Computers and Control Systems: Pinpoint Tests
Test H: Fuel Control

PINPOINT TEST H: FUEL CONTROL

H1 PERFORM THE KOER SELF-TEST

- Engine at normal operating temperature.
- Check for self-test DTCs.

Are DTCs P0040, P0041, P1127, P1128, P1129 or P2278 present?

Yes	No
Key in OFF position. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Diagnostic Trouble Code (DTC) Charts.	GO to H2 .

H2 CONTINUOUS MEMORY DTCS P0133 AND P2190: HO2S RESPONSE TEST

- Key ON, engine OFF.
- Select 'Generic OBD II Function'.
- Press CONTINUE.
- Select 'Diagnostic Monitoring Test Results'.
- Scroll to Test ID: 01.
- Key in OFF position.

Is the indicated value greater than the minimum threshold?

Yes	No
Key in OFF position. CLEAR the DTCs. Carry out the HO2S monitor drive cycle. GO to H1 .	GO to H3 .

H3 CHECK FOR UNMETERED AIR LEAKS

Note: Fuel calculations can be affected by unmetered air leaks.

- Carefully inspect the following areas for potential air leaks:
  - Hoses connecting to the MAF sensor assembly.
  - Hoses connecting to the throttle body.
  - Intake manifold gasket leaks.
  - PCV disconnected.
  - The vacuum lines are disconnected.
  - Improperly seated engine oil dipstick, tube or oil fill cap.
  - Exhaust leaks at flanges and gaskets.

Are any air leaks present?

Yes	No
REPAIR the source of the air leak. RESET the keep alive memory (KAM). REFER to Resetting The Keep Alive Memory (KAM).	GO to H4 .

Test H1 - H3

H4 CHECK HO2S CIRCUIT CONTINUITY

- HO2S connector disconnected.
- Check the connector (both halves) for any water contamination.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.

  Note: HO2S is displayed as O2S on the diagnostic tool.

- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1 V?

Yes	No
Key in OFF position. INSTALL a new HO2S. CHANGE the engine oil filter. RESET the keep alive memory (KAM). REFER to Resetting The Keep Alive Memory (KAM).	Key in OFF position. GO to H5 .

H5 CHECK THE HO2S CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Remove the jumper wire(s).

  Note: A vehicle hoist may be required to access the HO2S harness.

- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to H6 .	REPAIR the open circuit. Carry out the HO2S monitor drive cycle.

H6 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	VPWR

Is the resistance greater than 10K ohms?

Yes	No
GO to H7 .	GO to H9 .

H7 DTC P0131: CHECK FOR A SOURCE OF POTENTIAL HO2S CONTAMINATION

- Investigate the following items as potential sources of HO2S contamination:
  - Use of unapproved silicon sealers.
  - Fuel contaminated by silicon additives.
  - Excessive oil burning. (rings, valve seals, oil overfill).
  - Glycol leaking internally in the engine.
  - Lead-contaminated fuel
  - Short drive cycles in cold weather.
  - Use of unapproved cleaning agents

Were any of the above conditions or concerns found during inspection?

Yes	No
Repair the source of contamination. CHANGE the engine oil filter. RESET the keep alive memory (KAM). REFER to Resetting The Keep Alive Memory (KAM).	GO to H8 .

H8 DETERMINE THE DTC BEING DIAGNOSED

Are you diagnosing DTC P0141 or P0161?

Yes	No
GO to H10 .	GO to H9 .

H9 VERIFY THE HARNESS PINS ARE IN THE PROPER LOCATION

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
INSTALL a new HO2S.	REPAIR as necessary.

H10 DTCS P0135, P0141, P0147, P0155, P0161 OR P0167: VISUALLY INSPECT THE HO2S HARNESS

- PCM connector connected.
- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.

Were any exposed wiring, contamination, corrosion and correct assembly concerns present?

Yes	No
REPAIR as necessary.	GO to H11 .

H11 PERFORM KOEO THE ON-DEMAND SELF-TEST

- Key ON, engine OFF.

Are any of the following DTCs present: P0135, P0141, P0147, P0155, P0161 or P0167.

Yes	No
Key in OFF position. GO to H12 .	Key in OFF position. GO to H13 .

H12 DTCS P0053, P0054, P0055, P0059, P0060 AND P0061: CHECK FOR VPWR IN THE HARNESS

Note: If DTCs are present, test their related circuits individually.

- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
VPWR	SIGRTN

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to H13 .	REPAIR the open circuit. Check fuses.

H13 CHECK THE HO2S HEATER FOR SHORTS IN THE HARNESS

- HO2S connector disconnected.
- PCM connector disconnected.

Note: If DTCs P0053, P0054, P0055, P0059, P0060 or P0061 are present, test their related circuits individually.

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	VPWR
HO2S Heater	SIGRTN
HO2S Heater	HO2S Signal

Are the resistances greater than 10K ohms?

Yes	No
GO to H14 .	REPAIR the short circuit.

H14 CHECK THE HO2S CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	HO2S Heater

Is the resistance less than 5 ohms?

Yes	No
GO to H15 .	REPAIR the open circuit.

H15 CHECK THE INTERNAL RESISTANCE OF HO2SHTR

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	VPWR

Is the resistance between 3 - 30 ohms?

Yes	No
GO to H16 .	INSTALL a new HO2S.

H16 CHECK THE HO2S CASE FOR A SHORT TO VPWR, HTR AND SIGRTN

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	SIGRTN

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
INSTALL a new PCM.	INSTALL a new HO2S.

H17 DTCS P0171, P0174, P1130, P1131, P1150, P1151, P2195 OR P2197: LEAN SYSTEM DTCS

Note: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the ECT PID from the freeze frame data. The freeze frame data is used to recreate the concern.
- Retrieve and record the self-test DTCs.

Are any DTCs present other than the following: P0171, P0174, P1130, P1131, P1150, P1151, P2195 or P2197?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Diagnostic Trouble Code (DTC) Charts.	GO to H18 .

H18 CARRY OUT A VISUAL INSPECTION ON THE INTAKE AIR SYSTEM AND ALL VACUUM HOSES

- Check the intake air system for leaks, obstructions, and damage.
- Inspect the entire length of all the vacuum hoses for:
  - proper connections
  - damage or cracks
  - damaged or cracked vacuum tees
- Verify the integrity of the positive crankcase ventilation (PCV) system.
- Verify the proper PCV valve part number.

Is a concern present?

Yes	No
GO to H21 .	GO to H19 .

H19 CHECK FOR THE PRESENCE OF A VACUUM LEAK

Note: Fuel trim values at idle are more sensitive to a vacuum leak. The vacuum leak (unmetered air) represents a larger portion of the total air flow at idle than at part throttle.

Note: The barometric pressure (BARO) PID is not a recommended PID to monitor when diagnosing a vacuum leak. Barometric pressure is calculated during high engine load, when the vacuum leak represents a small portion of the total air flow.

Note: When calculating the total fuel correction in the following steps, if LONGFT1 equals +13% and SHRTFT1 equals +23%, the total fuel correction for bank 1 equals +36%. If LONGFT2 equals +24% and SHRTFT2 equals -3% the total fuel correction for bank 2 equals +21%.

Note: If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).

- Key ON, engine running.
- Access the PCM and monitor the ECT, CHT and IAT PIDs.
- Access the PCM and monitor the LONGFT1, SHRTFT1, LONGFT2 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at idle.
- Increase the engine speed to 2,500 RPM for 10 seconds.
- Record the LONGFT1, SHRTFT1, LONGFT2, and SHRTFT2 PID values.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at 2,500 RPM.

Is the total fuel correction value difference, between idle and 2,500 RPM, less than 15 percent?

Yes	No
No vacuum leak is present. GO to H23 .	GO to H20 .

H20 LOCATE THE VACUUM LEAK

CAUTION: Do not clamp or pinch a hard plastic hose. Use a vacuum cap or equivalent to restrict the hose.

Note: Restricting the EVAP vapor hose while the EVAP emission canister is purging may shift the SHRTFT. Carry out a visual inspection as necessary.

Note: When monitoring for a decrease in the SHRTFT PIDs in the following steps, if SHRTFT1 equals +15% and the hose is restricted, SHRTFT1 decreases to -7%. The total decrease in the SHRTFT PIDs equals 22%.

- Locate the vacuum tees for the intake air and PCV systems.
- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Restrict the vacuum lines one at a time for 30 seconds. If a vacuum leak is present, the SHRTFT PID values will decrease as the hose is restricted.

Is the decrease in the SHRTFT PIDs greater than 15 percent when one of the vacuum hoses is restricted?

Yes	No
GO to H21 .	INSPECT the intake air system for a vacuum leak in the intake manifold or intake gaskets. REPAIR as necessary. For repair verification, GO to H21 .

H21 VACUUM LEAK REPAIR VERIFICATION

Note: If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).

- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Record the SHRTFT1 and SHRTFT2 PID values.
- Key in OFF position.
- Repair the vacuum leak.
- Key ON, engine running.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Compare the recorded SHRTFT PID values, prior to the vacuum leak repair, to the current SHRTFT PID values.

Is the decrease in the SHRTFT PIDs greater than 15 percent?

Yes	No
Fault found. RESET the keep alive memory (KAM). REFER to Resetting The Keep Alive Memory (KAM)	A vacuum leak is still present, GO to H20 .

H22 DTCS P0172, P0175, P1132, P1152, P2196 OR P2198: HO2S PERFORMANCE

Note: Address all continuous memory ignition and misfire DTCs before any KOER HO2S DTCs.

- CHECK the intake air system for leaks, obstructions and damage.
  - CHECK the air filter element and housing for blockage.
  - Verify the integrity of the PCV system.
  - Check for vacuum leaks.

Were there any concerns found during the visual inspection?

Yes	No
REPAIR as necessary.	GO to H23 .

H23 PERFORM THE KOER SELF-TEST

- Disconnect the fuel vapor hose from the intake manifold and the plug fitting at the intake manifold.
- Start the engine and run at 2,000 RPM for 5 minutes and return to idle.
- Key ON, engine running.
- Perform the KOER self-test.
- Check for self-test DTCs.

Are DTCs P0040, P1128, P0041, P1129, P1127 or P0402 present?

Yes	No
Key in OFF position. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to Diagnostic Trouble Code (DTC) Charts.	Key in OFF position. GO to H24 .

H24 DETERMINE THE DTC BEING DIAGNOSED

- HO2S11, HO2S21 STUCK LEAN.
- Check for self-test DTCs.

Are DTCs P1131, P2195, P1151 or P2197 present?

Yes	No
Key in OFF position. GO to H26 .	GO to H25 .

H25 DETERMINE THE DTC BEING DIAGNOSED

- HO2S11, HO2S21 STUCK RICH.
- Check for self-test DTCs.

Are DTCs P1132, P2196, P1152 or P2198 present?

Yes	No
GO to H34 .	Reconnect the fuel vapor line. For DTCs P0171, P0172, P0174, P0175, P1130 or P1150, GO to H36 . For all others, Unable to identify the concern at this time. GO to Z1 .

H26 HO2S CIRCUIT TEST (WITH LEAN DTCS)

- Disconnect the HO2S related to the current DTC.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1.3 V?

Yes	No
Key in OFF position. GO to H27 .	Key in OFF position. GO to H29 .

H27 CHECK THE SIGRTN CIRCUIT FOR AN OPEN IN HARNESS

- Disconnect the HO2S related to the current DTC.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
SIGRTN	Negative terminal

Is the resistance less than 5 ohms?

Yes	No
GO to H36 .	GO to H28 .

H28 CHECK THE SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
SIGRTN	SIGRTN

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new PCM.	REPAIR the open circuit.

Test H26 - H28

H29 CHECK THE HO2S CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Signal

Is the resistance less than 5 ohms?

Yes	No
GO to H30 .	REPAIR the open circuit.

H30 CHECK THE HO2S CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	SIGRTN

Is the resistance greater than 10K ohms?

Yes	No
GO to H31 .	REPAIR the short circuit.

H31 CHECK THE HO2S CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HO2S Signal	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to H32 .	REPAIR the short circuit.

H32 CHECK THE HO2S SENSOR CIRCUIT FOR A SHORT TO GROUND

- HO2S connector connected. Related DTC
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	SIGRTN

Is the resistance greater than 10K ohms?

Yes	No
GO to H33 .	INSTALL a new HO2S.

H33 CHECK THE HO2S SENSOR CIRCUIT FOR A SHORT TO GROUND

- HO2S connector connected. Related DTC
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HO2S Signal	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
INSTALL a new PCM.	INSTALL a new HO2S.

H34 HO2S CIRCUIT TEST (WITH RICH DTCS)

- HO2S connector disconnected. Related DTC
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage less than 0.2 V?

Yes	No
GO to H36 .	Key in OFF position. GO to H35 .

H35 CHECK THE HO2S CIRCUIT FOR A SHORT TO THE VPWR OR HEATER IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Heater
HO2S Signal	VPWR

Are the resistances greater than 10K ohms?

Yes	No
INSTALL a new PCM.	REPAIR the short circuit.

H36 CHECK THE FUEL PRESSURE

WARNING: WHEN CHECKING THE FUEL SYSTEM REMEMBER THAT THE FUEL SYSTEM MAY STILL BE PRESSURIZED WHEN THE ENGINE IS SWITCHED OFF. ALWAYS FOLLOW THE INSTRUCTIONS RELATED TO FUEL SYSTEM PRESSURE RELIEF. ALL FUEL HANDLING SAFETY PRECAUTIONS MUST BE OBSERVED.

- HO2S connector connected.
- Connect the battery charger to the vehicle.
- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.

Is the fuel pressure within range for the vehicle being diagnosed?

Yes	No
Key in OFF position. GO to H37 .	GO to HC1 .

H37 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - FAST LEAKDOWN

- Key ON, engine OFF.
- Cycle the key several times to charge the fuel system.

Does the fuel pressure remain within 34 kPa (5 psi) of the highest reading after 10 seconds?

Yes	No
GO to H39 .	GO to H38 .

H38 VERIFY AN EXTERNAL FUEL LEAK

Is an external fuel leak present?

Yes	No
GO to HC1 .	GO to H41 .

H39 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - SLOW LEAKDOWN

- Key ON, engine OFF.
- Cycle the key several times to charge the fuel system.

Does the fuel pressure remain within 34 kPa (5 psi) of the highest reading after 1 minute?

Yes	No
GO to H40 .	GO to HC12 .

H40 DETERMINE THE DTC BEING DIAGNOSED

Are any misfire DTCs displayed with the HO2S DTCs?

Yes	No
GO to H43 .	GO to H48 .

H41 CHECK THE INJECTOR FAULT PIDS AND ASSOCIATED DTCS

Note: Access the all INJF PIDs using a diagnostic tool.

Are DTCs P0201 through P0210 or an associated injector fault flag PID present?

Yes	No
GO to H43 .	GO to H42 .

H42 DETERMINE THE DTC BEING DIAGNOSED

Are any misfire DTCs present?

Yes	No
GO to HD12 .	GO to H48 .

H43 CHECK THE FUEL INJECTOR(S) AND HARNESS RESISTANCE

Note: Continuous memory DTCs are erased during this test.

Note: Test all Fuel Injectors identified by DTC or PID interpretation.

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR	Suspect INJ

Is the resistance between 11 - 18 ohms?

Yes	No
GO to H44 .	GO to H45 .

H44 PERFORM A THOROUGH WIGGLE TEST ON THE INJECTOR HARNESS

- Fuel Injector connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the INJ PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the Injector to the PCM.

Are any injector values fluctuating in and out of range?

Yes	No
Key in OFF position. REPAIR the open circuit.	Key in OFF position. GO to H45 .

H45 DETERMINE THE DTC BEING DIAGNOSED

Are DTCs P0201 through P0210 or an associated injector fault flag PID present?

Yes	No
GO to H46 .	GO to Z1 .

H46 CHECK THE FUEL INJECTOR HARNESS RESISTANCE

Note: Disconnect the suspect fuel injector harness connector. Only the suspect injector needs to be diagnosed.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) INJ Connector, Harness Side
Suspect INJ	INJ
VPWR	VPWR

Are the resistances less than 5 ohms?

Yes	No
GO to H47 .	REPAIR the open circuit.

H47 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE FUEL INJECTOR HARNESS

- PCM connector disconnected.
- Suspect fuel injector disconnected.
- Measure the resistance between:

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

- Measure the resistance between:

(+) INJ Connector, Harness Side	(-) Vehicle Battery
INJ	Positive terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to H48 .	REPAIR the short circuit.

H48 FLOW TEST

- Flow test the injector using the Fuel Injector Tester/Cleaner.

Is the flow rate for each injector within specification?

Yes	No
For misfire related DTCs: GO to HD8 . For Other DTCs GO to H49 . For DTCs P0201 through P0210, INSTALL a new PCM.	INSTALL a new Fuel Injector.

H49 DETERMINE VEHICLE EQUIPMENT

Is a Secondary Air Pump equipped to this vehicle?

Yes	No
GO to H50 .	GO to H51 .

H50 CHECK FOR SECONDARY AIR LEAKS

Note: An HO2S always lean condition can be caused by:

- Leaks in the hoses from the secondary air injection pump to the engine.
- Secondary air diverted upstream of the HO2S.

- Disconnect the secondary air injection hose(s) from the engine and the plug side of the secondary air injection system.
- Key ON, engine running.
- Perform the KOER self-test.

Are DTCs P1131, P2195, P1151 or P2197 present?

Yes	No
GO to H51 .	GO to HM17 .

H51 INSPECT THE INDUCTION SYSTEM FOR LEAKS

- Carefully inspect the following areas for potential air leaks:
  - Inlet tube(s) from the air cleaner to the throttle body.
  - Gaskets sealing the upper to lower intake manifold.
  - Vacuum hoses and lines for cracks, breaks, and proper connections.

Are any of these conditions present?

Yes	No
REPAIR as necessary.	For Misfire DTCs GO to HD11 . For Other DTCs GO to H52 . For DTCs P0171 or P0174, GO to DC26 .

H52 CYLINDER COMPRESSION CHECK

Note: Use the Misfire DTC(s) displayed or prior retrieval to determine which cylinder's compression to check.

- Perform cylinder compression checks.

Is the suspect cylinder's compression within specification?

Yes	No
For P1131, P1151, P2195, P2197 GO to H53 . For P1132, P1152, P2196, P2198 GO to H54 . For Misfire DTCs GO to HD11 . For all others, GO to DC26 .	REPAIR as necessary.

H53 CHECK HO2S OUTPUT VOLTAGE

Note: Fuel calculations can be affected by unmetered air leaks. DTC P2195 may result.

- Check the following:
  - Water contamination in the connector.
  - Leaking vacuum actuators.
  - Engine sealing (intake manifold and IAC).
  - EGR system.
  - PCV system.
  - Unmetered air leaks between the throttle body and mass air flow (MAF) sensor assembly.
- Visually inspect the HO2S circuit for exposed wiring, contamination, corrosion and correct assembly. Repair as necessary.
- HO2S connector disconnected.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal	SIGRTN

- Run the engine at approximately 2,000 RPM.
- Maintain engine speed for three minutes.
- Monitor the HO2S voltage.

Is the voltage greater than 0.4 V?

Yes	No
Key in OFF position. GO to H56 .	Key in OFF position. INSTALL a new HO2S.

H54 ATTEMPT TO GENERATE DTC P1131 OR P2195 OR P1151 OR P2197

- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B Vehicle Battery
HO2S Signal	Negative terminal

- Perform the KOER self-test.

Did DTC P1131 or P2195 or P1151 or P2197 appear?

Yes	No
Key in OFF position. Remove the jumper wire(s). GO to H55 .	Key in OFF position. INSTALL a new PCM. Remove the jumper wire(s).

H55 HO2S VOLTAGE CHECK

- HO2S connector disconnected.
- Disconnect vacuum line to vacuum tree .
- Run the engine at approximately 2,000 RPM.
- Run the engine for approximately 30 seconds.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal	SIGRTN

Is the voltage less than 0.4 V?

Yes	No
Key in OFF position. Reconnect all hoses. GO to H56 .	Key in OFF position. INSTALL a new HO2S and retest vehicle.

H56 PERFORM A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- HO2S connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Signal PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.

While monitoring the HO2S PID, did the HO2S stop switching?

Yes	No
Key in OFF position. ISOLATE the fault and REPAIR as necessary.	Key in OFF position. GO to H57 .

H57 TEST DRIVE WHILE MONITORING HO2S PID SWITCHING

CAUTION: This test requires an observer to monitor the HO2S PID.

- Access the PCM and monitor the HO2S Signal and OL PIDs.
- Start engine and let idle until vehicle goes into the closed loop fuel condition.
- While an observer monitors the PIDs, test drive the vehicle in a manner consistent with the freeze frame data in an attempt to simulate the original fault.

Does the HO2S PID switch?

Yes	No
Key in OFF position. GO to DC26 .	Key in OFF position. INSTALL a new HO2S.

H58 KOER DTCS P1137, P2270, P1157, P2272, P1138, P2271, P1158, P2273, P2274 OR P2275: HO2S LACK OF SWITCHES STUCK LEAN OR RICH

Note: Address all continuous memory ignition and misfire DTCs before any KOER HO2S DTCs.

- Visually inspect for:
  - Pinched, shorted, and corroded wiring and pins
  - Oil or water contamination
  - Crossed sensor wires
  - Contaminated or damaged sensor

Were any of the above conditions or concerns found during inspection?

Yes	No
REPAIR as necessary.	GO to H59 .

H59 KOER DTCS P1137, P2270, P1157, P2272, P1138, P2271, P1158, P2273, P2274 OR P2275: CHECK FOR KOER DTCS

- Key ON, engine running.
- Run the engine at approximately 2,000 RPM. Maintain engine speed for three minutes.
- Perform the KOER self-test.

Are any of the above listed DTCs present?

Yes	No
Key in OFF position. GO to H60 .	Key in OFF position. Unable to duplicate or identify the fault at this time.

H60 DTCS P0132, P0138 AND P0144: CHECK THE HO2S SIGNAL LEVEL TOO HIGH

Note: Fuel calculations can be affected by unmetered air leaks.

- Carefully inspect the following areas for potential air leaks:
  - Hoses connecting to the MAF sensor assembly.
  - Hoses connecting to the throttle body.
  - Intake manifold gasket leaks.
  - PCV disconnected.
  - The vacuum lines are disconnected.
  - Improperly seated engine oil dipstick, tube or oil fill cap.
  - Exhaust leaks at flanges and gaskets.

Note: Any exhaust leaks between the engine and the output of the catalyst can cause DTCs P0136 or P0156.

- Raise the vehicle on a hoist and make sure the vehicle is level.
- Visually inspect for:
  - Exhaust leaks at flanges and gaskets.
  - HO2S not tightened to specification.
  - Physical exhaust system concerns.
  - Aftermarket exhaust.
  - Punctures or cracks in the catalyst.

Were any of the above conditions or concerns found during inspection?

Yes	No
REPAIR as necessary.	GO to H61 .

H61 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE HO2S HARNESS

- PCM connector disconnected.
- Disconnect the HO2S harness connector.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HO2S Signal	Negative terminal

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	SIGRTN
HO2S Signal	VPWR
HO2S Signal	HO2S Heater

Are the resistances greater than 10K ohms?

Yes	No
GO to H62 .	REPAIR the short circuit.

H62 CHECK THE HO2S CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	HO2S Heater
VPWR	VPWR
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to H63 .	REPAIR the open circuit.

H63 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1.5 volts?

Yes	No
Key in OFF position. For PZEV GO to H66 . For All Others: GO to H65 .	Key in OFF position. GO to H64 .

Test H62 - H63

H64 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1.5 V?

Yes	No
INSTALL a new HO2S.	INSTALL a new PCM.

H65 CHECK FOR OVER VOLTAGE IN THE PCM

- Key ON, engine running.
- HO2S connector disconnected.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
SIGRTN	Negative terminal
HO2S Signal	Negative terminal

Are the voltages less than 1.5 V?

Yes	No
INSTALL a new HO2S.	INSTALL a new PCM.

H66 CHECK THE HO2S CIRCUIT FOR A SHORT TO VREF AND VPWR IN THE HARNESS

- PCM connector disconnected.
- HO2S connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	VPWR

Is the resistance greater than 10K ohms?

Yes	No
GO to H67 .	REPAIR the short circuit.

H67 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1.5 V?

Yes	No
INSTALL a new HO2S and retest vehicle.	INSTALL a new PCM.

H68 KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE

Note: Address all other DTCs before proceeding.

Engine at normal operating temperature.

- Key ON, engine running.
- Access the PCM and monitor the HO2S Heater PID.

Is the PID state ON?

Yes	No
Perform the KOER self-test.	Run the engine until the PID indicates ON. Perform the KOER self-test.

H69 KOER DTCS P0040, P0041, P1128, P1129 AND P2278: CROSSED SENSOR WIRES

- Key in OFF position.

Note: Sensor wiring swapped bank to bank.

- Warning: Use caution near hot components.
- Confirm the wiring is connected to the opposite bank.

Are there any crossed connections or wires?

Yes	No
Swap the connectors on the HO2S sensors. CLEAR the DTCs. REPEAT the self-test.	Key in OFF position. Unable to duplicate or identify the fault at this time. GO to Z1 .

H70 KOER DTCS P0132, P0138, P0152 AND P0158: CHECK THE HO2S CIRCUIT FOR HIGH AND INTERMITTENT FAULTS

- HO2S connector disconnected.
- Visually inspect the HO2S harness.
- Check the connector (both halves) for any water contamination.
- A vehicle hoist may be required to access the HO2S harness.
- Be sure the connectors are fully seated.
- HO2S connector connected.
- Key ON, engine running.

Note: If DTCs are present, test their related circuits individually.

- Access the PCM and monitor the O2S11, O2S12 and O2S13 PIDs.

Is the suspect PID voltage above 1.5 volts?

Yes	No
GO to H72 .	GO to H71 .

H71 PERFORM A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- Perform a thorough wiggle test on the HO2S harness.

Did the voltage change while performing the wiggle test?

Yes	No
REPAIR as necessary.	GO to Z1 .

H72 CHECK THE SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- HO2S connector disconnected. Related DTC
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
SIGRTN	Negative terminal

Is the resistance less than 5 ohms?

Yes	No
GO to H74 .	GO to H73 .

H73 CHECK THE SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
SIGRTN	SIGRTN

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new PCM.	REPAIR the open circuit.

H74 CHECK THE HO2S SIGNAL FOR A SHORT TO VOLTAGE INSIDE THE SENSOR

- HO2S connector disconnected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 0.4 V?

Yes	No
GO to H75 .	INSTALL a new HO2S.

H75 CHECK THE HO2S CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	VPWR
HO2S Signal	VREF

Are the resistances greater than 10K ohms?

Yes	No
INSTALL a new PCM.	REPAIR the short circuit.