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

H: Fuel Control
Introduction

Note

This Pinpoint Test is intended to diagnose the following:

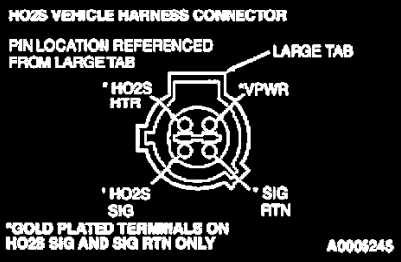
- HO2S/Heater (9F472)
- HO2S/Heater (9G444)
- Fuel Injector(s) (9F593)
- Vacuum Systems

- Harness Circuits: HO2S GND, HO2S, INJ 1-10, VPWR and SIG RTN
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematic

Cougar

All Others



Note: Location of the small index tabs may differ from illustration.

Use the large index tab as your reference during analysis. Some connectors may not have the small index tabs.

Note And Schematics

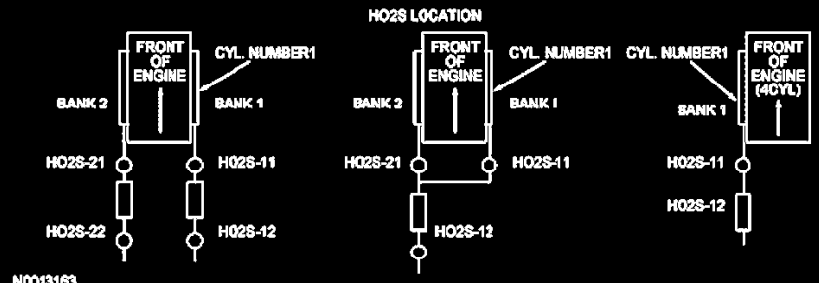
PCM CONNECTOR PIN NUMBERS

	HO2S-11	HTR-11	HO2S-12	HTR-12	HO2S-21	HTR-21	HO2S-22	HTR-22	VPWR	SIG RTN	PWR GND	VREF
150 Pin	C45	C7	B28	B15	C44	C8	B29	B16	A32/A33	A17, B17, C17	A24-27	A20, C20
2.5L Cougar	60	[a] 73	35	100	87	99	61	101	71/97	91	51,77, 103	90
All others	60	93	35	95	87	94	61	96	71/97	91	51,77, 103	90

[a] 2.0L Cougar with Pin 93.

INJECTOR PCM CONNECTOR PIN NUMBERS

Vehicles	Inj-1	Inj-2	Inj-3	Inj-4	Inj-5	Inj-6	Inj-7	Inj-8	Inj-9	Inj-10
150 Pin	C2	C14	C24	C32	C11	C21	C29	C37	—	—
2.5L Cougar	70	96	20	95	93	94	—	—	—	—
All others	75	101	74	100	73	99	72	98	68	42



Test Charts And Schematics

H: Fuel Control

H20 PERFORM KOER SELF-TEST

- Key on, engine running and engine at operating temperature.
- Activate Key On, Engine Running (KOER) Self-Test.

Is DTC P1127, P1128 or P1129 present during KOER Self-Test?

Yes	No
GO to Powertrain Diagnostic Trouble Code (DTC) Charts and SERVICE DTC P1127, P1128 or P1129.	GO to H21 .

H21 DIAGNOSTIC TROUBLE CODE (DTC) P0133 AND P0153: HO2S RESPONSE TEST

DTC/HO2S Reference List:

- DTC P0133 = HO2S-11
- DTC P0153 = HO2S-21

- Key on, engine off.
- Select Generic OBD II Function from the menu and trigger.
- Press Continue.
- Select Diagnostic Monitoring Test Results from the menu and trigger.
- Scroll to Test ID: 01 trigger and press start.
- Key off. (REFER to Diagnostic Monitoring Test Results.)

Is the indicated value greater than the minimum threshold?

Yes	No
COMPLETE PCM Reset to clear DTCs. COMPLETE HO2S Monitor Drive Cycle (REFER to Drive Cycles). GO to H20 . If test results indicate a pass, testing is complete.	GO to H23 .

H23 CHECK FOR UNMETERED AIR LEAKS

Fuel calculations can be affected by unmetered air leaks.

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

Are any air leaks present?

Yes	No
REPAIR source of air leak. COMPLETE PCM Reset to clear DTCs. COMPLETE HO2S Monitor Drive Cycle (REFER to Drive Cycles).	GO to H24 .

H24 CHECK HO2S CIRCUIT WIRING

Note: Refer to the PCM connector pin number in the beginning of this pinpoint test.

- Disconnect suspect HO2S.
- Check for water contamination.
- Jumper HO2S signal to VPWR at the HO2S harness connector.
- Key on, engine off.

Note: HO2S displayed as O2S on Scan Tool.

- Access the correct HO2S PID.

Is the voltage greater than 1.50 volts?

Yes	No
KEY OFF. REPLACE HO2S. CHANGE oil/filter. COMPLETE PCM Reset to clear DTCs. COMPLETE HO2S Monitor Drive Cycle (REFER to Drive Cycles).	KEY OFF. REMOVE jumper wire. GO to H25 .

H25 DTCS P0141 AND P0161: HO2S HEATER CIRCUIT IS OPEN, CHECK HO2S SIGNAL AND SIGNAL RETURN CIRCUITS FOR OPEN IN HARNESS

Note: Refer to the PCM harness connector pin numbers in the beginning of this pinpoint test.

DTC/HO2S Reference List:

- DTC P0141 = HO2S HTR-12
- DTC P0161 = HO2S HTR-22

Note: On some applications, a vehicle hoist is required to access the HO2S harness.

- Visually inspect the HO2S circuit for exposed wiring, water contamination, corrosion and proper assembly.
- Measure resistance of HO2S SIG circuit between PCM harness connector pin and HO2S harness connector.
- Measure resistance of HO2S SIG RTN circuit between PCM harness connector pin and HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
GO to H26 .	REPAIR open circuit. COMPLETE HO2S Monitor Drive Cycle (REFER to Drive Cycles).

H26 CHECK HO2S CIRCUIT FOR SHORT TO VPWR IN HARNESS

- Measure resistance between the HO2S SIG and VPWR circuit at the PCM harness connector pin.

Is the resistance greater than 10,000 ohms?

Yes	No
GO to H27 .	GO to H28 .

H25 - H26

H27 CHECK FOR 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 (i.e. rings, valve seals and oil overfill).
  - Glycol (antifreeze) 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 source of contamination. REPLACE HO2S and oil/filter. COMPLETE PCM Reset to clear DTCs. COMPLETE HO2S Monitor Drive Cycle (REFER to Drive Cycles).	If diagnosing DTC P0141 or P0161, GO to H30 . All others: REPLACE PCM.

H28 VERIFY WIRING IS IN PROPER PIN LOCATION

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure resistance of the HO2S SIG circuit and HO2S Signal Return circuit between the PCM harness connector pin and the HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
REPLACE HO2S.	REPAIR as necessary.

H27 - H28

H30 DTCS P0135 AND P0155: HO2S HEATER CIRCUIT IS SHORTED TO GROUND, SHORTED TO VPWR OR EXCESSIVE CURRENT DRAW, LOW CURRENT DRAW

Note: Refer to the PCM harness connector pin numbers in the beginning of this pinpoint test.

DTC/HO2S Reference List:

- DTC P0135 = HO2S HTR-11
- DTC P0155 = HO2S HTR-21

Note: On some applications, a vehicle hoist is required to access the HO2S harness.

- Visually inspect the HO2S circuit for exposed wiring, water contamination, corrosion and proper assembly.

Were any concerns found during inspection?

Yes	No
REPAIR any concerns found during inspection.	GO to H31 .

H31 PERFORM KEY ON ENGINE OFF (KOEO) SELF-TEST

- Key on, engine off.
- Perform KOEO Self-Test.

Are any of the following DTCs present: P0135, P0141, P0155, P0161?

Yes	No
KEY OFF. GO to H32 .	KEY OFF. GO to H33 .

H30 - H31

H32 CHECK VPWR VOLTAGE TO HO2S HARNESS CONNECTOR

Note: If DTCs P0135 and P0155 or P0141 and P0161 are displayed, both heater circuits will require testing. DTCs displayed separately are to be tested individually.

- Disconnect the appropriate HO2S(s).
- Key on, engine off.
- Measure voltage between VPWR and SIG RTN circuits at the HO2S harness connector.

Is the voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to H33 .	CHECK fuse in circuit. If fuse is OK, REPAIR open circuit. **For no VPWR on vehicles equipped with 150 Pin PCM:** GO to B5 .

H33 CHECK HO2S HEATER CIRCUIT FOR SHORT TO VPWR AND GND

- Disconnect PCM.
- Measure resistance between the suspect HO2S HTR circuit and PWR GND circuit.
- Measure resistance between the suspect HO2S HTR circuit and SIG RTN circuit at the HO2S harness connector.
- Measure resistance between the suspect HO2S HTR circuit and VPWR circuit at the HO2S harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to H34 .	REPAIR shorted circuit.

H32 - H33

H34 CHECK HO2S HTR CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of the suspect HO2S HTR circuit between PCM harness connector pin and HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
GO to H35 .	REPAIR open or excessive resistance in the heater circuit in harness.

H35 CHECK HO2S HTR RESISTANCE

- Measure the resistance of the HO2S HTR to VPWR at HO2S connector (refer to schematic at the beginning of this Pinpoint Test).

Is the resistance between 3 and 30 ohms?

Yes	No
GO to H36 .	REPLACE HO2S.

H36 CHECK HO2S CASE FOR SHORT TO VPWR, HTR AND SIG RTN

- Measure resistance between HO2S HTR pin at HO2S connector and the HO2S case.
- Measure resistance between the HO2S HTR pin and the SIG RTN Pin at the HO2S sensor.
- Measure the resistance between the HO2S VPWR pin at the HO2S connector and the HO2S case.

Is the resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPLACE HO2S.

H40 DTCS P0171, P0174, P1130, P1131, P1150, OR P1151: LEAN SYSTEM DTCS

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

Fuel System and HO2S DTC Reference List:

- Bank 1 = DTC P0171 (lean)
- Bank 2 = DTC P0174 (lean)
- HO2S-11 = DTCs P1130 and P1131
- HO2S-21 = DTCs P1150 and P1151

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

Are any DTCs present other than P0171, P0174, P1130, P1131, P1150, or P1151?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. GO to Diagnostic Trouble Code (DTC) Charts and REPAIR the other DTCs.	GO to H41 .

H41 CARRY OUT A VISUAL INSPECTION OF 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 H44 .	GO to H42 .

H42 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: As an example, when calculating the total fuel correction in the following steps, if LONGFT1 = +13% and SHRTFT1 = +23%, the total fuel correction for bank 1 = +36%, also if LONGFT2 = +24% and SHRTFT2 = -3% the total fuel correction for bank 2 = +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 and monitor the ECT or CHT, IAT, LONGFT1, SHRTFT1, LONGFT2 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- 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 2500 rpm for 10 seconds.
- Record the LONGFT1, SHRTFT1, LONGFT2, and SHRTFT2 PID values.
- Add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at 2500 rpm.

Is the total fuel correction value change, between idle and 2500 rpm, less than 15 percent?

Yes	No
No vacuum leak is present. GO to H47.	GO to H43.

H43 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: As an example, when monitoring for a decrease in the SHRTFT PIDs in the following steps, if SHRTFT1 is +15%, but when the hose is restricted SHRTFT1 decrease to -7%, the decrease in the SHRTFT PIDs = 22 percent.

- Locate the vacuum tees for the intake air and PCV systems.
- Access 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 H44 .	INSPECT the intake air system for a vacuum leak in the intake manifold or intake gaskets. REPAIR as necessary. For repair verification, GO to H44 .

H44 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 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 off.
- Repair the vacuum leak.
- Key on, engine running.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Access 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 H43 .

H45 DTCs P1132 AND P1152: UPSTREAM HO2S NOT SWITCHING.

Note: It is necessary to address all Continuous Memory Ignition and Misfire DTCs, if received during Continuous Memory testing, before addressing any KOER HO2S DTCs.

DTC/HO2S Reference List:

- HO2S-11 = DTC P1132
- HO2S-21 = DTC P1152

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

Were any concerns found during inspection?

Yes	No
REPAIR as necessary.	GO to H47 .

H46 DTCs P0172 AND P0175: FUEL SYSTEM AT THE CORRECTED FUEL TRIM

Note: It is necessary to address all Continuous Memory Ignition and Misfire DTCs, if received during Continuous Memory testing, before addressing any Fuel Trim DTCs.

Fuel System DTC Reference List:

- Bank 1 = DTC P0172 (rich)
- Bank 2 = DTC P0175 (rich)

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

Were any concerns found during inspection?

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM) to clear DTCs. REFER to Resetting The Keep Alive Memory (KAM).	GO to H47 .

H47 PERFORM KOER SELF-TEST

- Disconnect fuel vapor hose from intake manifold and plug fitting at intake manifold.
- Start engine and run at 2000 rpm for 5 minutes and return to idle.
- Complete Key On Engine Running (KOER) Self-Test.

Are any HO2S DTCs P1127, P1128, P1129, P1131, P1132, P1151 or P1152 present?

Yes	No
KEY OFF. If DTC P1127, P1128 or P1129 is present, GO to Powertrain Diagnostic Trouble Code (DTC) Charts and REPAIR those DTCs first. **DTCs (P1131, P1130) or (P1151, P1150):** GO to H48 . **DTCs (P1132, P1130) or (P1152, P1150):** GO to H54 .	KEY OFF. **For Continuous Memory DTCs Only P1130, P1150, P0171, P0174, P0172 and P0175:** GO to H57 . If DTC(s) P1132 and/or P1152 are no longer present, RECONNECT fuel vapor line. **Vehicles experiencing KOER DTC 1131, 1132, 1151 or 1152:** REFER to Evaporative Emissions, for system leakage. **All others without recurring DTCs:** Unable to duplicate or identify fault at this time. GO to Z1 .

H48 HO2S CIRCUIT TEST (WITH LEAN DTCs)

- Disconnect the HO2S related to the DTC.
- Key on, engine off.
- Access the correct HO2S PID.

Note: If arcing occurs (indicating a short), remove jumper and GO to H52 (check fuse in the heater circuit).

- Jumper the HO2S SIG circuit to the VPWR circuit at the HO2S vehicle harness connector.

Is the reading 1.30 volts or greater?

Yes	No
KEY OFF. CHECK SIG RTN circuit. GO to H49 .	KEY OFF. GO to H51 .

H49 CHECK SIGNAL RETURN CIRCUIT FOR OPEN

- Measure resistance of HO2S SIG RTN circuit between the HO2S harness connector and the battery negative post.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to H57 .	GO to H50 .

H50 CHECK HO2S SIGNAL RETURN CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of HO2S SIG RTN circuit between the PCM harness connector pin and HO2S harness connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit.

H51 CHECK HO2S SIGNAL AND HO2S GND CIRCUITS FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of HO2S SIG circuit between PCM harness connector pin and the HO2S harness connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to H52 .	REPAIR open circuit.

H52 CHECK HO2S CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect PCM.
- Measure resistance between the HO2S SIG and PWR GND circuits; and the HO2S SIG and SIG RTN circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to H53 .	REPAIR short circuit.

H53 CHECK HO2S CIRCUIT FOR SHORT TO GROUND

- Disconnect PCM.
- Reconnect HO2S.
- Measure resistance between HO2S SIG and PWR GND circuits and HO2S SIG and SIG RTN circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPLACE HO2S.

H54 HO2S CIRCUIT CHECK (FOR RICH DTCS)

- Disconnect the HO2S related to the DTC received.
- Key on.
- Access the correct HO2S PID(s).

Is the reading 0.2 volt or less?

Yes	No
KEY OFF. GO to H56 .	KEY OFF. GO to H55 .

H55 CHECK HO2S CIRCUIT FOR SHORT TO VPWR AND HO2S HEATER GROUND IN HARNESS

- Disconnect PCM.
- Measure resistance between the HO2S SIG and VPWR circuits; and HO2S Signal and HO2S HTR circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

H56 CHECK HO2S SIGNAL FOR SHORT TO HO2S HEATER CIRCUIT IN THE SENSOR

- Suspect HO2S sensor disconnected.
- Measure resistance between the HO2S SIG and HO2S HTR circuits at the HO2S connector.

Is the resistance greater than 10,000 ohms?

Yes	No
KEY OFF. GO to H57 .	KEY OFF. REPLACE HO2S.

H57 CHECK FUEL PRESSURE

WARNING: THE FUEL SYSTEM IS PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM. BECOME FAMILIAR WITH THE WARNING CAUTION AND NOTE IN PINPOINT TEST HC BEFORE SERVICING.

- Connect battery charger.
- Install fuel pressure gauge.
- Key on, engine off.
- Access Output Test Mode and run the fuel pump to obtain maximum fuel pressure.
- NOTE: The fuel pump will only operate for approximately 8 seconds when Output Test Mode is selected and activated. (GO to Pinpoint Test HC to refer to the Fuel Delivery System Test Information Chart.)

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

Yes	No
KEY OFF. GO to H58 .	KEY OFF. GO to HC1 .

H58 CHECK FUEL SYSTEM FOR PRESSURE STABILITY — FAST LEAKDOWN

- Cycle key on and off several times.
- Key on and engine off, monitor fuel pressure gauge.

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

Yes	No
GO to H59 .	Check fuel system for external leaks. If external leak is detected, GO to HC1 . If no external leak is detected, GO to H60 .

H59 CHECK FUEL SYSTEM FOR PRESSURE STABILITY WITH KEY ON — SLOW LEAKDOWN

- Cycle key on and off several times.
- Key on and engine off, monitor fuel pressure gauge.

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

Yes	No
For HO2S DTCs displayed with misfire DTCs: GO to H61 . **All other DTCs:** GO to H64 .	GO to HC5 .

H60 CHECK INJECTOR FAULT PIDS AND ASSOCIATED DTCS

- Access INJ1F-INJ10F PIDs.

Note: If misfire DTCs are present, access only injector fault PIDs corresponding to misfire DTCs.

Is DTC P0201 through P0210 or an injector(s) fault present?

Yes	No
GO to H61 .	**For DTCs P0300 through P0310:** GO to HD12 . **For all other DTCs:** GO to H64 .

H61 CHECK FUEL INJECTOR(S) AND HARNESS RESISTANCE

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

Note: This erases Continuous Memory DTCs.

Use the injector fault PID to determine the fuel injector circuit(s) requiring testing.

- Disconnected PCM.
- Measure resistance between the suspect fuel injector signal circuit and the VPWR circuit at the PCM harness connector.

Is the resistance between 11.0-18.0 ohms?

Yes	No
For Continuous Memory DTCs P0201 through P0210: Concern may be intermittent. Attempt to duplicate concern. If unable to duplicate concern GO to Z1 . REPLACE PCM. REFER to Flash Electrically Erasable Programmable Read Only Memory (EEPROM).	**For KOEO and KOER DTCs:** GO to H62 .

H62 CHECK FUEL INJECTOR HARNESS RESISTANCE

- Disconnect fuel injector harness connector at the suspect fuel injector.
- Measure resistance of VPWR circuit between PCM harness connector pin and the fuel injector harness connector.
- Measure resistance of fuel injector circuit between PCM harness connector pin and the fuel injector harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to H63 .	REPAIR open harness circuit.

H63 CHECK FUEL INJECTOR HARNESS CIRCUIT FOR SHORT TO POWER AND GROUND

- Disconnect PCM.
- Suspect fuel injector disconnected.
- Measure resistance between fuel injector SIG and VPWR circuits; and between fuel injector SIG and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No

H64 FLOW TEST FUEL INJECTOR(S)

- Use the Rotunda Injector Tester or equivalent to flow test the fuel injectors according to the instructions for the fuel injector tester.

Is the leakage and flow within specification?

Yes	No
DTC P0171 and P0174: GO to H66 . **DTC P0172 and P0175:** GO to DC25 . **For DTC P1130 and P1150:** GO to H66 . **For DTC P1131 and P1151:** GO to H65 . **For DTC P1132 and P1152:** GO to H69 .	REPLACE fuel injector.

H65 CHECK FOR SECONDARY AIR INTRUSION

Note: If the vehicle is not equipped with Secondary Air Injection System, GO to H66 .

An HO2S always lean condition can be caused by:

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

- Disconnect secondary air injection hose(s) from engine and plug engine side of secondary air injection system.
- Key on, engine running and at operating temperature.
- Activate Key On, Engine Running (KOER) Self-Test.

Is DTC P1131 or P1151 present?

Yes	No
GO to H66 .	Cause of DTC(s) is in the Secondary Air Injection System. GO to HM7 for Secondary Air Injection System diagnostics.

H66 INSPECT INDUCTION SYSTEM FOR AIR LEAKS

- Inspect the following areas for signs of air leaks:
  - Inlet tube(s) from air cleaner to the throttle body.
  - Gaskets which seal the upper and lower intake manifold.
  - Vacuum hoses and lines for cracks and proper connections.
  - PCV system.

Are there any signs of leaks or damage?

Yes	No
REPAIR as necessary.	**CONTINUOUS DTCs P0171, P0174, P1130 or P1150:** GO to DC25 . **DTCs P1131 and P1130 or P1151 and P1150:** GO to H67 .

H67 CHECK CYLINDER COMPRESSION

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

- Check cylinder compression.

Are cylinder compression readings within specification?

Yes	No
For DTCs P1131, P1130, P1151 and P1150: GO to H68 . **For DTCs P1132 and P1152:** GO to H69 . **Misfire DTCs displayed with fuel control DTCs:** GO to HD20 .	REPAIR as necessary.

H68 CHECK HO2S'S ABILITY TO GENERATE A VOLTAGE GREATER THAN 0.5 VOLT

Any vacuum or air leaks can cause DTCs P1131, P1130, P1151 and P1150.

Possible causes:

- Water contamination in connector.
- Leaking vacuum actuators.
- Engine sealing (Intake and IAC).
- EGR system (valve).
- PCV system (hose and valve).
- Unmetered air leaks between throttle body and mass air flow (MAF) sensor assembly.

- Inspect HO2S harness for chafing, burned wires or other damage and repair as necessary.
- Unplug the suspect HO2S.
- Connect digital multimeter to the HO2S Signal and HO2S SIG RTN or HO2S GND at the HO2S sensor connector.
- Run engine at 2000 rpm for three minutes.
- Rerun KOER Self-Test and monitor HO2S voltage on digital multimeter.

While monitoring, does the voltage ever increase to greater than 0.5 volts?

Yes	No
KEY OFF. GO to H71 .	KEY OFF. REPLACE HO2S.

H69 ATTEMPT TO GENERATE DTC P1131 OR P1151

- HO2S disconnected.
- Jumper HO2S Signal at the HO2S harness vehicle connector to the battery negative post.
- Activate Key On Engine Running (KOER) Self-Test.

Is DTC P1131 or P1151 present?

Yes	No
KEY OFF. REMOVE jumper. GO to H70 .	KEY OFF. REMOVE jumper. RECONNECT HO2S. DISCONNECT PCM. INSPECT both ends of connector for damaged or pushed out pins, moisture, corrosion, loose pins and REPAIR as necessary. If OK, REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

H70 HO2S SENSOR VOLTAGE CHECK

- HO2S disconnected.
- Connect digital multimeter to HO2S SIG circuit and HO2S SIG RTN at the HO2S sensor connector.
- Disconnect vacuum hose from vacuum tree.
- Start engine and run at 2000 rpm.

Does the voltage reading indicate less than 0.4 volt within 30 seconds?

Yes	No
KEY OFF. RECONNECT vacuum hose and HO2S. GO to H71 .	KEY OFF. REPLACE HO2S. PERFORM KOER SELF-TEST. If DTCs P1132 or P1152 still exist, REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

H71 MONITOR HO2S (PID) FOR SWITCHING WHILE PERFORMING WIGGLE TEST

- Key on, engine running.
- Engine at operating temperature.

Note: HO2S displayed as O2S on Scan Tool.

- Access suspect HO2S PID.
- Wiggle, bend and shake small sections of the Electronic Engine Control harness from the PCM to the HO2S.

Note: Do not compare HO2S switch rate from Bank to Bank as an indication of the sensor's function. It is normal to have a variance in switch ratio from Bank to Bank.

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

Yes	No
KEY OFF. ISOLATE area of harness concern causing lack of HO2S switches and repair.	KEY OFF. GO to H72 .

H72 TEST DRIVE WHILE MONITORING HO2S PID FOR SWITCHING

Note: This teet step requires an observer to monitor HO2S PID.

- Access HO2S PID.
- Access LOOP PID, ensure that vehicle is in Closed Loop before proceeding.
- While observer views PIDs, test drive vehicle in a manner consistent with the Freeze Frame Data in an attempt to simulate the original fault.

Does the HO2S switch?

Yes	No
GO to DC25 .	KEY OFF. REPLACE HO2S.

H80 DTC P0136 AND P0156 MONITOR DOWNSTREAM HO2S OUTPUT VOLTAGE FOR ACTIVITY. DTCs P1137, P1138, P1157 AND/OR P1158 INDICATE LACK OF HO2S SWITCHING

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

Note: It is necessary to address all Continuous Memory Ignition and Misfire DTCs, if received during Continuous Memory testing, before addressing any KOER HO2S DTCs.

- DTC P0136, P1137 and P1138=HO2S-12
- DTC P0156, P1157 and P1158=HO2S-22
- Visually inspect for:
  - pinched, shorted and corroded wiring and pins
  - water / oil / fluid contamination in HO2S and PCM connectors
  - crossed sensor wires
  - contaminated or damaged sensor

Were any concerns found during inspection?

Yes	No
REPAIR as necessary.	**Continuous Memory DTC P0136 and P0156:** GO to H81 . **All others:** GO to H82 .

H81 CHECK FOR KOER DTCS P1137, P1157, P1138 AND P1158

- Key on.
- Engine at 2000 rpm for 3 minutes.
- Activate KOER Self-Test.
- Check for DTCs.

Is DTC P1137, P1138, P1157 or P1158 present?

Yes	No
KEY OFF. GO to H82 .	KEY OFF. **For DTC P0136 and P0156:** Unable to duplicate or identify at this time. GO to Z1 .

H82 CHECK EXHAUST SYSTEM FOR LEAKS

Note: Any exhaust leaks between the engine and the end of the catalyst can cause DTC P0136 and P0156.

- Place vehicle on a hoist, transmission in PARK, emergency brake applied, raise vehicle.
- Inspect the following:
  - Exhaust flanges for leaks.
  - HO2S torque.
  - incorrect exhaust installation
  - aftermarket exhaust
  - Check for punctures and cracks in catalyst and pipes leading to them.

Is an exhaust leak present?

Yes	No
REPAIR as necessary.	GO to H83 .

H83 CHECK HO2S HARNESS CIRCUIT FOR SHORT TO VPWR AND GROUND

- Disconnect PCM.
- Disconnect suspect HO2S.
- Measure resistance between HO2S SIG and SIG RTN circuits at the PCM harness connector.
- Measure resistance between HO2S SIG circuit and VPWR and VREF circuits at the PCM harness connector.
- Measure resistance between HO2S SIG circuit and PWR GND circuit at the PCM harness connector.

Is the resistance greater than 10,000 ohms?

Yes	No
GO to H84 .	REPAIR short in harness.

H84 CHECK HO2S SIGNAL CIRCUIT AND HO2S SIGNAL RETURN CIRCUITS FOR OPEN IN HARNESS

- Measure resistance of VPWR circuit between the PCM harness connector pin and the HO2S harness connector.
- Measure resistance of HO2S SIG circuit between the PCM harness connector pin and the HO2S harness connector.
- Measure resistance of SIG RTN circuit between the PCM harness connector pin and HO2S SIG RTN vehicle harness connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to H85 .	REPAIR open circuit.

H85 CHECK HO2S CIRCUIT VOLTAGE

- Connect PCM.
- Suspect HO2S connected to harness.
- Key on, engine off.

Note: HO2S displayed as O2S on Scan Tool.

- Access the correct HO2S PID.

Is the voltage greater than 1.5 volts?

Yes	No
KEY OFF. GO to H88 .	KEY OFF. GO to H86 .

H86 CHECK HO2S GROUND CIRCUIT IN THE PCM

- Disconnect PCM.
- Measure resistance between SIG RTN and PWR GND circuits at the PCM connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to H87 .	REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

H87 HO2S CIRCUIT CHECK

- PCM connected.
- Suspect HO2S disconnected.
- Jumper VPWR to HO2S SIG circuit at the HO2S harness connector.
- Key on.
- Access HO2S PID.

Is the PID value greater than 1.5 volts?

Yes	No
REPLACE HO2S.	REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

H88 CHECK FOR OVER VOLTAGE ON THE HO2S CIRCUIT IN THE PCM

- Key on.
- HO2S disconnected.
- Measure voltage between SIG RTN circuit at the HO2S harness connector and battery negative post.
- Measure voltage between HO2S SIG circuit at the HO2S harness connector and battery negative post.

Are either voltage readings greater than 1.5 volts?

Yes	No
REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPLACE HO2S.

H100 KOER DTC P1127

- Address all other DTCs before proceeding with this pinpoint test.
- Key on, engine running.
- Access all HO2S heaters and HO2S heater monitor PIDs.

Do all PIDs switch or indicate ON?

Yes	No
Engine still operating. PERFORM KOER Self-Test.	Operate the engine until all PIDs indicate on. PERFORM KOER Self-Test.

H110 DTCS P1128 AND P1129 KOER

Note: Refer to the PCM harness connector pin numbers in the beginning of this pinpoint test.

- P1128 refer to the upstream HO2S.
- P1129 refer to the downstream HO2S.
- Visually inspect vehicle HO2S harness connector(s) for any indication of being crossed (stretched wires, wire harnesses not mounted properly).

Are there crossed connections or wires?

Yes	No
REPAIR as necessary.	GO to H111 .

H111 VERIFY PROPER HO2S SIGNAL PIN LOCATION

- PCM disconnected.
- Disconnect both of the suspect HO2S sensors from the vehicle harness connector.
  - P1128 = HO2S 11/21 Upstream
  - P1129 = HO2S 12/22 Downstream
- Measure resistance of HO2S signal circuits between PCM harness connector pins and HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
Unable to duplicate or identify at this time. GO to Z1 .	CONNECT HO2S connector to proper HO2S signal pins in the PCM harness connector or HO2S harness connectors. RERUN Quick Test.

H115 CHECK HO2S CIRCUIT VOLTAGE

- Visually inspect the HO2S circuit for exposed wiring, water contamination, corrosion and proper assembly.
- On some applications, a hoist is required to access the HO2S harness.
- Key on, engine running

Note: HO2S is displayed as O2S on Scan Tool.

- Access suspect HO2S PID(s).
  - P0132 = HO2S-11
  - P0138 = HO2S-12
  - P0152 = HO2S-21
  - P0158 = HO2S-22

Is PID voltage 1.5 volts or greater?

Yes	No
GO to H116 .	Concern may be intermittent. Attempt to duplicate concern, perform wiggle test on suspect circuit harness and component. **If concern was reproduced:** Perform this Pinpoint test again. All others:GO to Z1

H116 CHECK HO2S SIGNAL FOR SHORT TO POWER INSIDE OF SENSOR

- Key off.
- Suspect HO2S disconnected.
- Key on, engine off.
- Access suspect HO2S PID(s).

Is PID voltage .5 volts or greater?

Yes	No
GO to H117	Replace HO2S sensor.

H117 CHECK HO2S SIGNAL FOR SHORT TO POWER IN HARNESS

- Key off.
- Suspect HO2S disconnected.
- PCM disconnected.
- Check resistance between HO2S Signal circuit and both VPWR and VREF circuits at the PCM connector.

Are resistance values greater than 10,000 Ohms?

Yes	No
REPLACE PCM (refer to Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	Repair short to power in harness between PCM and HO2S.