codes (P0420, P0421, P0422, P0423, P0424, P0430, P0431, P0432, P0433 and P0434) must show catalyst monitor readiness during the subsequent inspection. The catalyst monitor will not be permitted to be one of the allowable "not ready" monitors during the reinspection.

Some of the most common DTCs we see are the catalyst efficiency codes. The catalytic converter is the single most effective post-combustion emission control component on a vehicle. Therefore, addressing the cause of the catalyst failure is a very effective strategy for reducing vehicle emissions.

New Readiness Monitor Criteria:

If a vehicle fails for a catalyst efficiency DTC, the subsequent retest must have the catalyst readiness monitor completed. This requirement is in addition to the original readiness monitor criteria:

⇒ 1996—2000 Model Year: 2 unset monitors

⇒ 2001– Newer Model Year: 1 unset monitor

New Catalyst Monitor Completion Requirement

- Did the prior failure have a DTC related to the catalyst?
- If there was a catalyst DTC on the previous failure, then the catalyst monitor would be required to be completed at the time of retest.
- If there was not a catalyst DTC on the prior failure, the catalyst monitor would not be required to be completed for the retest.
- The catalyst monitor requirement supersedes the normal 2 unset monitor criteria for 1996-2000 MY vehicles and >1 unset monitor criteria for 2001 and newer model years.

TECH TIPS

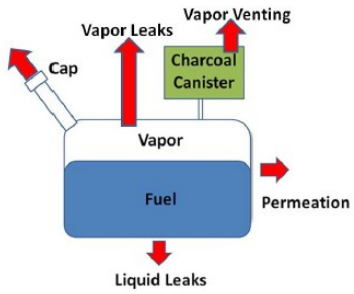
EVAP Systems A to Z

On March 12, area repair technicians attended a WIVIP sponsored seminar on understanding and diagnosing issues related to vehicles' evaporative emission systems The presenter was John Haunfelder, former owner of Jerry's Automotive, one of the Technical Assistance Centers for the Wisconsin Vehicle Inspection Program.

Newer vehicle design technologies have made evaporative emission systems more complex. Early controls saw the introduction of activated charcoal canisters for controlling fuel vapor emissions. Later controls included fuel tanks and hoses built with more advanced materials less prone to allowing permeation emissions. Adding to the complexity are different evaporative system designs that vary by model year and manufacturer.

Figure 1 illustrates the basic evaporative emission processes. Permeation occurs continuously through the tank walls, hoses, and seals. It is affected by fuel tank temperature and fuel properties. Vapor is generated by increasing tank temperature. These vapors are typically mitigated by a charcoal canister. If the canister is saturated or there are leaks in the system, vapors can bypass the emissions control system directly to the atmosphere. Liquid leaks can occur anywhere in the fuel system. Moreover, refueling displaces the vapor in the tank and can also result in spillage.

Figure 1: Illustration of Evaporative Processes



Both ambient temperature and engine operation cause the fuel tank temperature to increase. An increase in fuel tank temperature will generate more vapor in the tank. Activated charcoal canisters are a control technology commonly used to absorb the generated vapor. During engine operation, the canister is purged periodically and the captured vapor is diverted to the engine and burned as fuel. The emission certification standards for a vehicle (associated with model year and vehicle class) influence the capacity of the canister system. When the generated vapor exceeds the capacity of the canister, the vapor is vented to the atmosphere. This can occur when a fuel undergoes a large ambient temperature increase, or if a fuel with higher volatility is used, or when a vehicle canister collects vapor for many days without purging.

The most common DTC's are for leaks: P0440, P0442, P0455, P0456 and P0457. Each DTC indicates a different size leak, sensor malfunction or possibly just the fuel cap left off after refilling. When diagnosing the cause of an evaporative failure, it is advisable to check a repair manual for a specific flow chart for the DTC, make and model being worked on. John also recommended looking for the Technical Service Bulletin (TSB) using a repair manual or on-line database like Mitchell 1 or ALLDATA. TSBs are a good source of detailed information describing the fault and the solution including updated part numbers if applicable.

Different Ways of Testing Evaporative Systems

The following are the most common ways of testing a vehicle's evaporative system. The Natural Vacuum Leak Detection (NVLD) method is trending towards being the most commonly used for testing. The first two systems were used up to 2006 after that the NVLD system is mainly used because of tighter leak monitoring.

- Low-pressure pumps which apply small amounts of pressure to the system (usually no more than 20 in/H2O) then seal the system and check for pressure drop over a period of time.

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EVAP Systems A to Z

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Typically done while driving depending on enabling criteria. The system can determine down to a .040 leak.

- Vacuum pumps which will draw the evaporative system into a low-pressure vacuum for a predetermined amount of time and watch for a pressure increase. Typically done while driving. The system can determine down to a .040 leak.
- Natural Vacuum Leak Detection. This evaporative test is done key off usually right after engine shutdown. The evaporative system is sealed and vacuum monitored while the fuel in the system is cooling. Pass or fail depends on fuel temperature drop and the amount of vacuum in the system achieved. The system can determine down to a .020 leak.

Evaporative Testing Systems Can Vary by Model Year and Manufacturer

Chrysler:

Leak Detection Pump: The leak detection pump incorporates the vent and fuel tank pressure switch. The engine vacuum is used to power the pump. There is a reed switch that closes at .3 psi verifying system has reached proper pressure. Once verified, the EVAP system is monitored over time to see that the reed switch stays closed indicating no leaks are found. The EVAP test is done during the driving system and will report down to a .040 leak.

Natural Vacuum Leak Detection (NVLD): The vent valve is normally closed and opens when energized. The EVAP test is run key off starting 10 minutes after shutdown. The test must run longer than 30 minutes or it will abort. The small leak test is done first and if that fails the large leak test is run next. The large leak test is run with engine running. The system is sealed and the purge is activated until the system reaches 1 in/H2O then purge is shut off. The PCM watches how quickly pressure increases to determine if there is a large leak.

Evaporative System Integrity Monitor (ESIM): The ESIM is also a closed system, counter-weighted valves control the fuel tank pressures. The pressure relief happens after .5 in/H20 is reached. The vacuum relief happens after 2.2 in/H20 is reached. The monitor setting is similar to NVLD system with small leak detection first done through key off and if it fails, the large leak test is run key on engine running. Small leak failures occur after 1,050 minutes of off time and 1000 minutes of run time.

Toyota:

Key Off Evaporative System Testing: The Toyota system uses a vacuum pump mounted at the rear of the vehicle in close proximity to the fuel tank. The vacuum pump incorporates a BARO sensor and vent solenoid. The testing happens five hours after the vehicle is shut down. If the key is turned on at any time prior, the time starts all over. There are six different modes of operation.

- The first mode: vent valve open and BARO voltage is checked. A normal voltage is usually around 3.67 volts depending on weather and elevation.
- The second mode: pump is activated and the BARO reading is checked on an internal 0.020 leak. Typically dropping BARO reading to 3.52V.
- The third mode: vent valve is closed and the PCM monitors the BARO reading voltage. The PCM is looking for the BARO voltage to drop lower than 3.52 volts.
- The fourth mode: purge valve is opened back up and BARO reading should go back to 3.67 volts or atmospheric pressure. The PCM is checking for proper purge valve operation.
- The fifth mode: both purge and vent solenoids are closed and the system is drawn back into a vacuum and checked over time for leaks.
- The sixth mode: vent solenoid is opened and back up and BARO reading is checked again to

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EVAP Systems A to Z

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make sure it is consistent with 1st reading. Variation in BARO readings from start to finish will negate the test. If it happens twice, a DTC will be set for BARO reading issues.

Ford:

- Natural Vacuum Leak Detection: This is a permanently closed, passive system. The system doesn't rely on vacuum or pressure to test the system. There is no vent solenoid or fuel tank pressure sensor. The NVLD module monitors the fuel system vacuum as the fuel cools. The NVLD module contains the charcoal canister, vacuum switch, a pressure release and vacuum release valves. The NVLD is a three wire assembly: wire, ground, and CAN communication. The vacuum release valve opens when vacuum in the system gets too high from possible large decrease in fuel temperature. The pressure release valve opens in times of high fuel tank pressure (refueling). There is only one PID displayed for the NVLD and that shows the state of the vacuum switch. The NVLD module contains logic to determine whether the Evaporative System passes or fails.
- Test Sequence of the NVDL System: The PCM turns on the NVLD module right after shutdown leaving the NVLD module on to test and the PCM will turn off to minimize parasitic load. Ford also uses a Low Power Module in case of excessive voltage drop to save the battery (another reason a good battery is critical). The system first starts to test when the purge is energized (engine running). The vacuum switch will change state to close again so the system can continue to the next test. After 10 minutes, the NVLD will look at the vacuum switch to see if it is closed. If it is closed, the system will pass the test. Depending upon conditions (fuel temperature), it may take longer for the switch to close. The switch will be monitored for up to 24 hours. If a 14 degree temperature drop of the fuel isn't met, the monitor will be aborted. It is suggested that the vehicle be left in the sun before the test is run and then move it to the shade to decrease the time for the monitor to set.

What Type of Tools Make The Job Easier To Track Down Evaporative Problems?

The repair technician has a variety of tools that can be used to correctly diagnose and repair evaporative issues. Scanners are invaluable for quick trouble code retrieval and data acquisition. Most of the newer scan tools have bi-directional capabilities for enabling EVAP System tests to be done quickly and less intrusively.

Smoke Machines can help you find otherwise virtually invisible fuel leaks. If using nitrogen, nitrogen enriched air, steam, or carbon dioxide in the smoke machine, the vapors show up as a stream of inert smoke. Using an inert gas like nitrogen is recommended when performing a smoke test to lessen the chance of a combustion event. Two minutes of run time smoke testing with shop air will create an explosive condition!

John typically uses a laser pointer directed into the smoke to assist him in pinpointing the leaks. Backlighting of the smoke also helps in the process. A good flow meter on your smoke machine is priceless. He has found that the presence of rust in the evaporative system components are also a good place to start looking for leaks.

Vacuum testing in combination with the smoke test also assists in verifying if the EVAP is functioning properly. It can be used to draw the EVAP system into a vacuum instead of using engine vacuum through the purge valve. If a vacuum bleeder is used, a check valve must be used to be able to control the vacuum getting into the EVAP system to prevent damage.

This approach had been used for a 2005 Honda Civic with a recurring P1457 EVAP leak canister side. The hose from the canister to the purge valve was removed at the purge valve. The canister shut and EVAP Bypass Solenoids were energized to seal the EVAP system. 6 in/h20 were applied to the system. The fuel tank pressure sensor reading was monitored for correct valve and system was left under vacuum for 10 minutes to check for leaks. *A defective purge solenoid was causing a false code because of inadequate engine vacuum getting into the EVAP system causing a higher than expected*

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EVAP Systems A to Z

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fuel tank pressure reading (leak indication).

The Last Word

Diagnosing and repairing evaporative systems involves a multifaceted approach including:

- Research: What type of evaporative system is on the vehicle, and are there any Technical Service Bulletins related to the problem? Are there any flash updates or possible recalls? Has the vehicle been refueled recently with a higher ethanol content grade gasoline?
- Visual Inspection: Look for loose hoses, gas caps, rusted lines that are related to the evaporative system. Are there any missing, cracked or broken EVAP components? This is where the smoke and vacuum testing becomes important.
- Adequate Power: Make sure the battery is in good shape and can hold a charge. This is especially important if you are addressing a readiness monitor issue.
- Temperature: Ambient temperatures are important. For resetting monitors, they should be over 40 degrees F. Is the thermostat working properly? This could also impact the enabling criteria for resetting an EVAP readiness monitor.

Sources: EVAP A to Z presentation, John Haunfelder, 3/12/2019; Evaporative Emissions for On Road Vehicles

Top 10 2018 Diagnostic Trouble Codes (DTCs)

Did you notice that there were 4 EVAP DTCs in the top 10?

Trouble Code	Trouble Code Description
P0420	B1 Catalyst System Efficiency Below Threshold
P0300	Random/Multiple Cylinder Misfire Detected
P0171	System Too Lean Bank 1
P0455	**Evaporative Emission System Leak Detected (large leak)**
P0442	**Evaporative Emission System Leak Detected (small leak)**
P0128	Coolant Thermostat (Coolant Temp Below Regulating Temperature)
P0174	System Too Lean Bank 2
P0301	Cylinder 1 Misfire Detected
P0456	**Evaporative Emission System Leak Detected (very small leak)**
P0440	**Evaporative Emission System**

WIS VINS REQUIRE A PHONE CALL

Emissions inspection results for vehicles with WIS VINs will not transmit to DMV automatically. If you are testing a vehicle with a WIS VIN, call Opus at 262-641-5217 so the test result can be submitted.

WIS VINs are Wisconsin assigned vehicle identification numbers issued to vehicles that are missing the manufacturer VIN, including salvage and reconstructed vehicles. The VIN tags are metal, and contain the letters "WI" at the end of the number.

Introducing the Repair Book

Fast, Easy and Good For Business

It is now easier for your facility to receive credit for repair activity of vehicles that failed their emissions inspection. Once registered, repair technicians can access the Repair Book reporting website and log emission-related repairs. Your success rate in repairing vehicles will be posted on the www.wisconsinvip.org website. It is a great way to inform past, current and future customers about your success in performing emission-related repairs.

Step 1: Is Your Business Already Registered With the Wisconsin Vehicle Inspection Program?

a) Verify if your business is already registered with the program. The easiest way to check is to look at the Inspection Facility, Recognized Repair Facility or Non-Recognized Repair Facility listings on the program website at www.wisconsinvip.org.

b) If your facility is already registered, go to step 2.

c) If your facility has not registered with the program, complete the profile form found on the program website in the "Recognized Repair Facilities" section.

d) Once registered, your facility's repair activity can be reported on www.wisconsinvip.org, which is the official program website. The more effective you are at repairing vehicles that had failed the emission test, the better your repair score!

Repair Grade: 100%

Sample listing:

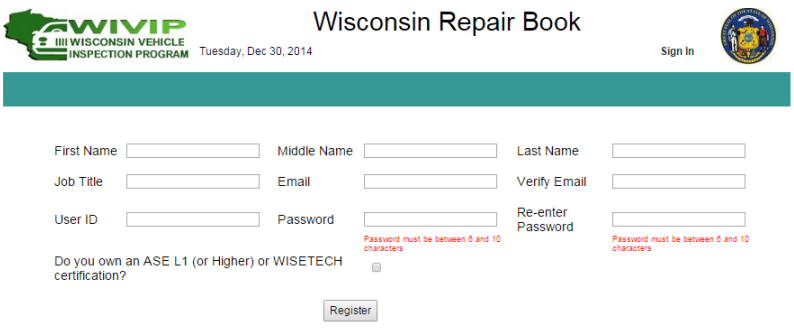
Facility Name	*Address*	*City*	*Phone*	*Zip Code*	*REI*	*Web Site*
YOUR GARAGE NAME	123 MAIN ST	ANYTOWN	(XXX) XXX-XXXX	53XXX	100.0	url hyperlink

Step 2: Technician Registration for the Repair Book?

a) At the sign-in screen, select register.

b) Choose the station you are currently employed and select continue.
NOTE: If you change locations, please complete an updated Emission Repair Facility profile and submit it to Opus.

c) Complete the registration information.



STEP 3: DATA ENTRY PROCESS FOR EMISSION RELATED REPAIRS

Certified Repair Info					
Owner Repair?	Yes ○ No ○	Total Parts Cost		Total Labor Cost	
For three dollars and thirty cents enter 3.30. For three hundred and thirty dollars enter 330					
The following should be completed only if NOT repaired by owner:					
Work Order #		Facility of Person Performing Repair		Apply to REI? ☐	
Phone#					
City		State		Zip	
Repair Date					

a) Complete the information requested.

b) Select whether it is an owner repair.

c) Enter parts and labor cost. (Example: For three dollars and thirty cents, enter 3.30. For three hundred and thirty dollars, enter 330.)

d) If not the owner, complete the section requesting more information on repairs.

e) Indicate whether you want the repair record applied to your Repair Book (REI) Score.

f) Select the repairs performed on the vehicle.

Vehicle Repair Data

For reinspection or waiver qualification, the person performing the repairs must complete this form. Please place one "X" per item in the box to indicate which component has been (A) repaired, (B) replaced, or (C) repairs were recommended but not performed.

	A	B	C	None		A	B	C	None
1. Air Filter Element	○	○	○	○	15. Air Injection System	○	○	○	○
2. Thermostatic Air Cleaner System	○	○	○	○	16. Positive Crankcase Ventilation System	○	○	○	○

g) Once the data is entered, select continue.

h) If you see the screen below, you have successfully entered the data.

Success

Congratulations! The repair data has been saved! This data may be used in the determination of your facilities REI. Continue

5470 South Westridge Dr
New Berlin, WI 53151
262-641-5217 (voice)
262-641-5095 (fax)

EMISSION REPAIR FACILITY *PROFILE*

(please circle one)
UPDATE **NEWLY REGISTERED**

If you wish to register your repair facility with the vehicle inspection program or need to update your business record, please provide the following information for your repair facility. Mail the completed form with technician certifications to address above, or fax it to 262-641-5095, or scan to sue.krueger@opusinspection.com. A recognized repair facility is one that employs at least one technician with ASE L1 certification, WISETECH training, or other equivalent training. Please attach copies of documentation for each technician's training or certifications.

FACILITY INFORMATION:

Facility Name: _____

Street Address: _____

City: _____ State: _____ ZIP: _____

Main Business Phone #: ( ) _____ E-Mail: _____

Owner or Manager: _____ County: _____

TECHNICIAN INFORMATION

Name: *(First Name)* _____ *(Last Name)* _____

Certifications: Circle & Indicate Expiration Date

ASE L1	Expiration Date	ASE L2	Expiration Date	WISETECH	Date Graduated	School

Other: (Explain) _____

DIESEL CERTIFICATIONS: Please indicate if you have diesel certification for a specific make (Honda, Ford) of vehicle(s) you are certified to work on. List all that apply and attach diesel certification documentation to this application:

TECHNICIAN INFORMATION

Name: *(First Name)* _____ *(Last Name)* _____

Certifications: Circle & Indicate Expiration Date

ASE L1	Expiration Date	ASE L2	Expiration Date	WISETECH	Date Graduated	School

Other: (Explain) _____

DIESEL CERTIFICATIONS: Please indicate if you have diesel certification for a specific make (Honda, Ford) of vehicle(s) you are certified to work on. List all that apply and attach diesel certification documentation to this application:

VERIFICATION

As owner/manager of this repair facility, I verify that my facility is actively engaged in the automotive repair business and that information provided is accurate. I understand that it is my responsibility to notify the Wisconsin Vehicle Inspection Program if my profile information changes.

_____ _____
Repair Facility Owner/Manager Date

OFFICIAL USE ONLY:

Recognized: YES NO Registration Number: | | | | | | | | | | |

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