

HX: Evaporative Emission (EVAP) System and Monitor

⚠ WARNING: Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to Section 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.

⚠ WARNING: Before repairing or installing a new component in the fuel system, reduce the possibility of injury or fire by following the warning, caution, and handling directions in pinpoint test HC. Failure to follow these instructions may result in personal injury.

Note: Use this pinpoint test only when directed here.

The use of a soap solution around the fuel filler cap or the use of the hydrocarbon emission analyzer to determine an evaporative emission system leak is not recommended. The mandatory Rotunda Evaporative Emission System Leak Tester for On Board Diagnostic (OBD) (including the ultrasonic tester) and the Rotunda Vacutec 522 Leak Detector Smoke Machine are the only devices to be used at this time for evaporative emission system leak detection.

When using the smoke machine, the fuel level in the fuel tank must be less than 85% full.

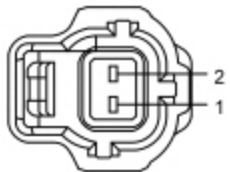
This pinpoint test is intended to diagnose the following:

- canister vent (CV) solenoid (9F945)
- fuel filler cap (9030)
- fuel tank pressure (FTP) sensor (9C052)
- EVAP canister purge (EVAPCP) valve (9C915). Also known as the vapor management valve (VMV).
- EVAP system leaks using the Rotunda Vacutec Leak Detector Smoke Machine.
- harness circuits: B+, CV, EVAPCP, FTP, FTPREF, SIGRTN, VPWR, VREF and CASE GND
- powertrain control module (PCM) (12A650)

For additional information on the EVAP system, refer to Section 1, [Evaporative Emission \(EVAP\) Systems](#), or the Workshop Manual Section 303-13, Evaporative Emissions.

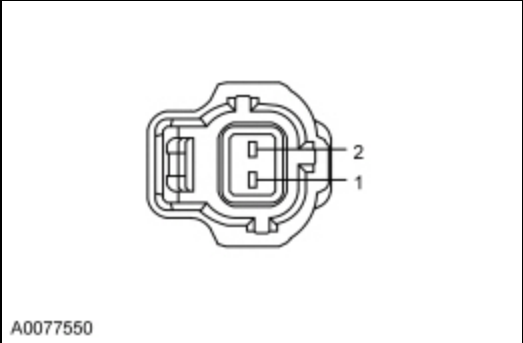
Canister Vent (CV) Solenoid Connector

For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.



Vehicle	Connector	Pin	Circuit
Explorer, Explorer Sport Trac, Mountaineer	A	2 1	KAPWR CANV
Focus, Mustang, Taurus	A	2 1	CANV VPWR
All other vehicles	A	1 2	KAPWR CANV

EVAP Canister Purge (EVAPCP) Valve Connector



Pin	Circuit
2	EVAPCP (EVAP Canister Purge)
1	VPWR (Vehicle Power)

Fuel Tank Pressure (FTP) Sensor Connector

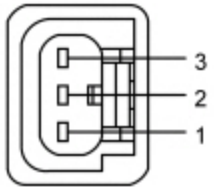
For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, FTPREF provides voltage to the FTP sensor instead of VREF.

A



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B



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Vehicle	Connector	Pin	Circuit
E-Series tank design, F-Super Duty tank design	A	3 1 2	FTP FTPREF SIGRTN
Focus, Mustang	B	3 2 1	FTP SIGRTN VREF
Taurus	A	3 2 1	FTP SIGRTN VREF
All other vehicles	B	3 1 2	FTP FTPREF SIGRTN

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to Section 6.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	B13 B3 B40 B41 E57 E1	CANV FTP FTPREF SIGRTN VREF EVAPCP
Edge, MKX	190 Pin	B61 B44 B29 B58 B29 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
Escape, Mariner	150 (50-50-50) Pin	B13 B9 B40 B41 E40 B34	CANV FTP FTPREF SIGRTN VREF EVAPCP
Expedition, Navigator	140 Pin	B61 B44 B29 B58 E57 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
F-150, Mark LT	190 Pin	B61 B44 B65 B58 B29 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
Five Hundred,	150 (50-50-50) Pin	B13	CANV

Vehicle	Connector	Pin	Circuit
Freestyle, Montego		B3 B40 B41 E40 E28	FTP FTPREF SIGRTN VREF EVAPCP
Focus	150 (50-50-50) Pin	B13 B9 B41 E40 B34	CANV FTP SIGRTN VREF EVAPCP
Freestar/Monterey	104 Pin	67 62 59 91 90 56	CANV FTP FTPREF SIGRTN VREF EVAPCP
Fusion, Milan, MKZ	140 Pin	B61 B44 B29 B58 B33 B4	CANV FTP FTPREF SIGRTN VREF EVAPCP
Mustang	170 Pin	B13 B3 B41 B40 E6	CANV FTP SIGRTN VREF EVAPCP
Taurus	104 Pin	67 62 91 90 56	CANV FTP SIGRTN VREF EVAPCP
All other vehicles	170 Pin	B13 B3 B40 B41	CANV FTP FTPREF SIGRTN

Vehicle	Connector	Pin	Circuit
		E57	VREF
		E6	EVAPCP

HX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCS P0442, P0443, P0446, P0451, P0452, P0453, P0455, P0456, P0457, P0460, P0461, P0462, P0463, P1443, P1450, P1451, or P260F present?

Yes	<p>For DTCS P0442 or P0456, GO to HX46.</p> <p>For DTC P0443, GO to HX2.</p> <p>For DTCS P0446 or P1451, GO to HX30.</p> <p>For DTC P0451, GO to HX39.</p> <p>For DTC P0452, GO to HX18.</p> <p>For DTC P0453, GO to HX23.</p> <p>For DTCS P0455 or P0457, GO to HX40.</p> <p>For DTC P0460, GO to HX38.</p> <p>For DTCS P0461 through P0463, GO to HX36.</p> <p>For DTC P1443, GO to HX43.</p> <p>For DTC P1450, GO to HX8.</p> <p>For DTC P260F, GO to HX49.</p>
No	<p>For symptoms without DTCS, GO to HX13.</p> <p>For all others, GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions.</p>

HX2 DTC P0443: CHECK THE PCM OUTPUT TO EVAP CANISTER PURGE VALVE

- Ignition OFF.
- EVAPCP Valve connector disconnected.
- Connect a non-powered test lamp between:

Point A EVAPCP Valve Connector, Harness Side	Point B EVAPCP Valve Connector, Harness Side
VPWR - Pin 1	EVAPCP - Pin 2

- Ignition ON, engine OFF.
- Enter output test mode. Refer to Section 2, [Output Test Mode \(OTM\)](#).
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.

Does the test lamp turn on and off when the output(s) is commanded on and off?

Yes	GO to HX3 .
No	GO to HX4 .

HX3 CHECK THE EVAP CANISTER PURGE VALVE SOLENOID RESISTANCE

- Ignition OFF.
- EVAPCP Valve connector disconnected.
- Measure the resistance between:

(+) EVAPCP Valve Connector, Component Side	(-) EVAPCP Valve Connector, Component Side
EVAPCP - Pin 2	VPWR - Pin 1

Is the resistance between 2.5 - 7 ohms?

Yes	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z .
No	INSTALL a new EVAPCP valve. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.

HX4 CHECK THE VPWR VOLTAGE TO THE EVAP CANISTER PURGE VALVE

- Ignition ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

Is the voltage greater than 10 V?

Yes	GO to HX5 .
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX5 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR AN OPEN IN THE HARNESS

- Ignition OFF.
- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EVAPCP Valve Connector, Harness Side
EVAPCP	EVAPCP - Pin 2

Is the resistance less than 5 ohms?

Yes	GO to HX6 .
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX6 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
EVAPCP	Ground

Is the resistance greater than 10K ohms?

Yes	GO to HX7 .
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX7 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Ignition ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-)
EVAPCP - Pin 2	Ground

Is the voltage less than 1 V?

Yes	GO to HX53 .
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX8 DTC P1450: CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM

Note: *If the CV solenoid and the fuel tank assemblies are not accessible during this step, refer to the Workshop Manual Sections 303-13, Evaporative Emissions and 310-01, Fuel Tank and Lines for removal instructions.*

- Check for kinks or bends in the fuel vapor hoses/tubes (EVAPCP outlet tube and EVAP canister tube).
- Visually inspect the EVAP canister inlet port, CV solenoid filter, and canister vent hose assembly for contamination or debris.
- Check the CV solenoid filter for blockage or contamination.

Is a concern present?

Yes	REMOVE any contamination or debris around the fuel vapor hose/tubes and CV solenoid assembly. REMOVE kinks or bends in the EVAPCP outlet tube, EVAP canister tube, and canister vent hose assembly. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to Section 2, On Board Diagnostic (OBD) Drive Cycle .
No	GO to HX9 .

HX9 CHECK THE FUEL TANK PRESSURE SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED

- Remove the fuel filler cap.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP PID.

Is the voltage between 2.4 - 2.8 V?

Yes	GO to HX13 .
No	GO to HX10 .

HX10 CHECK FOR ANY OTHER DTC

- Check for other 3-wire sensor DTCs (KOEO, KOER, or continuous memory) present with the DTC P1450.

Are any other DTCs present?

Yes	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions .
No	GO to HX11 .

HX11 CHECK THE VOLTAGE TO THE FTP SENSOR

- Ignition OFF.
- FTP Sensor connector disconnected.
- Ignition ON, engine OFF.

- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN
FTPREF	SIGRTN

Are the voltages between 4 - 6 V?

Yes	INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to Section 2, On Board Diagnostic (OBD) Drive Cycle .
No	GO to HX12 .

HX12 CHECK THE FTPREF OR VREF AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	VREF
SIGRTN	SIGRTN
FTPREF	FTPREF

Are the resistances less than 5 ohms?

Yes	GO to HX53 .
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX13 CHECK IF THE ENGINE IDLES

- Ignition ON, engine running.

Does the engine stall or is it unable to maintain idle?

Yes	GO to HX14 .
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No	GO to HX15 .
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HX14 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Ignition OFF.
- Disconnect the fuel vapor to intake manifold line at the EVAPCP valve and cap the line at the EVAPCP valve.
- Ignition ON, engine running.

Does the engine stall or is it unable to maintain idle?

Yes	The EVAP system is not the cause of the symptom. RETURN to Section 3, Symptom Charts for further direction.
No	INSTALL a new EVAPCP valve. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.

HX15 CHECK FOR BLOCKAGE IN THE FUEL TANK VENT SYSTEM

NOTICE: Do not allow FTP sensor voltage drop to less than 1.2 volts during this step. Excessive vacuum inside the fuel tank could trigger the vacuum release in the fuel filler cap.

Note: The CV is normally open and venting to the atmosphere.

- Access the PCM and monitor the EVAPCV PID.
- Access the PCM and monitor the FTP PID.
- Access the PCM and control the EVMV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.

Does the FTP sensor voltage drop below 1.5 volts when the EVAP canister purge valve is commanded fully open?

Yes	CHECK for blockage in the vapor line to the CV solenoid. CHECK the CV solenoid filter for blockage or contamination. CHECK the carbon canister for blockage. If OK, INSTALL a new CV solenoid. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.
No	GO to HX16 .

HX16 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Ignition ON, engine running.
- Access the PCM and control the EVMV PID.
- Close the EVAPCP by commanding the EVMV PID to 0 mA.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).

Does the FTPV PID decrease, the engine RPM change, or the engine stall, as an indication that the EVAPCP valve is stuck open?

Yes	INSTALL a new EVAPCP valve. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.
No	GO to HX17 .

HX17 EVAP CANISTER PURGE VALVE TEST

- Ignition ON, engine running.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and control the EVMV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.

Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAPCP valve is opening?

Yes	For DTC P1450, unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z . For all others, CHECK the EVAP system for leaks.
No	CHECK for blockages between the fuel tank, the EVAPCP valve, and the engine intake manifold. CHECK for obstructions in the EVAPCP valve diaphragm and ports. If OK, INSTALL a new EVAPCP valve. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.

HX18 DTC P0452: CHECK FOR FUEL TANK PRESSURE SENSOR CONNECTOR CONTAMINATION

- Ignition OFF.
- Visually check for liquid fuel contamination of the FTP sensor electrical connector.
- Check for a completely submerged FTP sensor (tank-mounted type only) in the liquid fuel. This can affect the correct FTP voltage reading.

Does the FTP sensor and its connector show any signs of fuel contamination?

Yes	REPAIR as necessary. ADJUST the fuel tank overfill. CLEAR the DTCs. REPEAT the self-test.
No	GO to HX19 .

HX19 CHECK FOR LOW FTP SENSOR VOLTAGE

Note: *The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.*

- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP PID.

Is the voltage less than 0.22 V?

Yes	GO to HX20 .
No	The concern that produced the DTC P0452 is intermittent. GO to Pinpoint Test Z .

HX20 CHECK THE OPPOSITE INDUCED HIGH FTP SENSOR SIGNAL

- Ignition OFF.
- FTP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
VREF	FTP

- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP PID.

Is the voltage between 4 - 5 V?

Yes	INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.
No	GO to HX21 .

HX21 CHECK THE VREF VOLTAGE TO THE FTP SENSOR

- Remove the jumper wire(s).
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN

Is the voltage between 4 - 6 V?

Yes	GO to HX22 .
No	GO to Pinpoint Test C .

HX22 CHECK THE FTP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FTP	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

Is the resistance greater than 10K ohms?

Yes	GO to HX53 .
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX23 DTC P0453: CHECK FOR HIGH FTP SENSOR VOLTAGE

Note: The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.

- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP PID.

Is the voltage greater than 4.5 V?

Yes	GO to HX24 .
No	The concern that produced the DTC P0453 is intermittent. GO to Pinpoint Test Z .

HX24 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE FTP SENSOR VEHICLE HARNESS CONNECTOR

- Ignition OFF.
- FTP Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN

Is the voltage between 4 - 6 V?

Yes	GO to HX25 .
No	GO to Pinpoint Test C .

HX25 CHECK THE FTP CIRCUIT FOR A SHORT TO VOLTAGE

- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

Is the voltage less than 10 V?

Yes	GO to HX27 .
No	GO to HX26 .

HX26 CHECK THE FTP CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Ignition OFF.
- PCM connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

Is the voltage greater than 10 V?

Yes	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.
No	GO to HX53 .

HX27 CHECK THE FTP CIRCUIT FOR AN OPEN IN THE HARNESS

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
FTP	FTP

Is the resistance less than 5 ohms?

Yes	GO to HX28 .
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX28 CHECK THE FTP CIRCUIT FOR A SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	FTP

Is the resistance greater than 10K ohms?

Yes	GO to HX29 .
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX29 CHECK THE OPPOSITE INDUCED LOW FTP SIGNAL

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
FTP	SIGRTN

- Ignition ON, engine OFF.

- Access the PCM and monitor the FTP PID.

Is the voltage less than 0.1 V?

Yes	INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.
No	GO to HX53 .

HX30 DTCS P0446 OR P1451: CHECK THE PCM OUTPUT TO THE CV SOLENOID

Note: For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

- Ignition OFF.
- CV Solenoid connector disconnected.
- Connect a non-powered test lamp between:

Point A CV Solenoid Connector, Harness Side	Point B CV Solenoid Connector, Harness Side
VPWR	CANV
KAPWR	CANV

- Ignition ON, engine OFF.
- Enter output test mode. Refer to Section 2, [Output Test Mode \(OTM\)](#).
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.

Does the test lamp turn on and off when the output(s) is commanded on and off?

Yes	GO to HX31 .
No	GO to HX32 .

HX31 CHECK THE CV SOLENOID RESISTANCE

Note: For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

- Ignition OFF.
- Measure the resistance between:

(+) CV Solenoid Connector, Component Side	(-) CV Solenoid Connector, Component Side
KAPWR	CANV
VPWR	CANV

Are the resistances between 48 - 65 ohms?

Yes	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z.
No	INSTALL a new CV solenoid. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.

HX32 CHECK THE VPWR VOLTAGE TO THE CV SOLENOID

Note: For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

- Measure the voltage between:

(+) CV Solenoid Connector, Harness Side	(-)
KAPWR	Ground
VPWR	Ground

Are the voltages greater than 10 V?

Yes	GO to HX33 .
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX33 CHECK THE CANV CIRCUIT FOR AN OPEN IN THE HARNESS

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CV Solenoid Connector, Harness Side
CANV	CANV

Is the resistance less than 5 ohms?

Yes	GO to HX34 .
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No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.
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HX34 CHECK THE CANV CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) CV Solenoid Connector, Harness Side	(-) Vehicle Battery
CANV	Negative terminal

Is the resistance greater than 10K ohms?

Yes	GO to HX35 .
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX35 CHECK THE CANV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Ignition ON, engine OFF.
- Measure the voltage between:

(+) CV Solenoid Connector, Harness Side	(-)
CANV	Ground

Is the voltage less than 1 V?

Yes	GO to HX53 .
No	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX36 DTCS P0461, P0462 AND P0463: CHECK THE INSTRUMENT CLUSTER MODULE FOR DTCS

- Ignition ON, engine OFF.
- Carry out the instrument cluster self-test.

Are any DTCs present?

Yes	REFER to the Workshop Manual Section 413-01, Instrument Cluster to continue diagnosis.
No	GO to HX37 .

HX37 CHECK THE FLI PID

- Ignition ON, engine running.
- Access the PCM and monitor the FLI PID.

Does the FLI PID match the fuel gauge?

Yes	GO to HX38 .
No	GO to HX53 .

HX38 DTC P0460: CHECK FOR FUEL TANK FLOAT LEVEL RESPONSE

Note: A dual-container (saddle type) fuel tank has 2 fuel level sensors. The FLI PID in the PCM is the average value of both fuel level sensors. Some dual-container tanks may require the fuel level to be greater 3/4 full before the fuel level equalizes.

- Ignition ON, engine running.
- Access the PCM and monitor the FLI PID.
- Ignition OFF.
- If the fuel level is less than 1/4 (25% on FLI), add approximately 1/4 tank of fuel.
- If the fuel level is greater than 3/4 (75% on FLI), drain approximately 1/4 tank of fuel.
- Ignition ON, engine running.
- Access the PCM and monitor the FLI PID.

Does the FLI PID indicate a movement upward or downward as fuel is either added or drained?

Yes	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z .
No	REFER to the Workshop Manual Section 413-01, Instrument Cluster to diagnose the incorrect fuel gauge indication symptom.

HX39 DTC P0451: CHECK THE FTP SENSOR FOR CORRECT OPERATION

- Ignition OFF.
- Remove the fuel filler cap.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP PID.

Is the pressure between -0.42 and 0.42 kPa (-1.7 and 1.7 in-H₂O)?

Yes	CHECK for kinks or bends in the fuel vapor hoses/tubes between the fuel tank and dust separator. CHECK the EVAP canister ports and canister vent hose assembly for contamination or debris. CHECK the dust separator for blockage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
No	INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.

HX40 DTCS P0455 OR P0457: CHECK THE FUEL FILLER CAP

Note: Many EVAP leaks are caused by a loose or damaged fuel filler cap. If the fuel filler cap is suspect during visual inspection, do not disturb the fuel filler cap until the repair verification method is complete. If the repair verification method fails, reposition or install a new fuel filler cap and repeat the test. This action isolates the fuel filler cap from the rest of the EVAP system as a potential concern.

- Visually inspect the fuel filler cap without initially disturbing it.
 - Verify the fuel filler cap tether is visible and free to move.
 - Check for missing or loose fuel filler cap.
 - Check the fuel filler cap for damage.

Is a concern present with the proper installation of the fuel filler cap?

Yes	For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. CONNECT or INSTALL a new fuel filler cap. GO to HX46 .
No	GO to HX41 .

HX41 CHECK FOR FLI DTCS

- Ignition ON, engine OFF.
- Carry out the self-test.

Are DTCs P0460, P0461, P0462 or P0463 present?

Yes	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions .
No	GO to HX42 .

HX42 CHECK THE OPERATION OF THE FUEL GAUGE

Note: A fuel gauge that always indicates a fuel level less than a 1/2 tank or always a full tank, may be caused by a fuel level input (FLI) concern.

- Check operation of the fuel gauge.

Is the fuel gauge functioning properly?

Yes	GO to HX43 .
No	CHECK the functionality of the FLI circuit. RETURN to Section 3, Symptom Charts for further direction.

HX43 DTC P1443: EVAPORATIVE EMISSION SYSTEM VISUAL INSPECTION

- Ignition OFF.
- Visually inspect for:
 - EVAP system lines/hoses (check for proper connections, damage or blockage)
 - loose fuel vapor hose/tube connections to the EVAP system components
 - blocked vacuum hose between the EVAPCP valve and the engine intake manifold

- damaged fuel tank or fuel filler pipe

Are there any concerns found during the visual inspection?

Yes	REPAIR as necessary. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX46 .
No	GO to HX44 .

HX44 CHECK THE FUEL TANK PRESSURE (FTP) SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED

- Remove the fuel filler cap.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP PID.

Is the voltage between 2.4 - 2.8 V?

Yes	CONNECT the fuel filler cap. GO to HX45 .
No	INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX46 .

HX45 EVAP CANISTER PURGE VALVE TEST

- Ignition ON, engine running.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and control the EVMV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.

Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAPCP valve is opening?

Yes	GO to HX46 .
No	INSTALL a new EVAPCP valve. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX46 .

HX46 DTCS P0442 OR P0456: HOOK UP THE SMOKE MACHINE (ROTUNDA VACUTEC)

NOTICE: Removing the Schrader valve from the test port permanently damages the valve.

Note: The smoke and air flow from the smoke machine will not pass through liquid fuel. Liquid fuel may be present in the fuel tank filler pipe.

Note: Some vehicles are not equipped with an evaporative emission test port. Use a suitable hose adapter in the following diagnostic procedures.

- Ignition OFF.
- Connect the smoke machine power cables to the vehicle battery. Check to see that the smoke machine power indicator lamp is on, indicating a good battery contact.
- For vehicles not equipped with an evaporative emission test port:
 - Disconnect the fuel vapor to intake manifold line at the EVAPCP valve and cap the line.
 - Connect a suitable hose adapter to the fuel vapor to intake manifold connection at the EVAPCP valve.
- For vehicles equipped with an evaporative emission test port:
 - Locate the evaporative emission test port and remove the green cap. The cap is located on or close to the EVAPCP valve.
 - Install the EVAP test port adapter (provided with the Vacutec Smoke Machine) to the test port.

Is the smoke machine hook up complete?

Yes	For leak detection, GO to HX47 . For leak repair verification, GO to HX48 .
No	REFER to the smoke machine operator manual for additional instructions and for helpful tips.

HX47 CARRY OUT SMOKE MACHINE PHASE 2 - LEAK DETECTION SMOKE TEST

Note: *If the leak is not detected from the top, check the EVAP system for leaks from under the vehicle.*

- Check the EVAP hoses, EVAPCP valve, CV solenoid, EVAP canister, fuel tank, fuel filler pipe, around the fuel tank area, and at the fuel filler cap.
- Wiggle the components and connections to simulate road bumps while looking for signs of leaking smoke.

If the leak is in the fuel filler neck between the check valve and the fuel filler cap, smoke under pressure may not reach the leak. If leaking smoke is not found, a thorough visual inspection of the fuel filler neck and fuel filler cap should be done.

- Position the control lever located on the smoke machine to SMOKE.
- Remove the fuel filler cap.
- Connect the smoke supply hose (black hose) nozzle tip into the EVAP service port or suitable hose adapter.
- Ignition ON, engine OFF.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and control the EVMV PID.
- For vehicles not equipped with an evaporative emission test port:
 - Press the remote starter button on the smoke machine and verify the connection at the EVAPCP valve is correct and not leaking
 - Open the EVAPCP valve by commanding the EVMV PID to 1,000 mA
- Press the remote starter button on the smoke machine. Smoke is then introduced into the EVAP system. If smoke does not exit the fuel filler neck after the system is pressurized, command the EVAPCV PID open to allow air to purge the CV solenoid. Once smoke is seen at the CV solenoid, command the EVAPCV PID close.
 - Secure the fuel filler cap once smoke is observed exiting the fuel tank neck area.
 - Continue to introduce smoke into the system for 60 seconds to obtain pressure.
 - Press and release the remote starter button in intervals of approximately 15 seconds on and 15 seconds off while checking for exiting smoke.
 - Use the halogen spotlight provided with the smoke machine to follow the EVAP system path and look for smoke exiting at the source of the leak(s).

Is the source of the EVAP leak located?

Yes	REPAIR as necessary. CONNECT all the disconnected components. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test.
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	GO to HX48 .
No	The test passed. CONNECT all the disconnected components. CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX48 .

HX48 CARRY OUT THE SMOKE MACHINE PHASE 1 - LEAK VERIFICATION PRESSURE TEST

- Position the control lever located on the smoke machine to METER.
- Calibrate the smoke machine flowmeter using the 0.020 (DTC P0456) or 0.040 (DTC P0442) standard as follows:
 - Insert the air supply hose (transparent hose) nozzle tip into the appropriate EVAP system standard located on the front of the smoke machine.
 - Press the remote starter button on the smoke machine. Observe the position of the flowmeter indicator ball.
 - Position the flowmeter red pointer flag so that it aligns with the measurement of the indicator ball.
 - Release the button and remove the air supply hose nozzle tip from the EVAP system standard.
- Connect the air supply hose (transparent hose) nozzle tip into the EVAP test port or suitable hose adapter.
- Ignition ON, engine OFF.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and control the EVMV PID.
- For vehicles not equipped with an evaporative emission test port, open the EVAPCP valve by commanding the EVMV PID to 1,000 mA.
- Press the remote starter button on the smoke machine. Notice that the ball in the flowmeter is all the way at the top. This indicates the system is being pressurized.
- Continue to press the remote starter button until the ball stops descending. Once the ball stops descending, observe if it is above or below the red pointer flag. If the measurement is below the indicator flag, the system has passed the pressure test. If the measurement is above the indicator flag, the EVAP system has an unacceptable leak.

Does the EVAP system pass the smoke machine leak verification pressure test?

Yes	The test passed and no concerns are present. CLEAR the DTCs. REPEAT the self-test.
No	GO to HX47 .

HX49 DTC P260F: CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Ignition ON, engine OFF.
- Check for self-test DTCs in all of the vehicle modules.

Are any communication concerns or communication DTCs present?

Yes	For communication concerns in the PCM, DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions . For communication concerns in other modules, REFER to the applicable Workshop Manual Section to diagnose the communication DTC.
No	GO to HX50 .

HX50 CHECK THE PERFORMANCE OF THE PROCESSOR

- Ignition OFF.
- Disconnect the battery and wait for 1 minute. Refer to the Workshop Manual Section 414-01, Battery, Mounting and Cables.
- Connect the battery.
- Ignition ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FTP PID.

Is the pressure equal to 0 kPa (0 psi)?

Yes	GO to HX52 .
No	GO to HX51 .

HX51 CHECK FOR SELF-TEST DTC P260F

- Idle the engine for 2 minutes.
- Carry out the self-test.

Is DTC P260F present?

Yes	GO to HX52 .
No	RETURN the vehicle to the customer.

HX52 CHECK THE PCM FOR THE LATEST CALIBRATION

- Program the PCM to the latest calibration.
- Ignition ON, engine running.
- Idle the engine for 2 minutes.
- Carry out the self-test.

Is DTC P260F present?

Yes	GO to HX53 .
No	RETURN the vehicle to the customer.

HX53 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
 - pushed out pins
 - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new PCM. REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM) .
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.