

HX: Evaporative Emission (EVAP) System and Monitor

[← HX: Introduction](#)

HX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCS P0442, P0443, P0446, P0451, P0452, P0453, P0455, P0456, P0457, P0460, P0461, P0462, P0463, P144A, P1450, P1451, or P260F present?

Yes	No
For DTCS P0442 or P0456, GO to HX46 . For DTC P0443, GO to HX2 . For DTCS P0446 or P1451, GO to HX30 . For DTC P0451, GO to HX39 . For DTC P0452, GO to HX18 . For DTC P0453, GO to HX23 . For DTCS P0455 or P0457, GO to HX40 . For DTC P0460, GO to HX38 . For DTCS P0461 through P0463, GO to HX36 . For DTC P144A, GO to HX49 . For DTC P1450, GO to HX8 . For DTC P260F, GO to HX50 .	For symptoms without DTCS, GO to HX13 . For all others, GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Descriptions .

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

Note: For E-Series, Escape/Mariner, Expedition, F-150, and Navigator, use the EVAPCP PID to control the EVAPCP valve. For all others, use the EVMV PID to control the EVAPCP 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	EVAPCP

- Ignition ON, engine OFF.
- Access the PCM and control the EVMV PID.
- Access the PCM and control the EVAPCP PID.

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

Yes	No

GO to [HX3](#).

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	VPWR

Vehicle	Minimum Resistance (ohms)	Maximum Resistance (ohms)
E-Series, Escape/Mariner, Expedition, F-150, Navigator	13.5	24.5
All others	2.5	7

Is the resistance within specification?

Yes	No
Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z .	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	Negative terminal

Is the voltage greater than 10 V?

Yes	No
GO to HX5 .	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:

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

Is the resistance less than 5 ohms?

Yes	No
GO to HX6 .	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	No
GO to HX7 .	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	Ground

Is the voltage less than 1 V?

Yes	No
GO to HX54 .	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?

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Yes	No
<p>REMOVE any contamination or debris around the fuel vapor hose/tubes and CV solenoid assembly.</p> <p>REMOVE kinks or bends in the EVAPCP outlet tube, EVAP canister tube, and canister vent hose assembly.</p> <p>CLEAR the DTCs.</p> <p>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.</p>	<p>GO to HX9.</p>

HX9 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

Note: For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.

Note: After installing the supplemental refueling adaptor or removing the fuel filler cap, wait one minute to allow the pressure in the fuel tank to equalize with the ambient air pressure before accessing the PID.

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

Measurement Unit	Minimum Pressure	Maximum Pressure
kPa	-0.50	0.50
psi	-0.07	0.07
in-H2O	-2.0	2.0
V	2.35	2.9

Is the pressure within specifications?

Yes	No
GO to HX13 .	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	No
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 .	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	No
<p>INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly.</p> <p>CLEAR the DTCs.</p> <p>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.</p>	<p>GO to HX12.</p>

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	No
<p>GO to HX54.</p>	<p>REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.</p>

HX13 CHECK IF THE ENGINE IDLES

- Ignition ON, engine running.

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

Yes	No
<p>GO to HX14.</p>	<p>GO to HX15.</p>

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	No
The EVAP system is not the cause of the symptom. RETURN to Section 3 , Symptom Charts for further direction.	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 or capless fuel filler system.

Note: For E-Series, Escape/Mariner, Expedition, F-150, and Navigator, use the EVAPCP PID to control the EVAPCP valve. For all others, use the EVMV PID to control the EVAPCP valve.

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.
- Access the PCM and control the EVAPCP PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA or EVAPCP PID to 100%.

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

Yes	No
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.	GO to HX16 .

HX16 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

Note: For E-Series, Escape/Mariner, Expedition, F-150, and Navigator, use the EVAPCP PID to control

the EVAPCP valve. For all others, use the EVMV PID to control the EVAPCP valve.

- Ignition ON, engine running.
- Access the PCM and monitor the FTP PID.
- Access the PCM and control the EVMV PID.
- Access the PCM and control the EVAPCP PID.
- Close the EVAPCP valve by commanding the EVMV PID to 0 mA or EVAPCP PID to 0%.
- 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	No
INSTALL a new EVAPCP valve. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.	GO to HX17 .

HX17 EVAP CANISTER PURGE VALVE TEST

Note: For E-Series, Escape/Mariner, Expedition, F-150, and Navigator, use the EVAPCP PID to control the EVAPCP valve. For all others, use the EVMV PID to control the EVAPCP valve.

- 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 monitor the FTP PID.
- Access the PCM and control the EVMV PID.
- Access the PCM and control the EVAPCP PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA or EVAPCP PID to 100%.

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

Yes	No
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.	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	No
REPAIR as necessary. ADJUST the fuel tank overfill. CLEAR the DTCs. REPEAT the self-test.	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	No
GO to HX20 .	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	No
INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.	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
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VREF	SIGRTN
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Is the voltage between 4 - 6 V?

Yes	No
GO to HX22 .	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	No
GO to HX54 .	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 4.85 V?

Yes	No
GO to HX24 .	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:

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

Is the voltage between 4 - 6 V?

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

HX25 CHECK THE FTP CIRCUIT FOR A SHORT TO POWER

- Measure the voltage between:

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

Is the voltage less than 10 V?

Yes	No
GO to HX27 .	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	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to HX54 .

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	No
GO to HX28 .	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	No
GO to HX29 .	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	No
INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.	GO to HX54 .

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.
- Access the PCM and control the EVAPCV PID.

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

Yes	No
GO to HX31 .	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	No
Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z .	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	No
GO to HX33 .	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	No
GO to HX34 .	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

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	No
GO to HX35 .	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	No
GO to HX54 .	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX36 DTCS P0461, P0462 AND P0463: CHECK THE INSTRUMENT PANEL CLUSTER (IPC) OR INSTRUMENT CLUSTER (IC) FOR DTCS

- Ignition ON, engine OFF.
- For E-Series and MKS:
- Carry out the IPC self-test.
- For all others:
- Carry out the IC self-test.

Are any DTCs present?

Yes	No
REFER to the Workshop Manual Section 413-01, Instrumentation, Message Center, and Warning Chimes, to continue diagnosis.	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	No
GO to HX38 .	GO to HX54 .

HX38 DTC P0460: CHECK FOR FUEL TANK FLOAT LEVEL RESPONSE

Note: A dual-container (saddle type) fuel tank has two 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.

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

Yes	No
Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z .	REFER to the Workshop Manual Section 413-01, Instrumentation, Message Center, and Warning Chimes, to DIAGNOSE the incorrect fuel gauge indication symptom.

HX39 DTC P0451: CHECK THE FTP SENSOR FOR CORRECT OPERATION

Note: For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.

Note: After installing the supplemental refueling adaptor or removing the fuel filler cap, wait one minute to allow the pressure in the fuel tank to equalize with the ambient air pressure before accessing the PID.

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

Measurement Unit	Minimum Pressure	Maximum Pressure
kPa	-0.50	0.50
psi	-0.07	0.07
in-H2O	-2.0	2.0
V	2.35	2.9

Is the pressure within specifications?

Yes	No
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.	INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.

HX40 DTCS P0455 OR P0457: CHECK THE FUEL FILLER CAP OR CAPLESS FUEL TANK FILLER PIPE

Note: If the fuel filler cap or capless fuel tank filler pipe is suspected as an EVAP leak source during visual inspection, do not disturb the fuel filler cap or capless fuel tank filler pipe 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. For vehicles with a capless fuel tank filler pipe, install and remove the supplemental refueling adaptor provided with the vehicle to reseal the capless fuel tank filler pipe and repeat the test. This action isolates the fuel filler cap or capless fuel tank filler pipe from the rest of the EVAP system as a potential concern.

- For vehicles with a fuel filler cap, 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.
- For vehicles with a capless fuel tank filler pipe, visually inspect the capless fuel tank filler pipe inlet without initially disturbing it.
 - Check the capless fuel tank filler pipe inlet for an obstruction that prevents it from sealing.
 - Check the capless fuel tank filler pipe for damage.

Is a concern present?

Yes	No
For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. REPAIR as necessary. GO to HX46 .	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	No
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 .	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	No
GO to HX43 .	CHECK the functionality of the FLI circuit. RETURN to Section 3 , Symptom Charts for further direction.

HX43 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	No
REPAIR as necessary. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX46 .	GO to HX44 .

HX44 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

Note: For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.

- 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	No
GO to HX45 .	INSTALL a new FTP sensor. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. 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

Note: For E-Series, Escape/Mariner, Expedition, F-150, and Navigator, use the EVAPCP PID to control the EVAPCP valve. For all others, use the EVMV PID to control the EVAPCP valve.

- Ignition OFF.
- Install the fuel filler cap or remove the supplemental refueling adaptor.
- 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 monitor the FTP PID.
- Access the PCM and control the EVMV PID.
- Access the PCM and control the EVAPCP PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA or EVAPCP PID to 100%.

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

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

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 Fusion, Milan, MKZ:
 - 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.
- For E-Series, Escape/Mariner, Expedition, F-150, Navigator:
 - Disconnect the fuel vapor to EVAP canister line at the EVAPCP valve.
 - Connect a suitable hose adapter to the fuel vapor to EVAP canister connection at the EVAPCP valve.
- For all others:
 - 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.

Is the smoke machine hook up complete?

Yes	No
For leak detection, GO to HX47 . For leak repair verification, GO to HX48 .	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: For E-Series, Escape/Mariner, Expedition, F-150, and Navigator, use the EVAPCP PID to control the EVAPCP valve. For all others, use the EVMV PID to control the EVAPCP valve.

Note: 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 or capless fuel tank filler pipe inlet for leaks. Wiggle the components and connections while looking for signs of leaking smoke. If the leak is in the fuel tank filler pipe between the check valve and the fuel filler cap or capless fuel tank filler pipe inlet, smoke under pressure may not reach the leak. If leaking smoke is not found, a thorough visual inspection of the fuel tank filler pipe and fuel filler cap or capless fuel tank filler pipe inlet should be done.

- Set the smoke machine to SMOKE.
- Remove the fuel filler cap or install the supplemental refueling adaptor.
- Connect the smoke supply hose nozzle tip into the EVAP test port or suitable hose adaptor.
- 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 EVAPCP PID.
- For vehicles not equipped with an evaporative emission test port:
 - Start the smoke machine and verify the connection at the EVAPCP valve is correct and not leaking
 - Open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA or EVAPCP PID to 100%
- Start the smoke machine. If smoke does not exit the fuel tank filler pipe 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.
 - Install the fuel filler cap or remove the supplemental refueling adaptor once smoke is observed exiting the fuel tank neck area.
 - Continue to smoke 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	No
REPAIR as necessary. CONNECT all the disconnected components. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX48 .	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

Note: For E-Series, Escape/Mariner, Expedition, F-150, and Navigator, use the EVAPCP PID to control the EVAPCP valve. For all others, use the EVMV PID to control the EVAPCP valve.

- 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).
- For vehicles not equipped with an evaporative emission test port, open the EVAPCP valve by commanding the EVMV PID to 1,000 mA or EVAPCP PID to 100%.
- 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	No
The test passed and no concerns are present. CLEAR the DTCs. REPEAT the self-test.	GO to HX47 .

HX49 DTC P144A: CHECK FOR A BLOCKED FUEL VAPOR TUBE BETWEEN THE FTP SENSOR AND THE FUEL TANK

- Ignition OFF.
- Remove the fuel vapor tube assembly. Refer to the Workshop Manual Section 303-13, Evaporative Emissions.
- Visually inspect the fuel vapor tube for a blockage between the FTP sensor and the connection to the fuel tank or fuel pump module.
- Visually inspect the connection at the fuel tank or fuel pump module for a blockage.
- Attempt to manually remove the blockage.

Is the blockage visible and can be removed?

Yes	No
REMOVE the blockage. INSTALL the Fuel Vapor Tube assembly. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new Fuel Vapor Tube assembly. REFER to the Workshop Manual Section 303-13, Evaporative Emissions. CLEAR the DTCs. REPEAT the self-test.

HX50 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	No
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 .	GO to HX51 .
For communication concerns in other modules, REFER to the applicable Workshop Manual Section to diagnose the communication DTC.	

HX51 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 voltage between 2.35 - 2.9 V?

Yes	No
GO to HX53 .	GO to HX52 .

HX52 CHECK FOR SELF-TEST DTC P260F

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

Is DTC P260F present?

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

HX53 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	No
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GO to [HX54](#).

Return the vehicle to the customer.

HX54 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	No
INSTALL a new PCM. REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM) , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
