DIAGNOSTIC ITEM

DTC	Diagnostic item
P0106	MAP Sensor-Rationality
P0107	MAP Sensor-Range Check Low
P0108	MAP Sensor-Range Check High

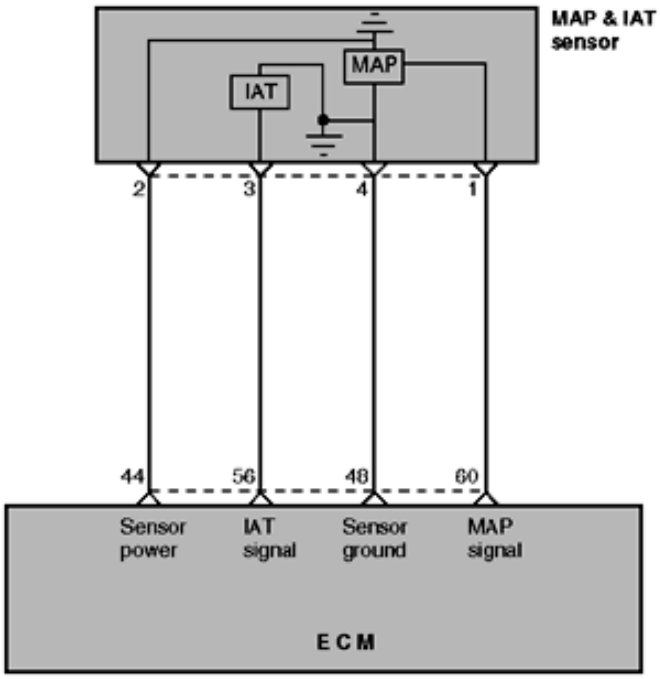
DESCRIPTION

The Manifold Absolute Pressure(MAP) sensor is essentially a strain gauge used to measure the pressure in the surge tank. Inside the sensor is a metal diaphragm with a small wire attached. The diaphragm flexes according to changes in pressure. When the diaphragm flexes, the wire attached to it stretches, changing the resistance of the wire. The Engine Control Module (ECM) applies five volts to the MAP sensor and measures the voltage drop across the sensor. Sensor output is in volts and as pressure decreases, the voltage drop across the sensor increases. Since the MAP sensor is used as an air flow sensor, the sensor signal is an important input. The ECM uses the information to determinefuel amount and ignition timing.

FAILURE CONDITIONS

The MAP sensor outputs a voltage which corresponds to the pressure in the surge tank. The ECM checks whether this voltage is within a specified range. The ECM will set P0107 or P0108 and the Malfunction Indicator Lamp (MIL) will turn on if the MAP sensor output voltage has continued to be 4.5V or higher - corresponding to a surge tank pressure of 114kPa (17psi) or higher - for 4 sec. or to be 1.95V or lower - corresponding to a surge tank pressureof 50kPa (7.4psi) or lower - for 4 sec.

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0106, P0107 and/or P0108 is set.

Is DTC P0112 or P0113 also set?

NO

- MAP sensor disconnected.
- Measure resistance between MAP & IAT sensor connector terminals 1 and 4.

Resistance should read approximately 30 kilo ohms, does it?

YES

- Turn ignition off.
- Disconnect MAP & IAT sensor.
- Turn ignition on.
- Measure voltage between ground and MAP & IAT sensor harness connector terminal 2.

5 volts should be present, is it?

YES

- MAP & IAT sensor disconnected.
- Turn ignition off.
- Disconnect ECM connector.
- Measure resistance between ground and MAP & IAT harness connector terminal 3.

Resistance should indicate open circuit, does it?

YES

- Turn ignition on, engine off.
- Measure voltage between ground and MAP & IAT sensor terminal 1 (backprobe).

Voltage measured should be 0.2 to 4.5 volts, is it?

YES

Verify ECM connector is secure. If OK, replace MAP & IAT with known good component. If problem persists, replace ECM. Clear code and verify MAP sensor signal voltage is within normal parameters.

NO

Replace MAP & IAT sensor. Clear code and verify output signal voltage is within normal parameters.

NO

Repair short to ground in the wire between MAP & IAT sensor harness connector terminal 3 and ECM. Clear code and verify MAP sensor signal voltage is within normal parameters.

NO

Repair open circuit in wire between MAP & IAT sensor harness connector terminal 2 and ECM. Clear code and verify MAP sensor signal voltage is within normal parameters.

NO

Replace MAP & IAT sensor. Clear code and verify MAP sensor signal voltage is within normal parameters.

YES

A

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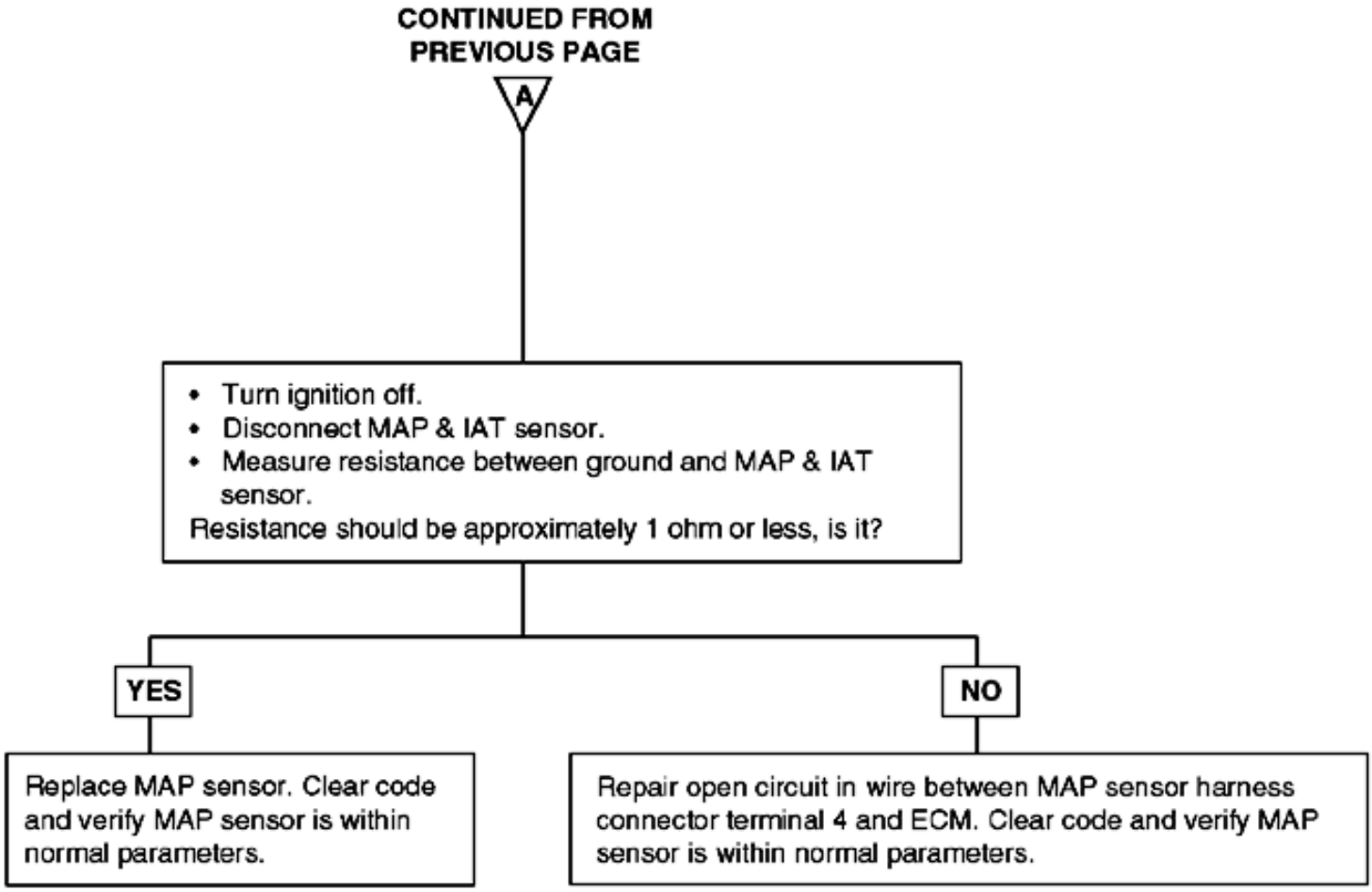
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A
• Turn ignition off.
• Disconnect MAP & IAT sensor.
• Measure resistance between ground and MAP & IAT sensor.
Resistance should be approximately 1 ohm or less, is it?
YES
NO
Replace MAP sensor. Clear code and verify MAP sensor is within normal parameters.
Repair open circuit in wire between MAP sensor harness connector terminal 4 and ECM. Clear code and verify MAP sensor is within normal parameters.

DTC	Diagnostic item
P0112 P0113	Intake Air Temperature Circuit Low Input Intake Air Temperature Circuit High Input

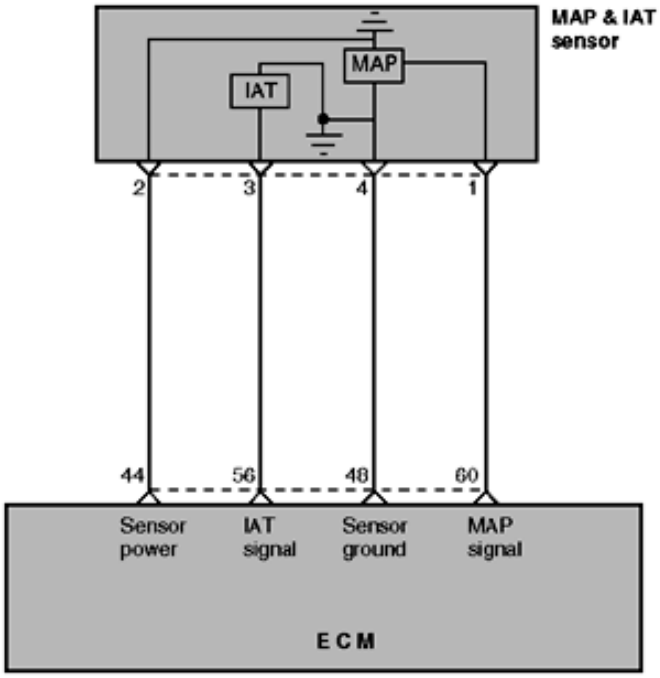
DESCRIPTION

The Intake Air Temperature (IAT) sensor is built in to the MAP sensor. The IAT sensor is a variable resistor whose resistance changes as the temperature of the air flowing through the air intake changes. The Engine Control Module (ECM) uses the IAT sensor input to adjust fuel injector pulse width. When the temperature sensed is cold, the ECM enriches fuel mixture by increasing injector pulse width; as the air warms, the injector pulse width time is shortened.

FAILURE CONDITIONS

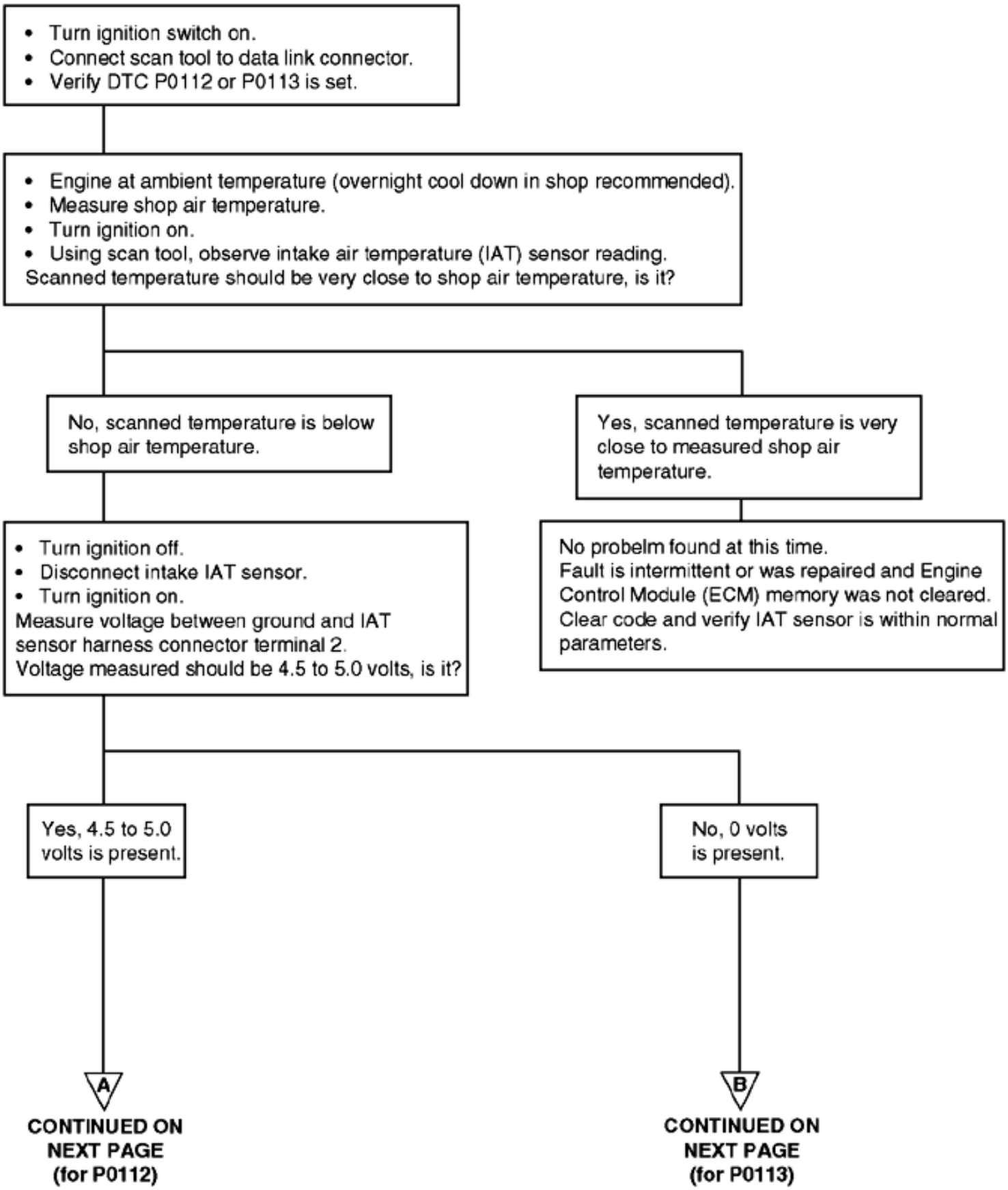
The ECM will set P0112 and the Malfunction Indicator Lamp (MIL) will turn on if the IAT sensor indicates a temperature lower than -49°F (-45°C) for 0.2 seconds during two driving cycles. This check is made after the engine has run for 4 minutes and 10 seconds and then idles for 30 seconds (with no fuel cut-off during a coast-down). This code indicates a lower than expected temperature is being read by the IAT sensor or ECM after the engine has beenwarmed up.

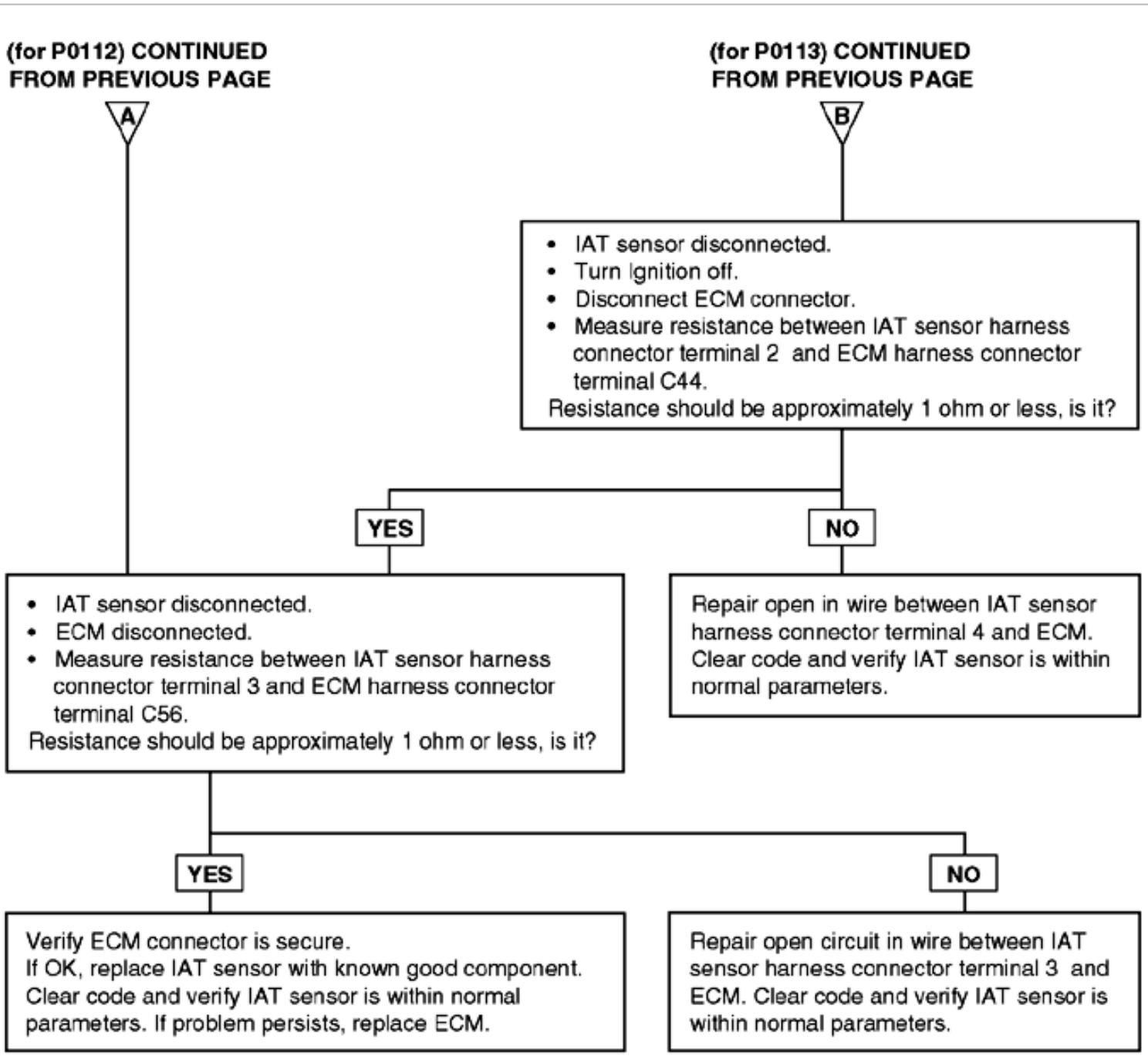
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE


• Turn ignition switch on.
• Connect scan tool to data link connector.
• Verify DTC P0112 or P0113 is set.
• Engine at ambient temperature (overnight cool down in shop recommended).
• Measure shop air temperature.
• Turn ignition on.
• Using scan tool, observe intake air temperature (IAT) sensor reading.
Scanned temperature should be very close to shop air temperature, is it?
No, scanned temperature is below shop air temperature.
Yes, scanned temperature is very close to measured shop air temperature.
• Turn ignition off.
• Disconnect intake IAT sensor.
• Turn ignition on.
Measure voltage between ground and IAT sensor harness connector terminal 2.
Voltage measured should be 4.5 to 5.0 volts, is it?
No probelm found at this time.
Fault is intermittent or was repaired and Engine Control Module (ECM) memory was not cleared.
Clear code and verify IAT sensor is within normal parameters.
Yes, 4.5 to 5.0 volts is present.
No, 0 volts is present.
A
CONTINUED ON NEXT PAGE (for P0112)
B
CONTINUED ON NEXT PAGE (for P0113)


(for P0112) CONTINUED FROM PREVIOUS PAGE
A
(for P0113) CONTINUED FROM PREVIOUS PAGE
B
• IAT sensor disconnected.
• Turn Ignition off.
• Disconnect ECM connector.
• Measure resistance between IAT sensor harness connector terminal 2 and ECM harness connector terminal C44.
Resistance should be approximately 1 ohm or less, is it?
YES
NO
• IAT sensor disconnected.
• ECM disconnected.
• Measure resistance between IAT sensor harness connector terminal 3 and ECM harness connector terminal C56.
Resistance should be approximately 1 ohm or less, is it?
Repair open in wire between IAT sensor harness connector terminal 4 and ECM. Clear code and verify IAT sensor is within normal parameters.
YES
NO
Verify ECM connector is secure.
If OK, replace IAT sensor with known good component. Clear code and verify IAT sensor is within normal parameters. If problem persists, replace ECM.
Repair open circuit in wire between IAT sensor harness connector terminal 3 and ECM. Clear code and verify IAT sensor is within normal parameters.

DTC	Diagnostic item
P0116	Engine Coolant Temperature Circuit Range / Performance
P0117	Engine Coolant Temperature Circuit Low Input
P0118	Engine Coolant Temperature Circuit High Input

DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is located in the coolant passage of the cylinder head. The ECT sensor is a variable resistor whose resistance changes as the temperature of the engine coolant flowing past the sensor changes. When coolant temperature is low, sensor resistance is high;when coolant temperature is high, sensor resistance is low. The Engine Control Module (ECM) checks ECT sensor voltage and uses the information to adjust fuel injector pulse width and ignition timing. When the temperature sensed is very cold, the ECM enriches the fuel mixture and advances ignition timing. As coolant temperature rises, the ECM reduces theamount of enrichment and timing advance.

FAILURE CONDITIONS

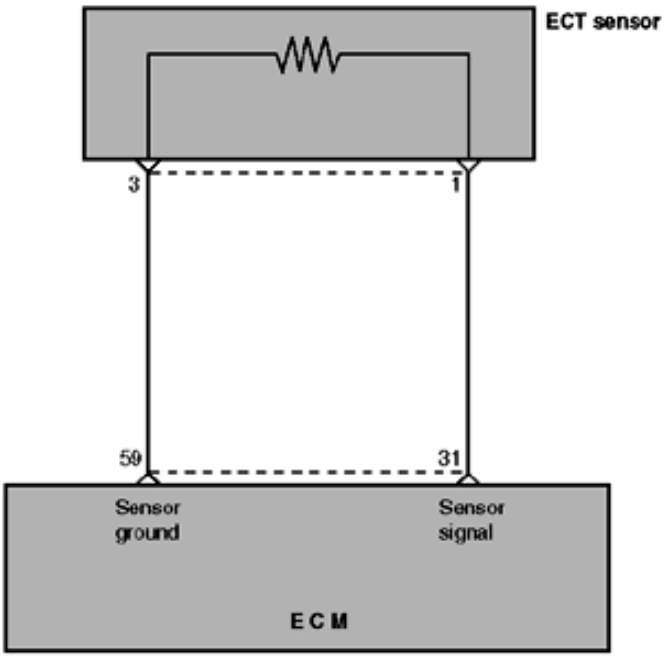
The ECM will set P0116 and the Malfunction Indicator Lamp (MIL) will turn on if the ECT sensor's actual performance curve falls more than 68°F (20°C) below the ECM's model curve (based on fuel delivery, ambient air temperature and engine running time) for 0.2 seconds during two driving cycles. This code indicates uncharacteristic engine temperature performance beingread by the ECT sensor or ECM.

NOTE

The ECT sensor resistance varies with temperature as follows:

- 5.18 ~ 6.60 kΩ@ 32°F (0°C).
- 2.27 ~ 2.73 kΩ @ 68°F (20°C).
- 0.30 ~ 0.32 kΩ @ 176°F (80°C).

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE

- Turn Ignition Switch on.
- Connect scan tool to Data Link Connector.
- Verify DTC P0116 is set.

Is DTC P0117 or P0118 also set?

NO

Verify ECM connector is secure. If OK, replace ECT sensor with known good component. Clear code and verify ECT sensor is within normal parameters. If problem persists, replace ECM.

YES

Refer to sections P0117 and/or P0118 and follow test procedures.

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0117 is set.

- Engine idling at normal operating temperature.
- Using scan tool, observe Engine Coolant Temperature (ECT) sensor reading.

Scanned temperature should be between 180˚F and 203˚F (82˚C and 95˚C), is it?

No, scanned temperature is below 170˚F (77˚C).

- Turn ignition off.
- Disconnect ECT sensor.
- Turn ignition on.
- Measure voltage across ECT sensor harness connector terminals 1 and 3.

Voltage measured should be 4.5 to 5.0 volts, is it?

Yes, scanned temperature is within normal parameters.

No probelm found at this time.
Fault is intermittent or was repaired and Engine Control Module (ECM) memory was not cleared.
Clear code and verify ECT sensor is within normal parameters.

Yes, 4.5 to 5.0 volts is present.

Replace ECT sensor. Clear code and verify ECT sensor is within normal parameters.

No, less than 4.5 volts is present.

A

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A

- Turn ignition off.
- ECT sensor disconnected.
- Disconnect ECM connector.
- Ground ECT sensor harness connector terminal 3.
- Measure resistance between ground and ECM harness connector terminal 59.

Resistance should be approximately 1 ohm or less, is it?

YES

- ECT sensor disconnected.
- ECM disconnected.
- Ground ECT sensor harness connector terminal 3.
- Measure resistance between ground and ECM harness connector terminal 59.

Resistance should be approximately 1 ohm or less, is it?

NO

Repair open in wire between ECT sensor harness connector terminal and ECM harness connector terminal. Clear code and verify ECT sensor is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace ECT with known good component. Clear code and verify ECT sensor is within normal parameters. If problem persists, replace ECM.

NO

Repair open in wire between ECT sensor harness connector terminal and ECM harness connector terminal. Clear code and verify ECT sensor is within normal parameters.

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0118 is set.

- Engine idling at normal operating temperature.
- Using scan tool, observe Engine Coolant Termperature (ECT) sensor reading.

Scanned temperature should be between 180˚F and 203˚F (82˚C and 95˚C), is it?

No, scanned temperature is above 203˚F (95˚C).

Yes, scanned temperature is within normal parameters.

- Turn ignition off.
- Disconnect ECT sensor.
- Turn ignition on.
- Observe ECT sensor reading on scan tool.

Scanned temperature should now be -40˚F (-40˚C), is it?

No problem found at this time. Fault is intermittent or was repaired and Engine Control Module (ECM) memory was not cleared.
Clear code and verify ECT sensor is within normal parameters.

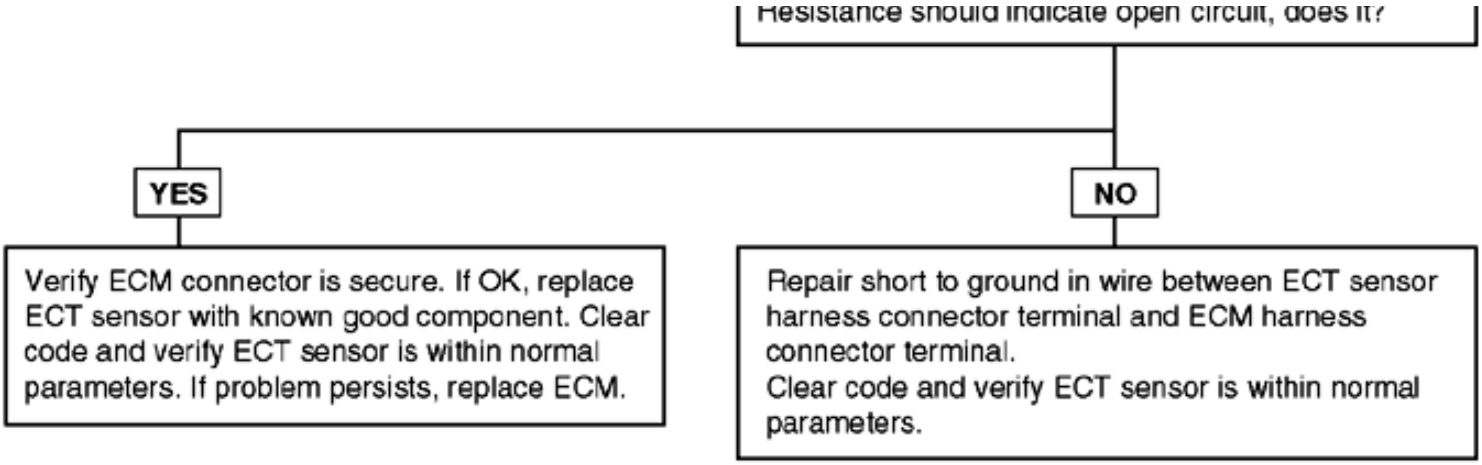
YES

Replace ECT sensor.

NO

- ECT sensor disconnected.
- Turn ignition off.
- Disconnect ECM connector.
- Measure resistance between ground and ECT sensor harness connector terminal 3.

Resistance should indicate open circuit, does it?



DTC	Diagnostic item
P0121 P0122 P0123	Throttle / Pedal Position Circuit Range/Performance Problem Throttle / Pedal Position Circuit Low Input Throttle / Pedal Position Circuit High Input

DESCRIPTION

The Throttle Position Sensor (TPS) mounts on the side of the throttle body and is connected to the throttle valve shaft. The TPS is a variable resistor (potentiometer) whose resistance changes according to throttle valve shaft position. During acceleration, the TPS resistance decreases; duringdeceleration, the TPS resistance increases.

The Engine Control Module (ECM) applies a reference voltage to the TPS and then measures the voltage that is present on the TPS signal circuit. The ECM uses the TPS signal to adjust timing and injector pulse width. The TPS signal along with the MAP sensor signal is used by the ECM to calculate engineload.

FAILURE CONDITIONS

The ECM will set P0121 and the Malfunction Indicator Lamp (MIL) will turn on if the engine load indicated by the Throttle Position (TP) sensor and the Manifold Absolute Pressure (MAP) sensor are different. This code indicates that the throttle position and air flow readings by the TP and MAP sensor,or ECM, do not result in the expected engine load value.

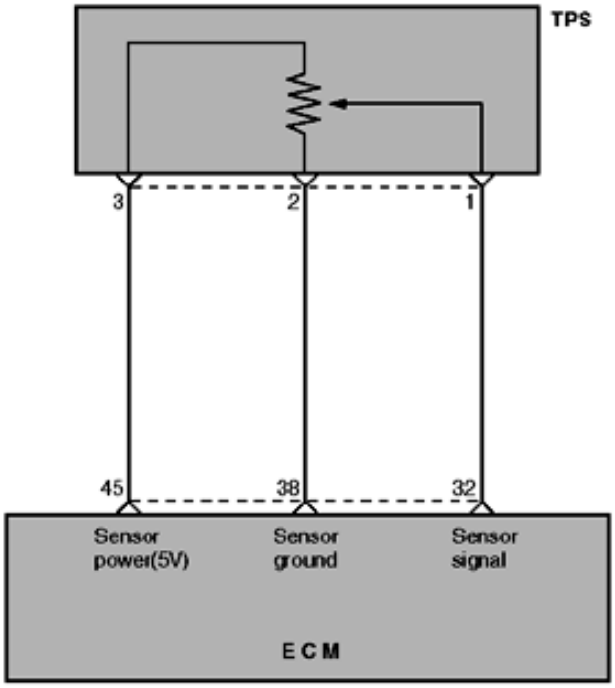
The ECM will set P0122 and the Malfunction Indicator Lamp (MIL) will turn on if the throttle angle is reported as less than 2.1 degrees for more than 0.2 seconds during 2-driving cycles. This code indicates an unusuallylow throttle position angle being read by the TP sensor or ECM.

The ECM will set P0123 and the Malfunction Indicator Lamp (MIL) will turn on if the throttle angle is reported as greater than 105.4 degrees for 0.2 seconds during 2-driving cycles. This code indicates an unusually highthrottle position angle being read by the TP sensor or ECM.

NOTE

The standard resistance value between terminals 2 and 3 of the throttle position sensor is 1600-2500 ohms.

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE

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A

NO

- Turn Ignition off.
- Disconnect TP sensor.
- Turn ignition on.
- Using voltmeter, measure voltage between ground and TP sensor connector terminal 3.

5 volts should be present, is it?

YES

- Ignition on, engine on.
- Quickly push throttle to wide open position, then release.
- Using scan tool, record TP sensor reading.

Reading should reach as high as about 4.75V, does it?

YES

Fault repaired. Problem was misadjusted TP sensor. Clear code and verify TP sensor is within normal parameters.

NO

Replace TP sensor. Clear code and verify TP sensor is within normal parameters.

YES

- Ignition on, engine off.
- TP sensor disconnected.

NO

Repair open wire between TP sensor harness connector terminal and ECM harness connecter

- Ignition on, engine off.
- TP sensor disconnected.
- Measure resistance between ground and TP sensor harness connector terminal 2.

Resistance should be approximately 1 ohm or less, is it?

YES

- Ignition on, engine off.
- TP sensor disconnected.
- Connect fused jumper between TP harness connector terminals 2 and 3.
- Using scan tool, observe TP sensor's output reading.

Reading should be above 4.5V, is it?

B

CONTINUED ON NEXT PAGE

NO

Repair poor ground connection or open circuit in wire between TP sensor harness connector terminal 2 and ECM harness connector terminal 38.
Clear code and verify TP sensor is within normal parameters.

Repair open wire between TP sensor harness connector terminal and ECM harness connecter terminal. Clear code and verify TP sensor is within normal parameters.

CONTINUED FROM PREVIOUS PAGE

B

NO

- Ignition on, engine off.
- TP sensor disconnected.
- Fused jumper in place.
- With ECM connected, measure voltage (backprobe) between ground and ECM connector terminal 45.

5 volts should be present, is it?

YES

Verify ECM connector is secure. If OK, replace ECM. Clear code and verify TP sensor is within

YES

Replace TP sensor.
Clear code and verify TP sensor is within normal parameters.

NO

Repair open circuit or short to ground wire between TP sensor harness connector

Verify ECM connector is secure. If OK, replace ECM. Clear code and verify TP sensor is within normal parameters.

Repair open circuit or short to ground wire between TP sensor harness connector terminal 1 and ECM harness connector terminal 32.
Clear code and verify TP sensor is within normal parameters.

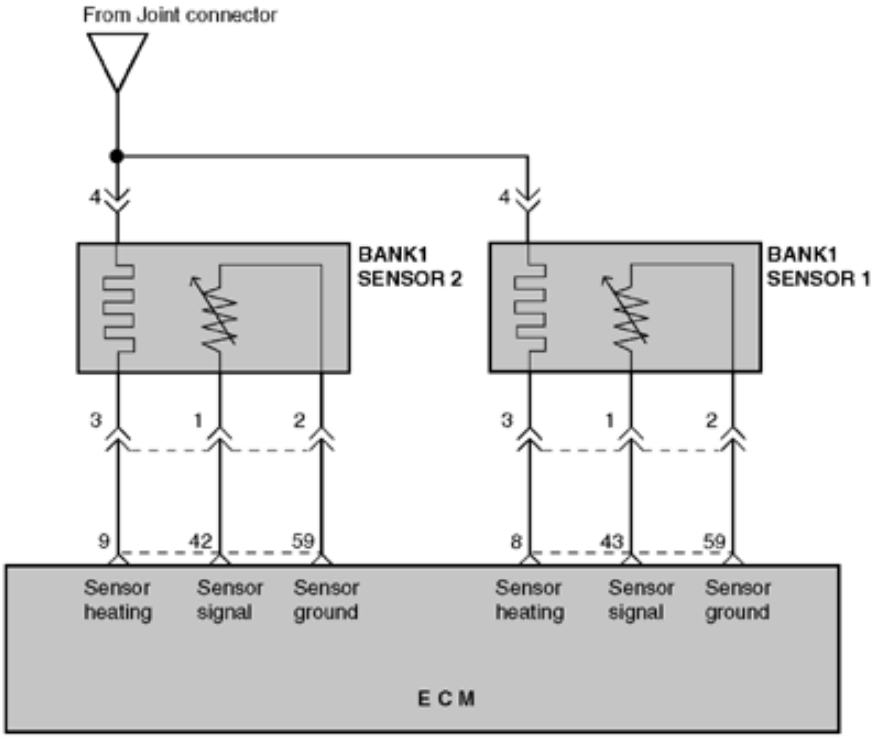
DTC	Diagnostic item
P0130 P0136	O2 Sensor Circuit(Bank 1/ Sensor 1) O2 Sensor Circuit Malfunction(Bank 1 / Sensor 2)

DESCRIPTION

The Engine Control Module (ECM) uses oxygen sensor signals to maintain the air fuel mixture at the ratio resulting in optimum fuel economy and reduced emissions. The amount of oxygen in the exhaust gases indicates, to the front oxygen sensor, whether the air fuel mixture being supplied to the engine cylinders is rich or lean. The readings of the rear oxygen sensor are used to indicate the efficiency of the catalytic converter. The ECM calculates catalytic converter efficiency by comparing the rear oxygen sensor signal to the front oxygensensor signal.
A normal oxygen sensor signal will constantly fluctuate above and below 500 mV, with the front oxygen sensor signal frequency of at least 5Hz at 2500 RPM. Due to the effect of the catalytic converter, the rear oxygen sensor signal frequency will be lower than the front oxygen sensor signal frequency. If the rear oxygen sensor signal coincides with the front oxygen sensor signal a large percentage of the time, this indicates a loss in efficiency of thecatalytic converter or a malfunction within the fuel system.

FAILURE CONDITIONS

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE

- Turn Ignition Switch on.
- Connect scan tool to Data Link Connector.
- Verify DTC P0130 or P0136 is set.

Are other DTCs also set?

NO

- Start engine and warm it to normal operating temperature .
- Vary engine speed and, using scan tool, monitor oxygen sensor voltage.

Voltage should vary between 0 and 900 mV, does it?

No, voltage is constant and the reading is approximately 450 mV.

No, voltage is constant and approximately 5 or 12 volts.

Repair short to voltage in wiring harness. Clear code and verify oxygen sensor is within normal parameters

No, 0 volts present.

No, voltage varies but stays below 500 mV (lean).

B

No, voltage varies but stays above 500 mV (rich).

C

CONTINUED ON NEXT PAGE

Yes, voltage varies between 0 and 900 mV.

D

YES

Repair conditions that caused other DTCs to set. Refer to DTC test procedures.

- While running the engine.
- Disconnect oxygen

- While running the engine, measure voltage (backprobe) between oxygen sensor connector terminals 1 and 2.

Does voltage vary above and below 500 mV?

A

CONTINUED ON NEXT PAGE

- Disconnect oxygen sensor connector.

Does voltage now read approximately 450 mV on scan tool?

NO

For P0130 : Repair short to ground in wire between oxygen sensor harness connector terminal and ECM connector terminal.
For P0136 : Repair short to ground in wire between oxygen sensor harness connector terminal and ECM connector terminal.
Clear code and verify oxygen sensor is within normal parameters.

YES

Replace oxygen sensor. Clear code and verify oxygen sensor is within normal parameters.

CONTINUED FROM PREVIOUS PAGE

A

YES

- Ignition off.
- Disconnect front oxygen senosr [for P0130] or rear oxygen sensor [for P0136].
- Disconnect ECM connector.
- Ground oxygen sensor harness terminal 2.
- Measure resistance between ground and ECM connector terminal 59.

Resistance measured should be approximately 1 ohm or less, is it?

YES

Verify ECM connector is secure. If OK, replace oxygen sensor with a known good component. Clear code and verify oxygen sensor is within normal parameters. If problem persists, replace ECM.

NO

Repair open wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.

NO

Replace oxygen sensor. Clear code and verify oxygen sensor is within normal parameters.

CONTINUED FROM PREVIOUS PAGE

B

Voltage varies but stays below 500 mV (lean).

CONTINUED FROM PREVIOUS PAGE

C

Voltage varies but stays above 500 mV (rich).

- Inspect air inlet downstream of MAP sensor for leaks or damage.
- Inspect exhaust manifold for cracks.

Are any leaks or damage found?

YES

Repair leaks or replace exhaust manifold.
Clear code and verify oxygen sensor is within normal parameters.

NO

- Perform fuel pressure test as outlined in shop manual (section FL).

Is fuel pressure within specification and no pressure leak down observed?

E

CONTINUED ON NEXT PAGE

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D

Voltage varies between 0 and 900 mV.

CONTINUED FROM PREVIOUS PAGE

E

YES

- Ignition off.
- Disconnect ignition coil connector.
- Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine

Voltage drop measured should be less than 0.5 volts, is it?

NO

Follow diagnostic procedures outlined in shop manual.
Clear code and verify oxygen sensor is within normal parametes.

YES

- Disconnect negative battery terminal.
- Measure resistance between generator case and engine ground point.

Resistance measured should be approximately 1 ohm or less, is it?

NO

Replace negative battery cable.
Clear code and verify oxygen sensor is within normal parameters.

YES

- If malfunction Indicator Lamp (MIL) is turning on intermittently

NO

Clean mating surfaces of generator

- If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0130 or P0136 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
- If Malfunction Indicator Lamp (MIL) was on and DTC P0130 or P0136 is set, replace oxygen sensor.
- Clear code and verify oxygen sensor is within normal parameters.

Clean mating surfaces of generator housing and engine block.
Clear code and verify oxygen sensor is within normal parameters.

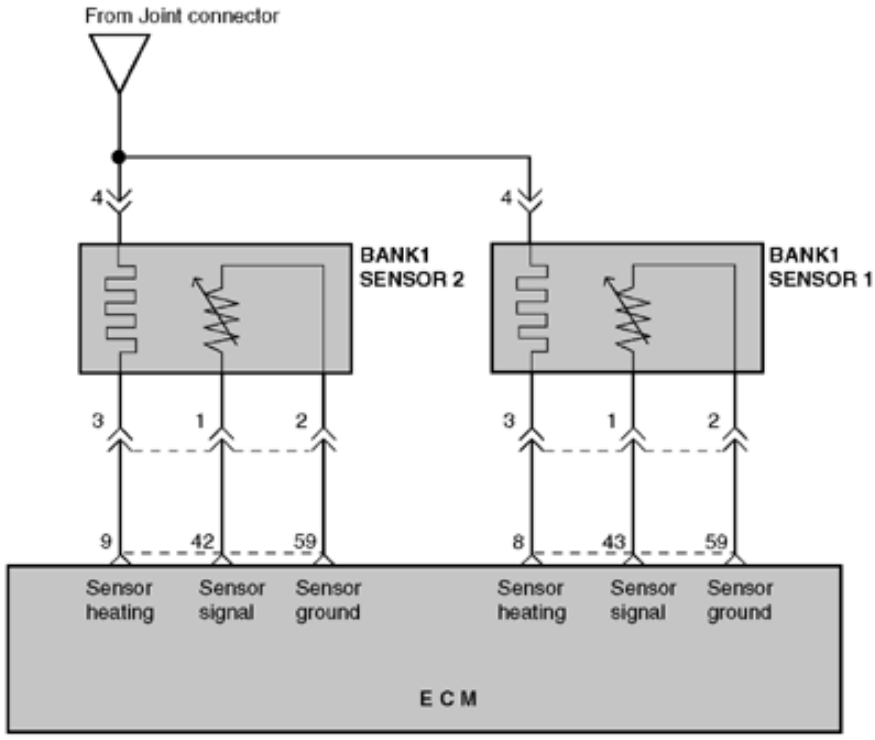
DTC	Diagnostic item
P0131	O2 Sensor Circuit Low Input(Bank 1 / Sensor 1)
P0137	O2 Sensor Circuit Low Input (Bank 1 / Sensor 2)

DESCRIPTION

Refer to DTC P0130 & P0136.

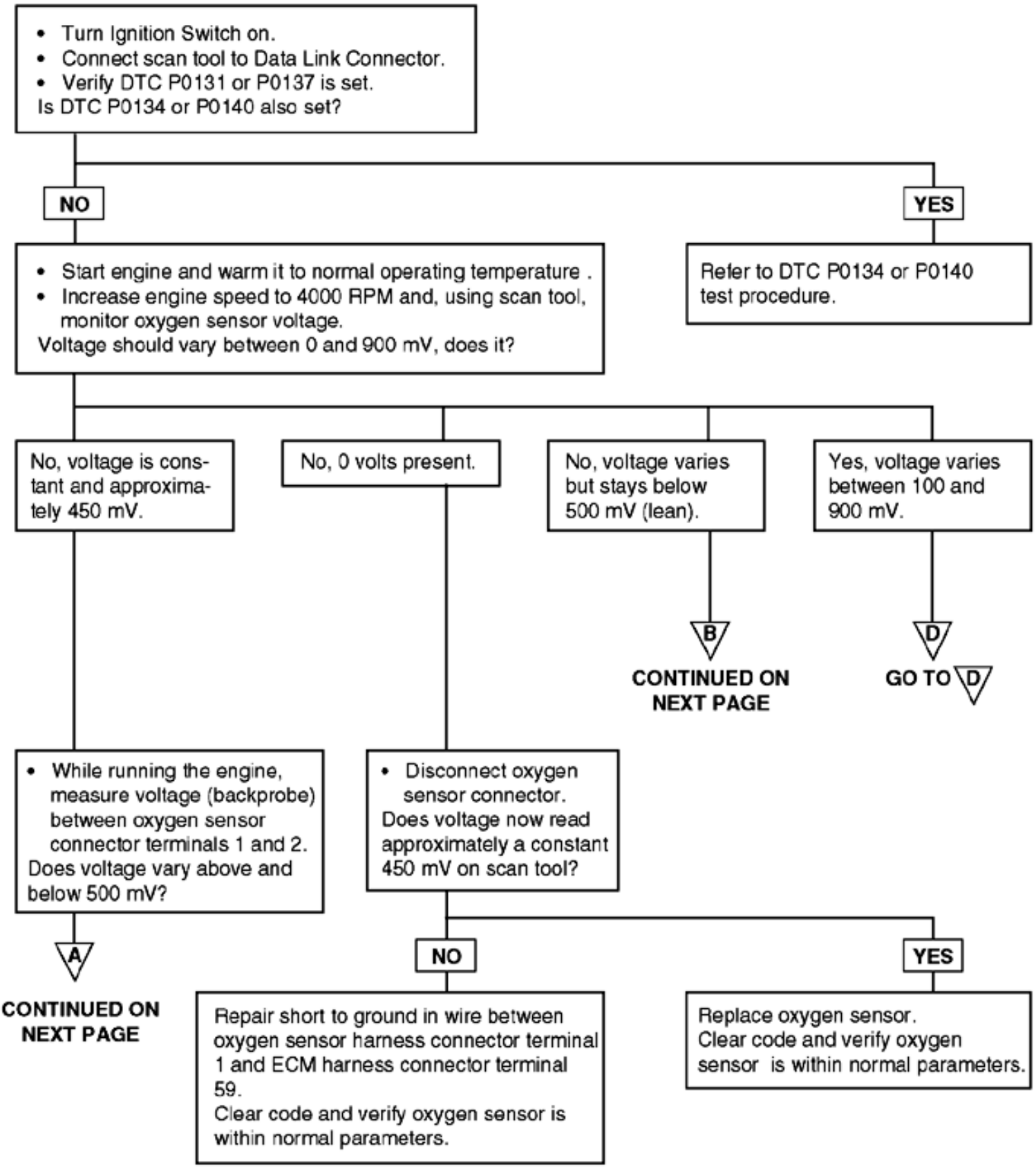
FAILURE CONDITIONS

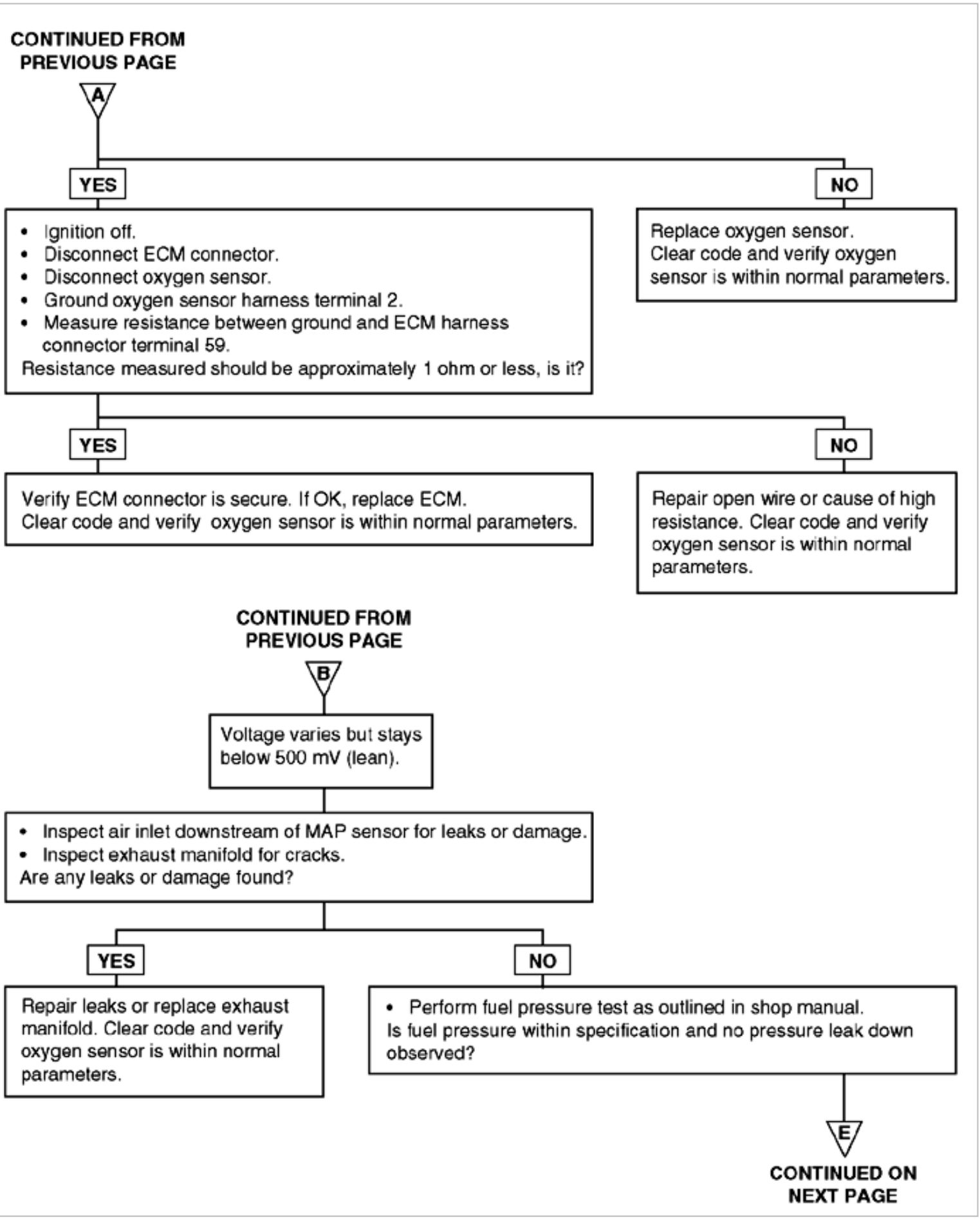
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE


• Turn Ignition Switch on.
• Connect scan tool to Data Link Connector.
• Verify DTC P0131 or P0137 is set.
Is DTC P0134 or P0140 also set?
NO
YES
• Start engine and warm it to normal operating temperature .
• Increase engine speed to 4000 RPM and, using scan tool, monitor oxygen sensor voltage.
Voltage should vary between 0 and 900 mV, does it?
Refer to DTC P0134 or P0140 test procedure.
No, voltage is constant and approximately 450 mV.
No, 0 volts present.
No, voltage varies but stays below 500 mV (lean).
Yes, voltage varies between 100 and 900 mV.
B
CONTINUED ON NEXT PAGE
D
GO TO D
• While running the engine, measure voltage (backprobe) between oxygen sensor connector terminals 1 and 2.
Does voltage vary above and below 500 mV?
• Disconnect oxygen sensor connector.
Does voltage now read approximately a constant 450 mV on scan tool?
A
CONTINUED ON NEXT PAGE
NO
YES
Repair short to ground in wire between oxygen sensor harness connector terminal 1 and ECM harness connector terminal 59.
Clear code and verify oxygen sensor is within normal parameters.
Replace oxygen sensor.
Clear code and verify oxygen sensor is within normal parameters.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A
YES
NO
• Ignition off.
• Disconnect ECM connector.
• Disconnect oxygen sensor.
• Ground oxygen sensor harness terminal 2.
• Measure resistance between ground and ECM harness connector terminal 59.
Resistance measured should be approximately 1 ohm or less, is it?
Replace oxygen sensor. Clear code and verify oxygen sensor is within normal parameters.
YES
NO
Verify ECM connector is secure. If OK, replace ECM. Clear code and verify oxygen sensor is within normal parameters.
Repair open wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.
CONTINUED FROM PREVIOUS PAGE
B
Voltage varies but stays below 500 mV (lean).
• Inspect air inlet downstream of MAP sensor for leaks or damage.
• Inspect exhaust manifold for cracks.
Are any leaks or damage found?
YES
NO
Repair leaks or replace exhaust manifold. Clear code and verify oxygen sensor is within normal parameters.
• Perform fuel pressure test as outlined in shop manual.
Is fuel pressure within specification and no pressure leak down observed?
E
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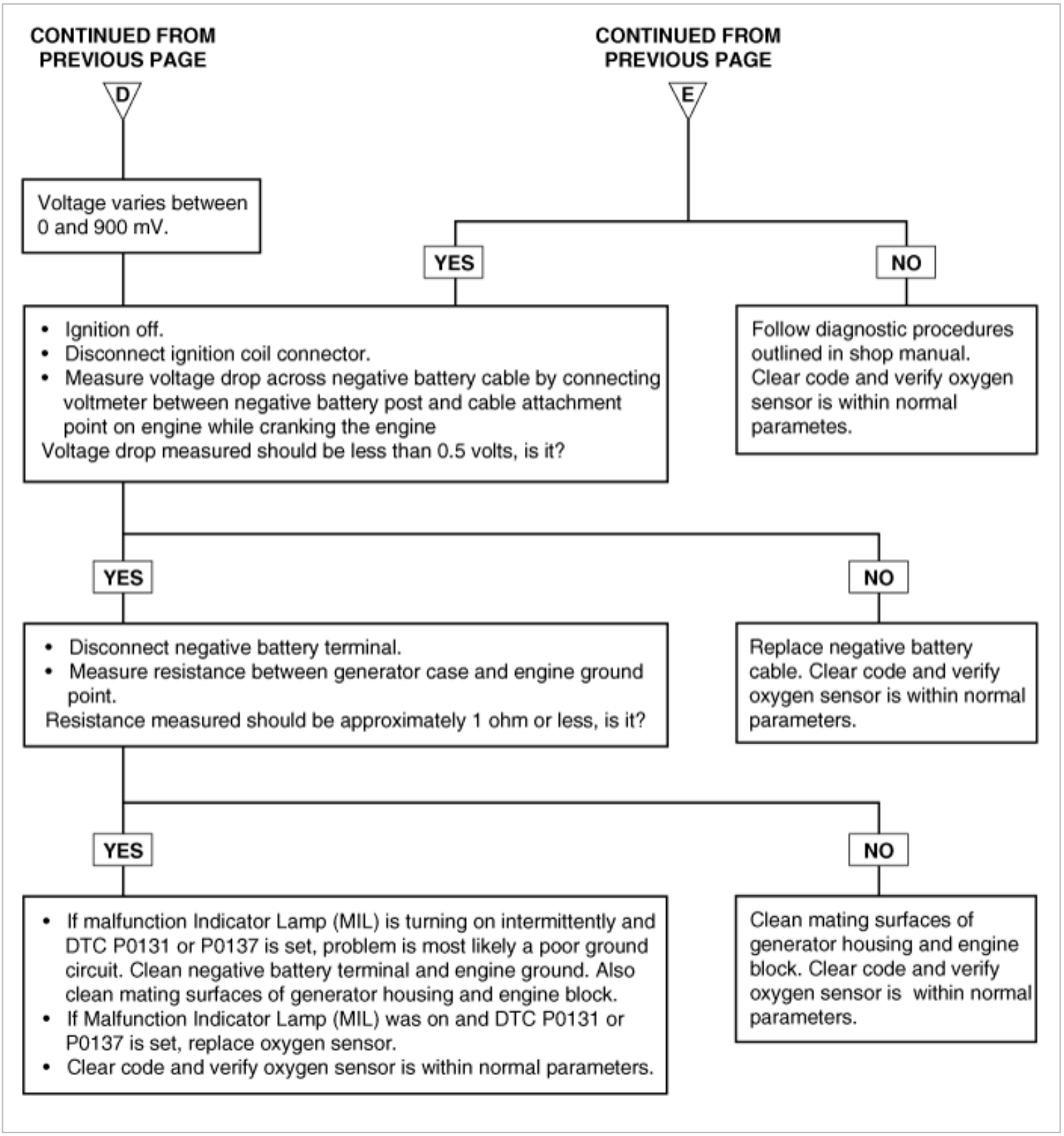


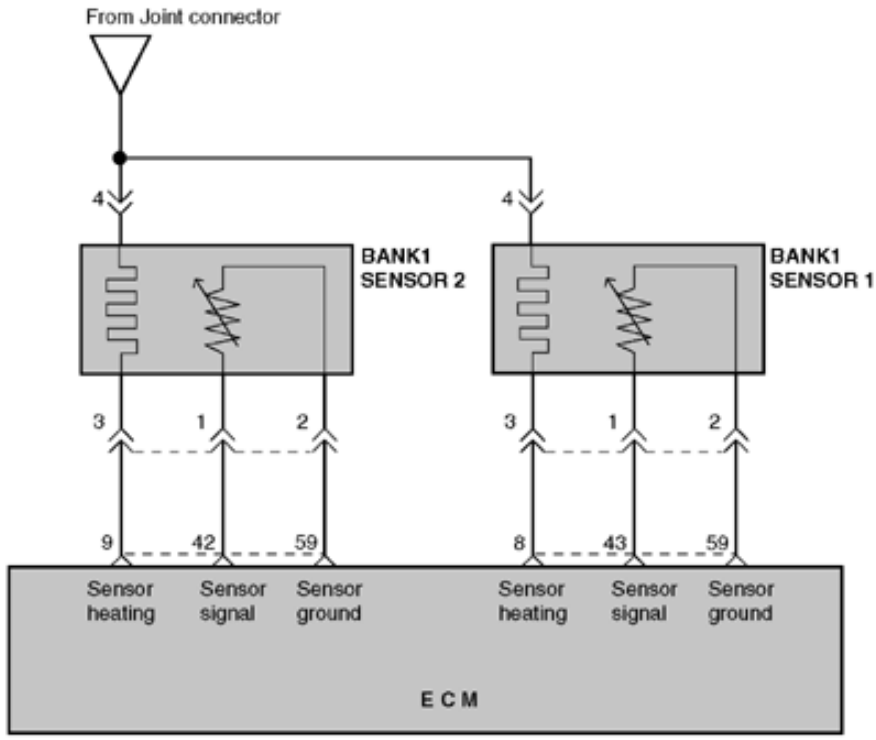
DTC	Diagnostic item
P0132	O2 Sensor Circuit High Input(Bank 1 / Sensor 1)
P0138	O2 Sensor Circuit High Input (Bank 1 / Sensor 2)

DESCRIPTION

Refer to DTC P0130 & P0136.

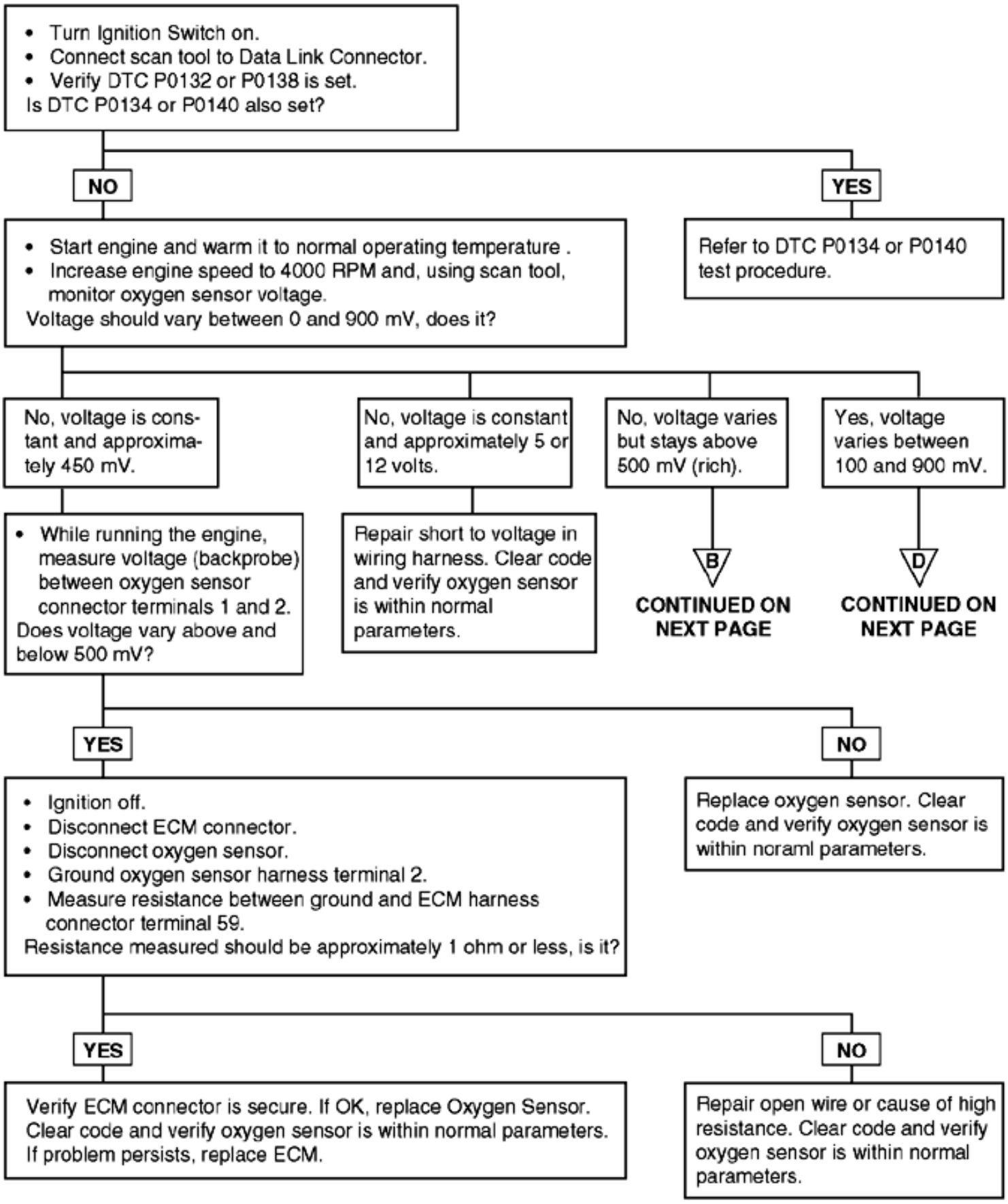
FAILURE CONDITIONS

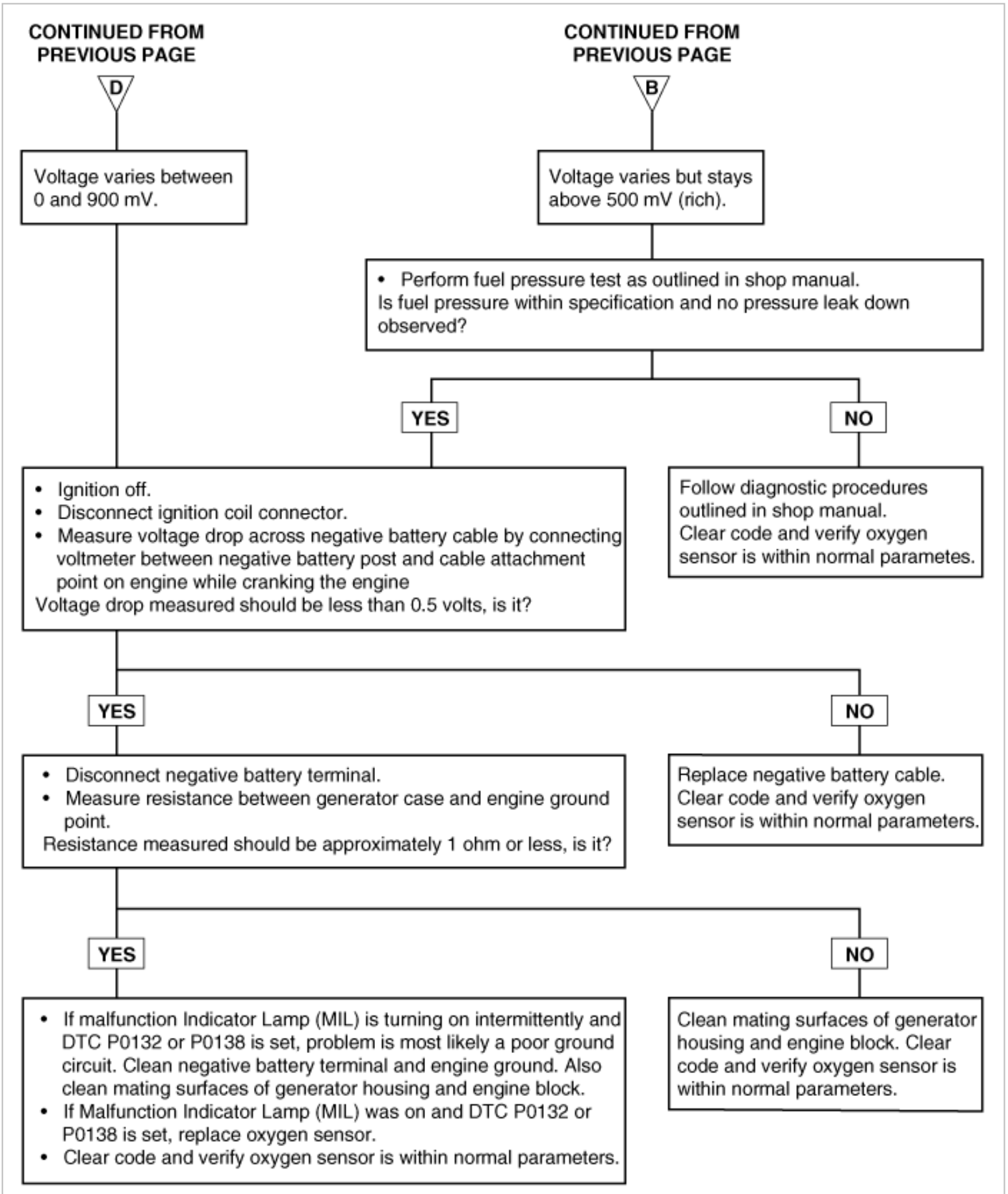
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE


• Turn Ignition Switch on.
• Connect scan tool to Data Link Connector.
• Verify DTC P0132 or P0138 is set.
Is DTC P0134 or P0140 also set?
NO
YES
Refer to DTC P0134 or P0140 test procedure.
• Start engine and warm it to normal operating temperature .
• Increase engine speed to 4000 RPM and, using scan tool, monitor oxygen sensor voltage.
Voltage should vary between 0 and 900 mV, does it?
No, voltage is constant and approximately 450 mV.
No, voltage is constant and approximately 5 or 12 volts.
No, voltage varies but stays above 500 mV (rich).
Yes, voltage varies between 100 and 900 mV.
• While running the engine, measure voltage (backprobe) between oxygen sensor connector terminals 1 and 2.
Does voltage vary above and below 500 mV?
Repair short to voltage in wiring harness. Clear code and verify oxygen sensor is within normal parameters.
B
CONTINUED ON NEXT PAGE
D
CONTINUED ON NEXT PAGE
YES
NO
• Ignition off.
• Disconnect ECM connector.
• Disconnect oxygen sensor.
• Ground oxygen sensor harness terminal 2.
• Measure resistance between ground and ECM harness connector terminal 59.
Resistance measured should be approximately 1 ohm or less, is it?
Replace oxygen sensor. Clear code and verify oxygen sensor is within noraml parameters.
YES
NO
Verify ECM connector is secure. If OK, replace Oxygen Sensor. Clear code and verify oxygen sensor is within normal parameters. If problem persists, replace ECM.
Repair open wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.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D
Voltage varies between 0 and 900 mV.
CONTINUED FROM PREVIOUS PAGE
B
Voltage varies but stays above 500 mV (rich).
• Perform fuel pressure test as outlined in shop manual.
Is fuel pressure within specification and no pressure leak down observed?
YES
NO
Follow diagnostic procedures outlined in shop manual.
Clear code and verify oxygen sensor is within normal parametes.
• Ignition off.
• Disconnect ignition coil connector.
• Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and cable attachment point on engine while cranking the engine
Voltage drop measured should be less than 0.5 volts, is it?
YES
NO
Replace negative battery cable.
Clear code and verify oxygen sensor is within normal parameters.
• Disconnect negative battery terminal.
• Measure resistance between generator case and engine ground point.
Resistance measured should be approximately 1 ohm or less, is it?
YES
NO
Clean mating surfaces of generator housing and engine block. Clear code and verify oxygen sensor is within normal parameters.
• If malfunction Indicator Lamp (MIL) is turning on intermittently and DTC P0132 or P0138 is set, problem is most likely a poor ground circuit. Clean negative battery terminal and engine ground. Also clean mating surfaces of generator housing and engine block.
• If Malfunction Indicator Lamp (MIL) was on and DTC P0132 or P0138 is set, replace oxygen sensor.
• Clear code and verify oxygen sensor is within normal parameters.

DTC	Diagnostic item
P0133	O2-Sensor Circuit Slow Response (Bank 1 / Sensor 1)
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 / Sensor 1)

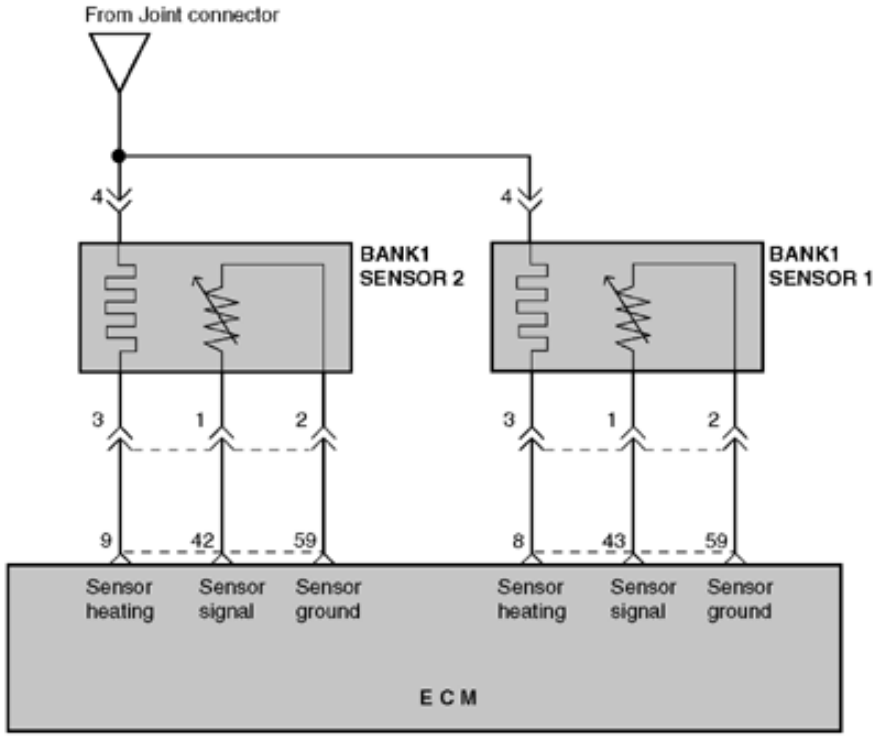
DESCRIPTION

Refer to DTC P0130 & P0136.

FAILURE CONDITIONS

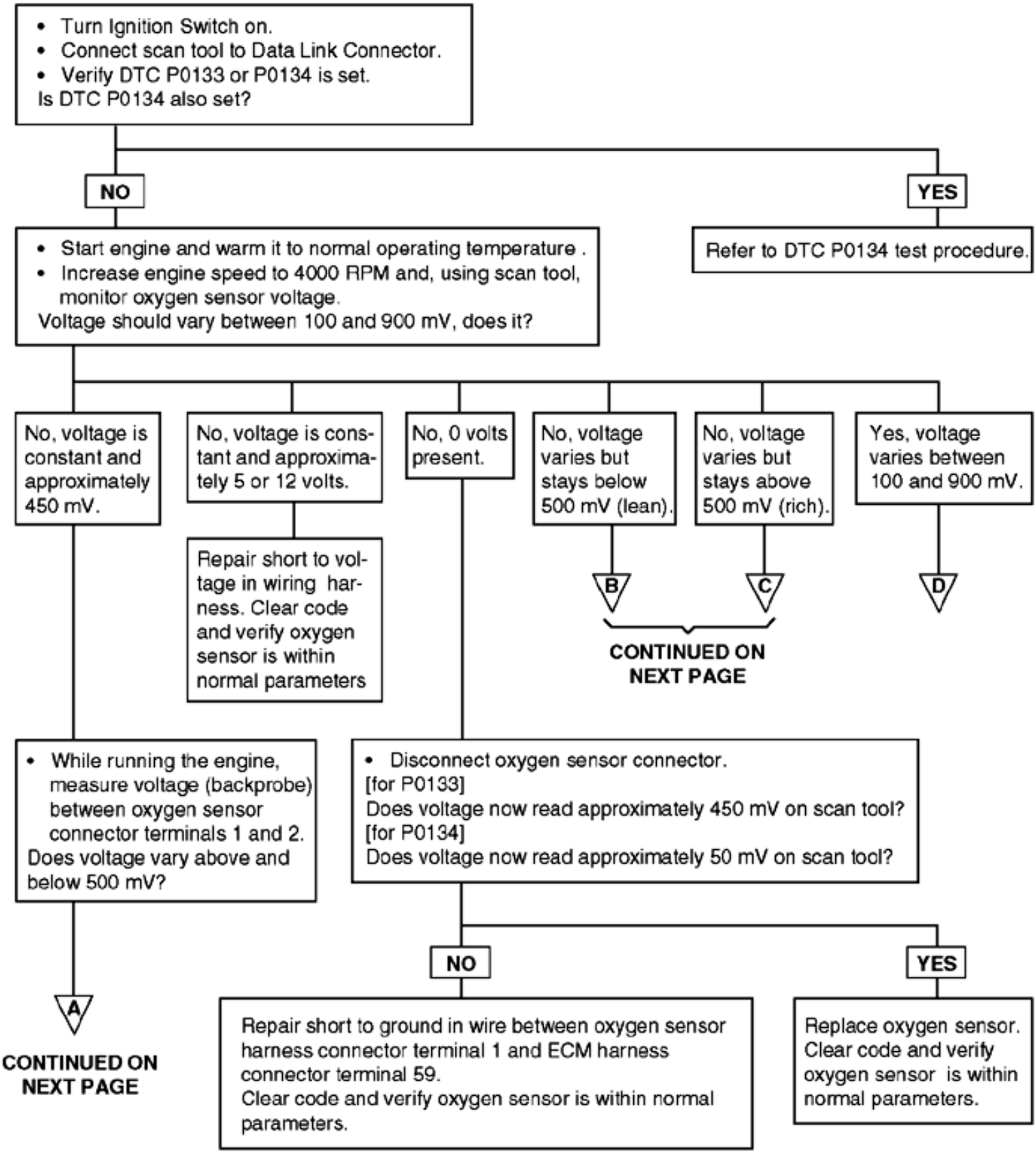
1. Over a period of 2 minutes, the ECM must sense a fuel compensation factor greater 85% or less than 95%:
2. The ECM must make some correction in the air/fuel ratio when:
   - Engine RPM is between 1600 and 3200 RPM.
   - Engine load range is between 1.35 and 3.4 milliseconds.
   - Catalyst temperature is above 372°C (702°F).
   - System is in closed loop.

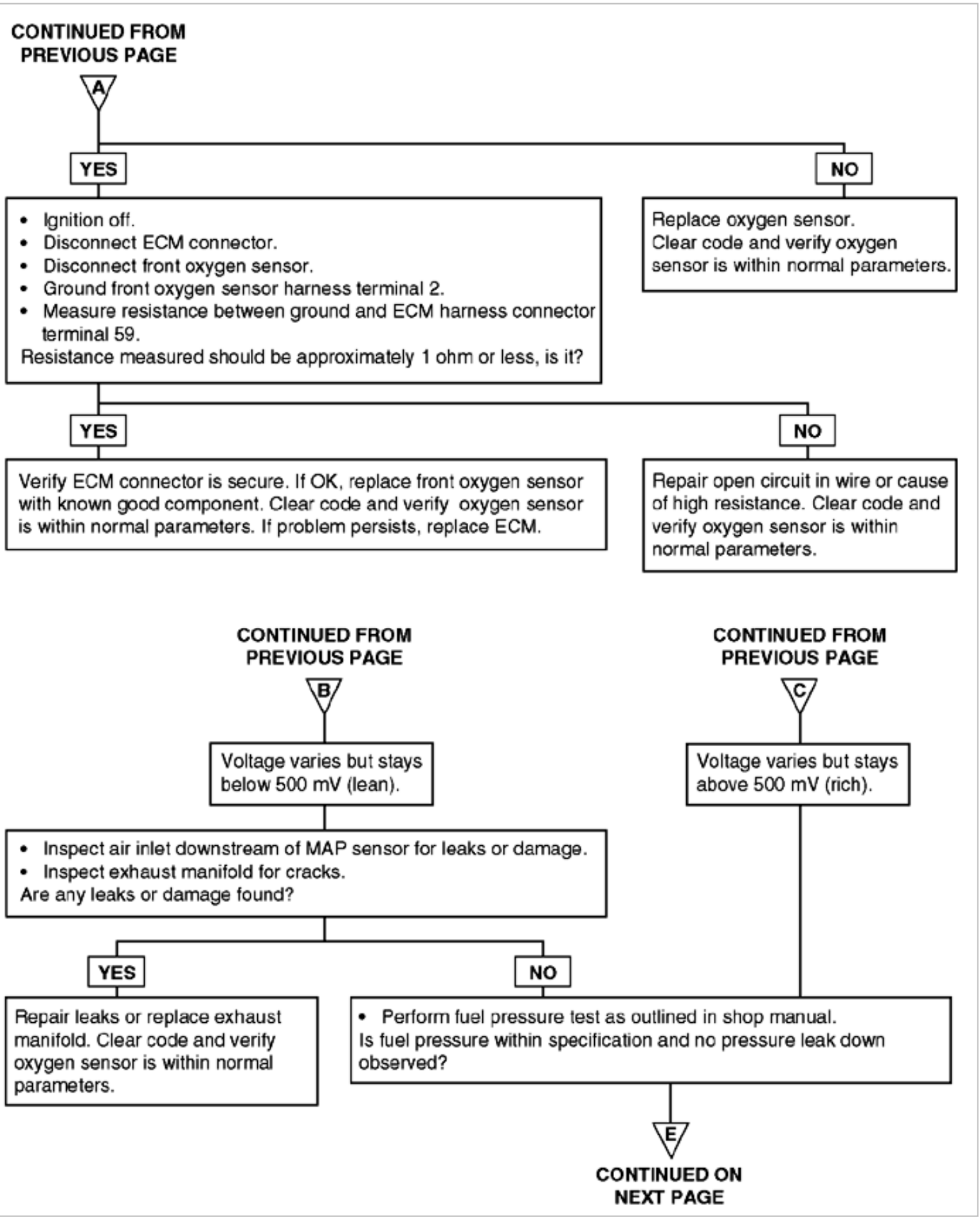
CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE


• Turn Ignition Switch on.
• Connect scan tool to Data Link Connector.
• Verify DTC P0133 or P0134 is set.
Is DTC P0134 also set?
NO
YES
Refer to DTC P0134 test procedure.
• Start engine and warm it to normal operating temperature .
• Increase engine speed to 4000 RPM and, using scan tool, monitor oxygen sensor voltage.
Voltage should vary between 100 and 900 mV, does it?
No, voltage is constant and approximately 450 mV.
No, voltage is constant and approximately 5 or 12 volts.
No, 0 volts present.
No, voltage varies but stays below 500 mV (lean).
No, voltage varies but stays above 500 mV (rich).
Yes, voltage varies between 100 and 900 mV.
Repair short to voltage in wiring harness. Clear code and verify oxygen sensor is within normal parameters
B
C
D
CONTINUED ON NEXT PAGE
• While running the engine, measure voltage (backprobe) between oxygen sensor connector terminals 1 and 2.
Does voltage vary above and below 500 mV?
• Disconnect oxygen sensor connector.
[for P0133]
Does voltage now read approximately 450 mV on scan tool?
[for P0134]
Does voltage now read approximately 50 mV on scan tool?
NO
YES
A
CONTINUED ON NEXT PAGE
Repair short to ground in wire between oxygen sensor harness connector terminal 1 and ECM harness connector terminal 59.
Clear code and verify oxygen sensor is within normal parameters.
Replace oxygen sensor. Clear code and verify oxygen sensor is within normal parameters.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A
YES
NO
• Ignition off.
• Disconnect ECM connector.
• Disconnect front oxygen sensor.
• Ground front oxygen sensor harness terminal 2.
• Measure resistance between ground and ECM harness connector terminal 59.
Resistance measured should be approximately 1 ohm or less, is it?
Replace oxygen sensor. Clear code and verify oxygen sensor is within normal parameters.
YES
NO
Verify ECM connector is secure. If OK, replace front oxygen sensor with known good component. Clear code and verify oxygen sensor is within normal parameters. If problem persists, replace ECM.
Repair open circuit in wire or cause of high resistance. Clear code and verify oxygen sensor is within normal parameters.
CONTINUED FROM PREVIOUS PAGE
B
Voltage varies but stays below 500 mV (lean).
CONTINUED FROM PREVIOUS PAGE
C
Voltage varies but stays above 500 mV (rich).
• Inspect air inlet downstream of MAP sensor for leaks or damage.
• Inspect exhaust manifold for cracks.
Are any leaks or damage found?
YES
NO
Repair leaks or replace exhaust manifold. Clear code and verify oxygen sensor is within normal parameters.
• Perform fuel pressure test as outlined in shop manual.
Is fuel pressure within specification and no pressure leak down observed?
E
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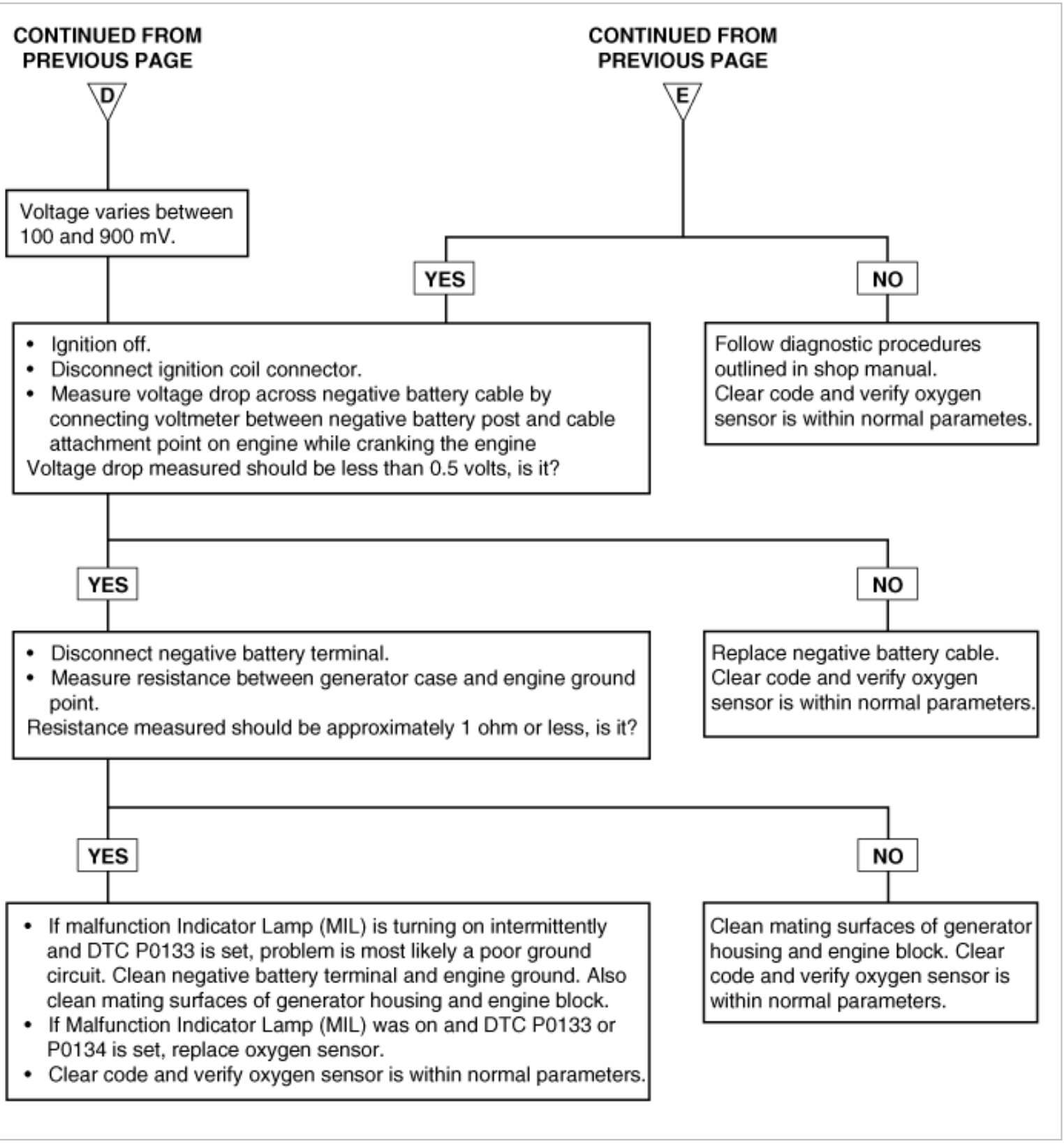


DTC	Diagnostic item

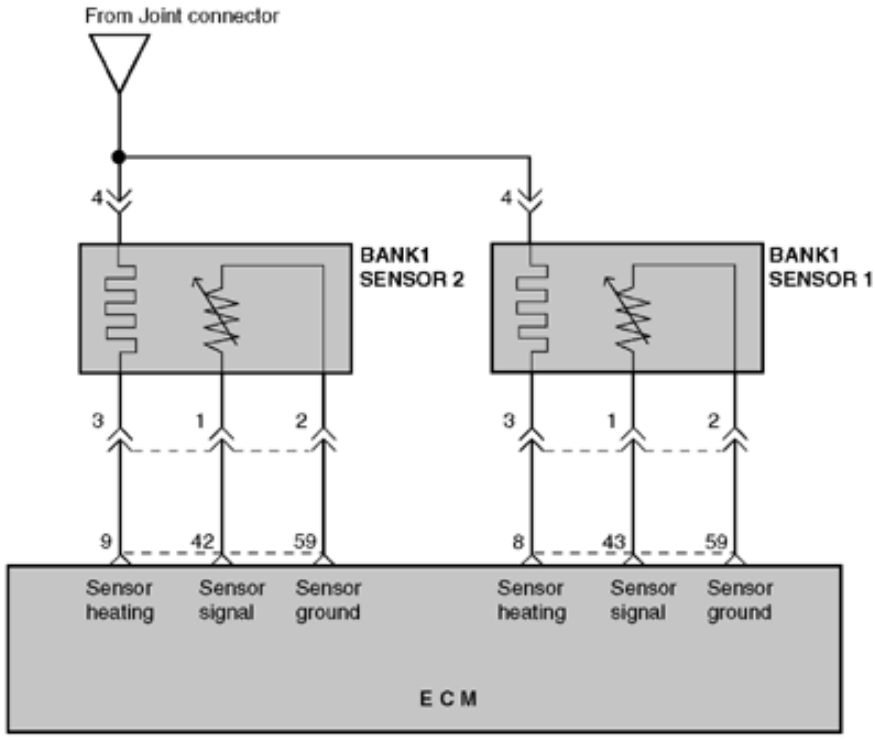
P0030	O2 Sensor Heater - Heater Control Circuit (Bank 1 / Sensor 1)
P0036	O2 Sensor Heater - Heater Control Circuit (Bank 1 / Sensor 2)
P0031	O2 Sensor Heater Circuit low (Bank 1 / Sensor 1)
P0032	O2 Sensor Heater Circuit high (Bank 1 / Sensor 1)
P0037	O2 Sensor Heater Circuit low (Bank 1 / Sensor 2)
P0038	O2 Sensor Heater Circuit high (Bank 1 / Sensor 2)

DESCRIPTION

Refer to DTC P0130 & P0136.

FAILURE CONDITIONS

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0031, P0032, P0037, P0038 or P0030, P0036 is set.

- Disconnect front [for P0030, P0031, P0032] or rear [for P0036, P0037, P0038] oxygen sensor.
- Start engine.
- Measure voltage between oxygen sensor harness connector terminal 3 or terminal 1.

Voltage should between 12 and 16 volts, is it?

YES

- Turn ignition switch off.
- Disconnect front [for P0030, P0031, P0032] or rear [for P0036, P0037, P0038] oxygen sensor.
- ECM disconnected.
- Ground front [for P0030, P0031, P0032] or rear [for P0036, P0037, P0038] oxygen sensor harness terminal.
- Measure resistance between ground and ECM harness terminal 59.

Resistance should be approximately 1 ohm or less, is it?

YES

- Ignition switch off.
- Disconnect front [for P0030, P0031, P0032] or rear [for P0036, P0037, P0038] oxygen sensor.
- Measure resistance between ground and oxygen sensor harness connector terminal.

Resistance should indicate an open circuit, does it?

A
CONTINUED ON NEXT PAGE

NO

Repair open or shourt to ground in wire between engine compartment and oxygen sensor harness connector terminal.
Clear code and verify oxygen sensor is within normal parameters.

NO

Repair open in wire between oxygen sensor harness connector termial and ECM harness connector terminal 59.
Clear code and verify oxygen sensor is within normal parameters.

CONTINUED FROM PREVIOUS PAGE

A

YES

- Ignition switch off.
- Disconnect front [for P0030, P0031, P0032] or rear [for P0036, P0037, P0038] oxygen sensor.
- Measure resistance between terminals 3 and 4 of oxygen sensor connector.

Is resistance within normal parameters (3-5 ohms)?

NO

Repair short to ground or another circuit in wire between oxygen sensor harness connector terminal 3 and ECM harness connector terminal 59.
Clear code and verify oxygen sensor is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace Front [for P0030, P0031, P0032] or rear [for P0036, P0037, P0038] oxygen sensor with a known good component.
Clear code and verify oxygen sensor is within normal parameters.
If problem persists, replace ECM.

NO

Replace oxygen sensor. Clear code and verify oxygen sensor is within normal parameters.

DTC	Diagnostic item
P0261	Cylinder 1 - Injector Circuit Low
P0262	Cylinder 1 - Injector Circuit High
P0264	Cylinder 2 - Injector Circuit Low
P0265	Cylinder 2 - Injector Circuit High
P0267	Cylinder 3 - Injector Circuit Low
P0268	Cylinder 3 - Injector Circuit High
P0270	Cylinder 4 - Injector Circuit Low
P0271	Cylinder 4 - Injector Circuit High

DESCRIPTION

The fuel injectors are solenoid operated valves. When a fuel injector solenoid is energized (pulsed) the injector needle valve opens, allowing pressurizedfuel to pass through the injector and mix with air entering the engine.

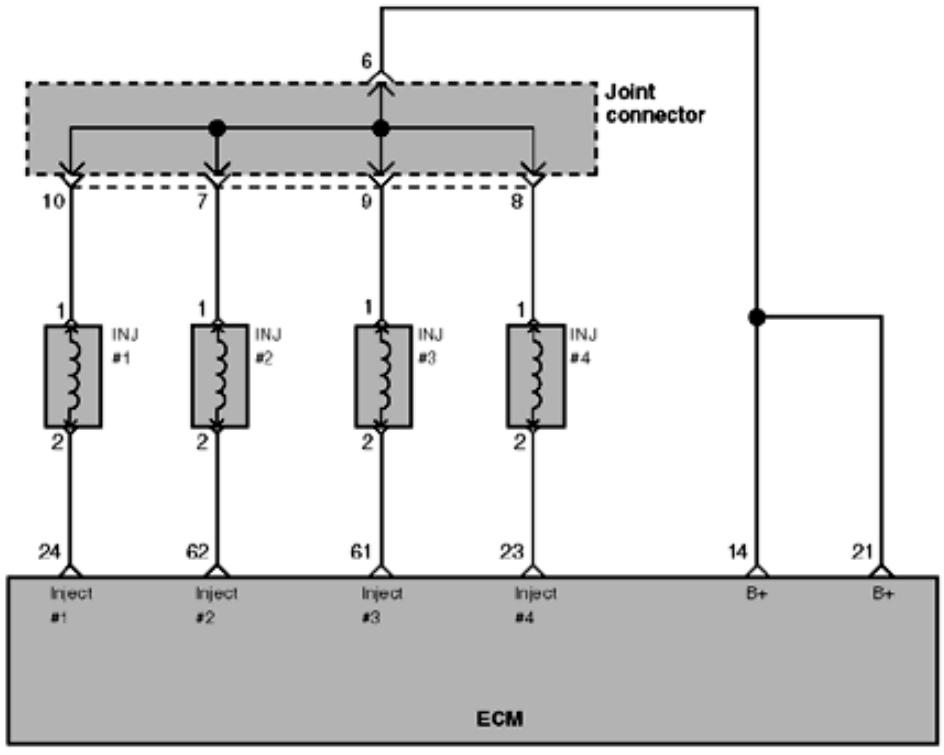
The Engine Control Module (ECM) controls injector timing and pulse width. The ECM pulses the fuel injectors based on information provided by its network of engine sensors. The ECM uses the crankshaft position sensor to determine when to pulse the injectors. Engine coolant temperature, intake air temperature, air flow, and throttle position data are all used by the ECM to calculateinjector pulse width.

The ECM also uses its network of sensors to determine whether all injectors should be pulsed at the same time (simultaneous injection) or each injector should be pulsed individually (sequential injection). Sequential injection is almost always used during normal engine operation. Simultaneous injectionmay be used when the engine is being cranked.

FAILURE CONDITIONS

The ECM will set a code and the MIL will turn on if an open circuit or short to ground is detected in the fuel injector circuit during two drivingcycles.

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0261, P0262, P0264, P0265, P0267 P0268, P0270 or P0271 is set.

- Engine idling at normal operating temperature.
- Disconnect the fuel injectors, one at a time, and note the drop in engine speed for each one.

Engine speed should drop the same amount for each fuel injector, does it?

NO

- Turn ignition off.
- Disconnect fuel injector connector related to DTC.
- Turn ignition on.
- Measure voltage between ground and fuel injector harness connector terminal 1.

Battery voltage should be present, is it?

YES

- Disconnect fuel injector related to DTC.
- Turn ignition off.
- Disconnect ECM connector.
- Ground fuel injector harness connector terminal 2. Measure resistance between ground and ECM connector harness terminal 24 [for P0261, P0262], terminal 62 [for P0264, P0265], terminal 61 [for P0267, P0268] or terminal 23 [for P0270, P271].

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Ignition off.
- Disconnect fuel injector related to DTC.
- Disconnect ECM connector.
- Measure resistance between ground and fuel injector harness connector terminal 2.

Resistance should indicate open circuit, does it?

A

CONTINUED ON NEXT PAGE

YES

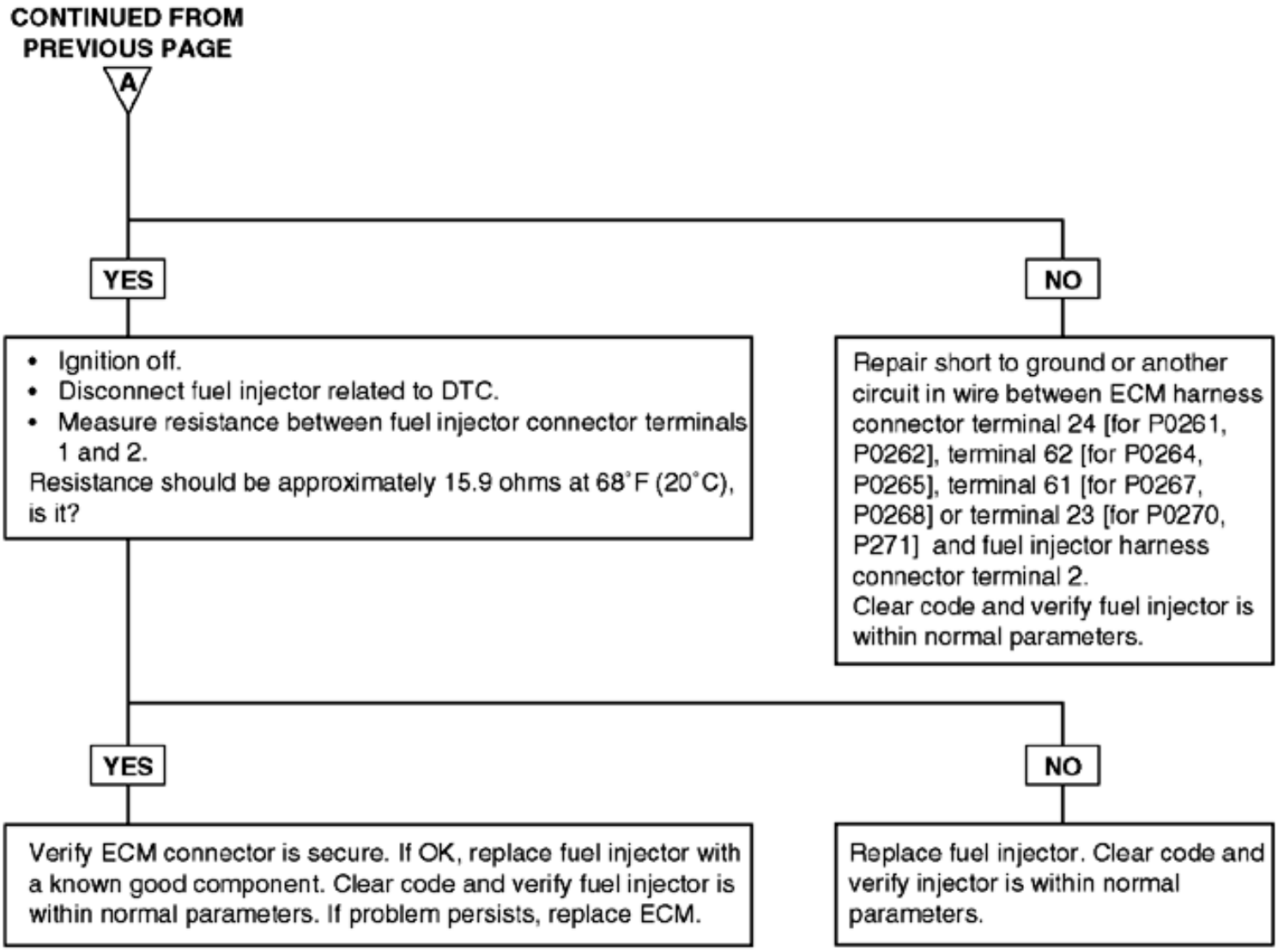
Problem is intermittent or was repaired and Engine Control Module (ECM) memory was not cleared. Clear code and verify fuel injector is within normal parameters.

NO

Repair open in wire between ECM control relay harness connector terminal 1 and fuel injector harness connector terminal 1. Clear code and verify fuel injector is within normal parameters.

NO

Repair open circuit in wire between ECM harness connector terminal 24 [for P0261, P0262], terminal 62 [for P0264, P0265], terminal 61 [for P0267, P0268] or terminal 23 [for P0270, P271] and fuel injector harness connector terminal 2. Clear code and verify fuel injector is within normal parameters.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A
YES
NO
• Ignition off.
• Disconnect fuel injector related to DTC.
• Measure resistance between fuel injector connector terminals 1 and 2.
Resistance should be approximately 15.9 ohms at 68˚F (20˚C), is it?
Repair short to ground or another circuit in wire between ECM harness connector terminal 24 [for P0261, P0262], terminal 62 [for P0264, P0265], terminal 61 [for P0267, P0268] or terminal 23 [for P0270, P271] and fuel injector harness connector terminal 2.
Clear code and verify fuel injector is within normal parameters.
YES
NO
Verify ECM connector is secure. If OK, replace fuel injector with a known good component. Clear code and verify fuel injector is within normal parameters. If problem persists, replace ECM.
Replace fuel injector. Clear code and verify injector is within normal parameters.

DTC	Diagnostic item
P0300	Multiple Cylinder Misfire Detected

DESCRIPTION

With the ignition switch at ON or START, voltage is applied to the ignition coil. The ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coil. The ignition coil fires two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). Coil number one fires cylinders 1 and 4. Coil number twofires cylinders 2 and 3.

The Engine Control Module (ECM) provides a switching circuit to ground for energizing the primary ignition coils. The ECM uses the crankshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltagespike across the attached spark plugs.

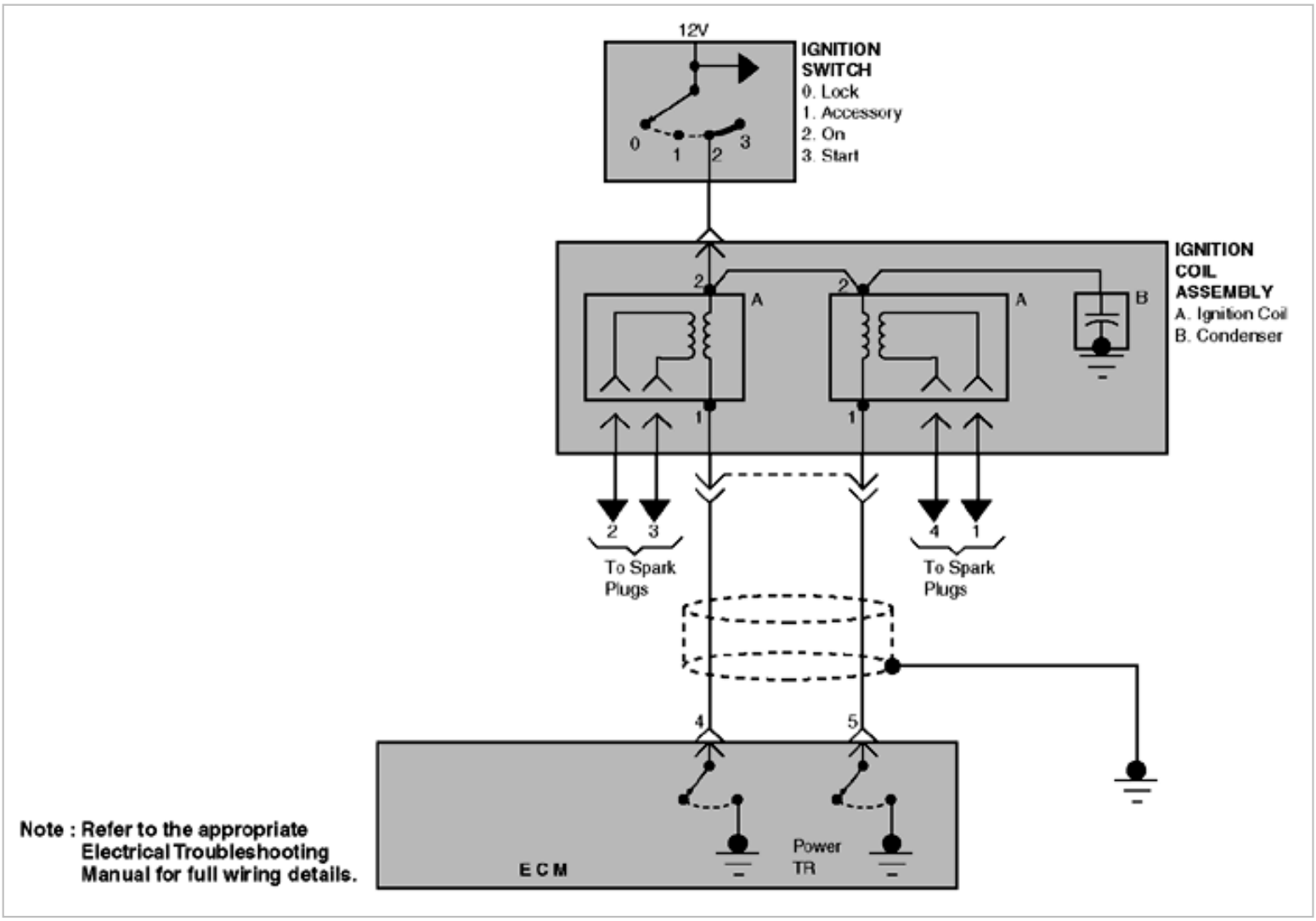
FAILURE CONDITIONS

The ECM will set P0300 and the MIL will turn on if 2 misfires per 100 revolutions are detected during two driving cycles. The misfire rate is measuredevery 200 revolutions when the following conditions are met:

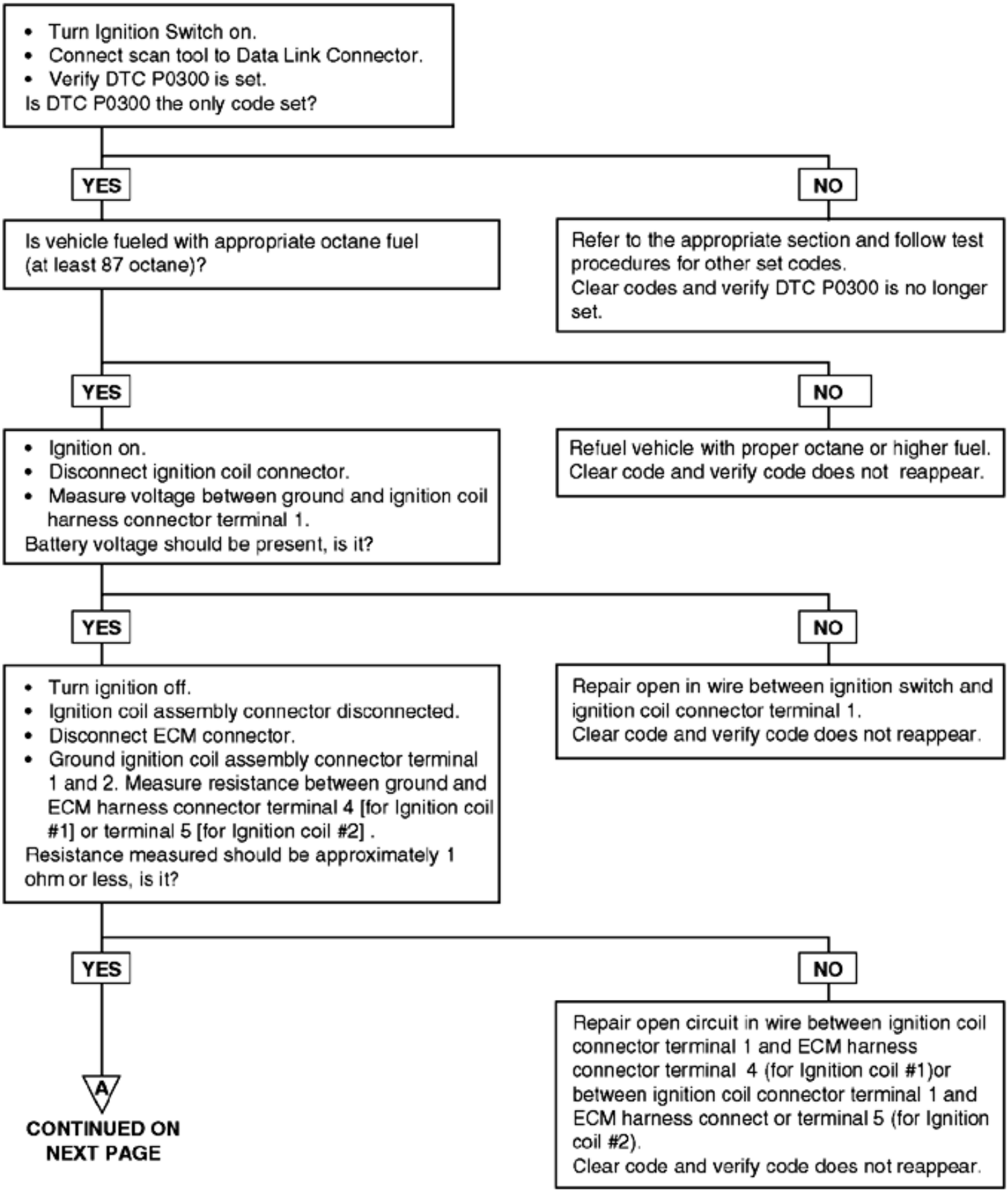
- •Speed change is less than 1000 rpm per second.
- •Engine speed is between 600 and 4000 RPM.
- •Engine load is greater than 2 milliseconds.
- •No fuel cut-off.
- •Starter is not engaged.
- •Vehicle on smooth road (acceleration sensor reports less than 0.3 g acceleration).

If the misfire rate increases to between 5%-25% per 200 revolutions, there is danger of catalyst damage and the MIL will flash off and on. The catalyst temperature could exceed 3542°F (1950°C) if the misfire rate increases enough. This code indicates a problem with cylinder ignition beingread by the ECM.

CIRCUIT DIAGRAM



TEST PROCEDURE


• Turn Ignition Switch on.
• Connect scan tool to Data Link Connector.
• Verify DTC P0300 is set.
Is DTC P0300 the only code set?
YES
NO
Is vehicle fueled with appropriate octane fuel (at least 87 octane)?
Refer to the appropriate section and follow test procedures for other set codes.
Clear codes and verify DTC P0300 is no longer set.
YES
NO
• Ignition on.
• Disconnect ignition coil connector.
• Measure voltage between ground and ignition coil harness connector terminal 1.
Battery voltage should be present, is it?
Refuel vehicle with proper octane or higher fuel.
Clear code and verify code does not reappear.
YES
NO
• Turn ignition off.
• Ignition coil assembly connector disconnected.
• Disconnect ECM connector.
• Ground ignition coil assembly connector terminal 1 and 2. Measure resistance between ground and ECM harness connector terminal 4 [for Ignition coil #1] or terminal 5 [for Ignition coil #2] .
Resistance measured should be approximately 1 ohm or less, is it?
Repair open in wire between ignition switch and ignition coil connector terminal 1.
Clear code and verify code does not reappear.
YES
NO
A
CONTINUED ON NEXT PAGE
Repair open circuit in wire between ignition coil connector terminal 1 and ECM harness connector terminal 4 (for Ignition coil #1)or between ignition coil connector terminal 1 and ECM harness connect or terminal 5 (for Ignition coil #2).
Clear code and verify code does not reappear.

CONTINUED FROM PREVIOUS PAGE

A

- Ignition coil connector disconnected.
- Reconnect ECM connector.
- Ignition in start.
- Measure voltage between ground and ignition coil harness connector terminal 1. Note voltage.
- Measure voltage between ground and ignition coil harness connector terminal 2. Note voltage.

Voltage should vary between 0.02 and 0.2 volts, does it?

YES

- Ignition off.
- Disconnect ignition coil connector.
- Disconnect spark plug wires from ignition coil.
- Measure resistance between ignition coil connector terminals 1 and 2. Note primary coil resistance.
- Measure resistance between ignition coil spark plug connector terminals 1 and 4 and between spark plug connector terminals 2 and 3. Note secondary coil resistance.

Primary coil resistance should be approximately 1.0 ohm. Secondary coil resistance should be between 10.3 kilo ohms and 13.9 kilo ohms. Are resistances within specifiecation?

YES

Inspect the following components/systems.

- Spark plugs and spark plug wires needing replacement.
- Fuel injectors for clogging or wiring damage.
- Obstructions to the air flow meter.
- Acceleration sensor wiring, connection.
- Canister purge valve for normal operation.
- Vacuum hoses for leaks.

Are all components undamaged and within specification?

YES

- Verify fuel pressure according to procedure outlined in shop manual.
- Check engine oil for improper level or contamination (fuel in oil).

Is fuel pressure and oil level/contamination within specifications?

YES

Verify ECM connector is secure. If OK, replace ECM. Clear code and verify code does not reappear.

NO

Repair out of specification components. Clear codes and verify code does not reappear.

NO

Repair or replace damaged or out of specification components. Clear codes and verify code does not reappear.

NO

Replace ignition coil (s). Clear code and verify code does not reappear.

NO

Verify ECM connector is secure. If OK, replace ECM. Clear codes and verify code does not reappear.

DTC	Diagnostic item
P0301	Cylinder 1 - Misfire detected
P0302	Cylinder 2 - Misfire detected
P0303	Cylinder 3 - Misfire detected
P0304	Cylinder 4 - Misfire detected

DESCRIPTION

Refer to DTC P0300.

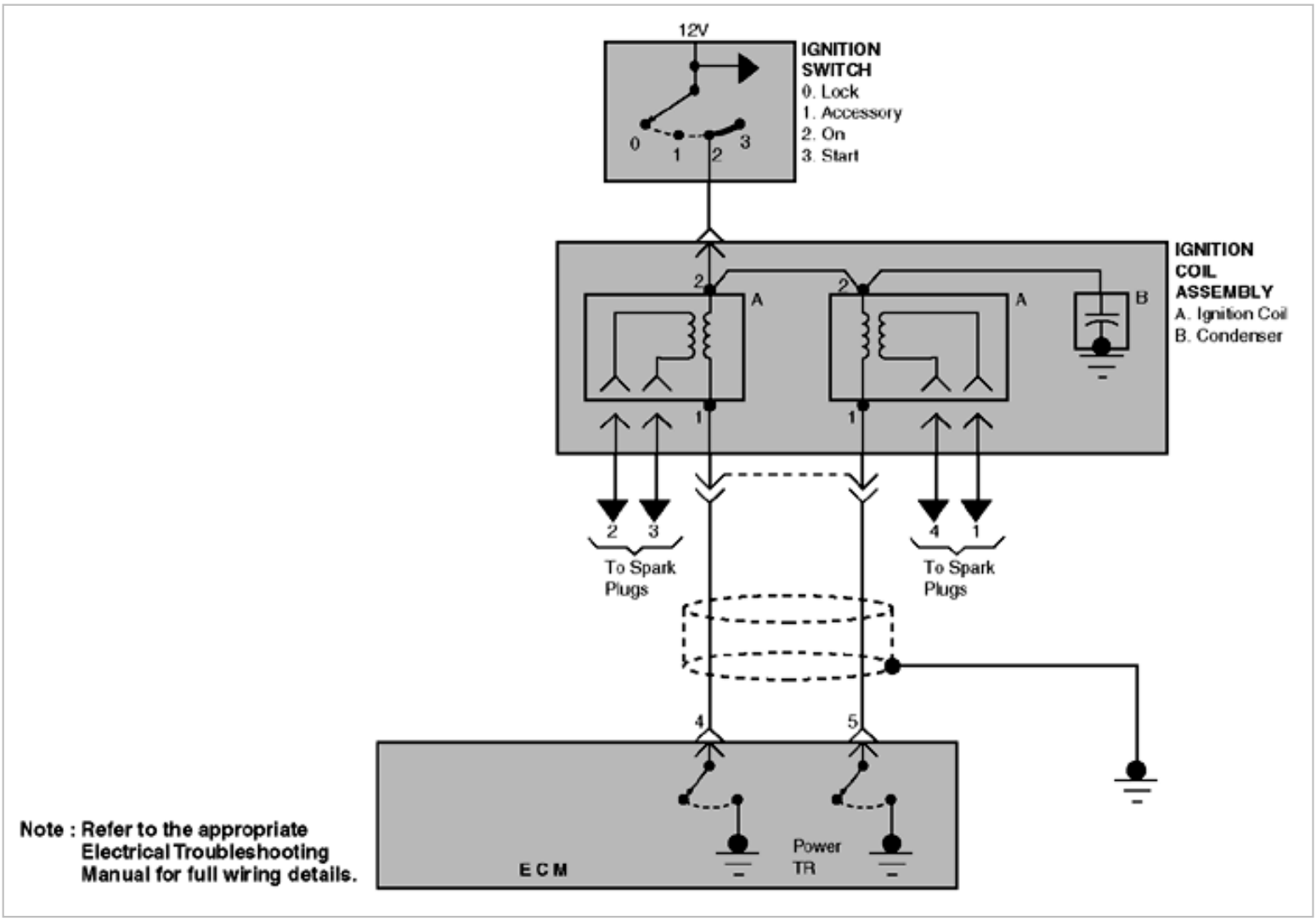
FAILURE CONDITIONS

The ECM will set P0301, P0302, P0303 or P0304 and the MIL will turn on if 2 misfires per 100 revolutions are detected during two driving cycles. The misfire rate is measured every 200 revolutions when the following conditionsare met:

- •Speed change is less than 1000 rpm per second.
- •Engine speed is between 600 and 4000 RPM.
- •Engine load is greater than 2 milliseconds.
- •No fuel cut-off.
- •Starter is not engaged.
- •Vehicle on smooth road (acceleration sensor reports less than 0.3 g acceleration).

If the misfire rate increases to between 5%-25% per 200 revolutions, there is danger of catalyst damage and the MIL will flash off and on. The catalyst temperature could exceed 3542°F (1950°C) if the misfire rate increases enough. This code indicates a problem with cylinder ignition beingread by the ECM.

CIRCUIT DIAGRAM



TEST PROCEDURE

- Turn Ignition Switch on.
- Connect scan tool to Data Link Connector.
- Verify DTC P0301, P0302, P0303 or P0304 is set.

Is DTC for Injector #1 or P0300 also set?
Is DTC for Injector #2 or P0300 also set?
Is DTC for Injector #3 or P0300 also set?
Is DTC for Injector #4 or P0300 also set?

NO

Is vehicle fueled with appropriate octane fuel (at least 87 octane)?

YES

Perform DTC for Injector #1 and/or DTC P0300 test procedures.
Perform DTC for Injector #2 and/or DTC P0300 test procedures.
Perform DTC for Injector #3 and/or DTC P0300 test procedures.
Perform DTC for Injector #4 and/or DTC P0300 test procedures.

YES

- Ignition off.
- Disconnect ignition coil connector (s).
- Disconnect spark plug wires from ignition coil.
- Measure resistance between ignition coil connector terminals 1 and 2. Note primary coil resistance.
- Measure resistance between ignition coil spark plug connector terminals 1 and 4 and between spark plug connector terminal 2 and 3. Note secondary coil resistance.

Primary coil resistance should be approximately 1.0 ohm. Secondary coil resistance should be between 10.3 kilo ohms and 13.9 kilo ohms. Are resistances within specification?

NO

Refuel vehicle with 87 octane or higher fuel. Clear code and verify code does not reappear.

YES

- Ignition off.
- Inspect spark plugs, cables and connections.
- Inspect acceleration sensor wiring and connection.

Are spark plugs, cables, acceleration sensor and connections undamaged or within specifications?

NO

Replace ignition coil. Clear code and verify code does not reappear.

YES

- Ignition off.
- Check fuel injector for clogging.
- Inspect acceleration sensor wiring and connection.

Is fuel injector OK?

NO

Repair or replace parts. Clear code and verify code does not reappear.

YES

Verify ECM connector is secure. If OK, replace ECM. Clear code and verify code does not reappear.

NO

Clean or replace fuel injector. Clear code and verify code does not reappear.

DTC	Diagnostic item
P0325	Knock Sensor 1 Circuit Malfunction

DESCRIPTION

The knock sensor is attached to the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the sensor's piezoelectric element. This vibration pressure is then converted into a voltage signal. The Engine Control Module (ECM) uses this signal tosuppress knocking by retarding ignition timing.

FAILURE CONDITIONS

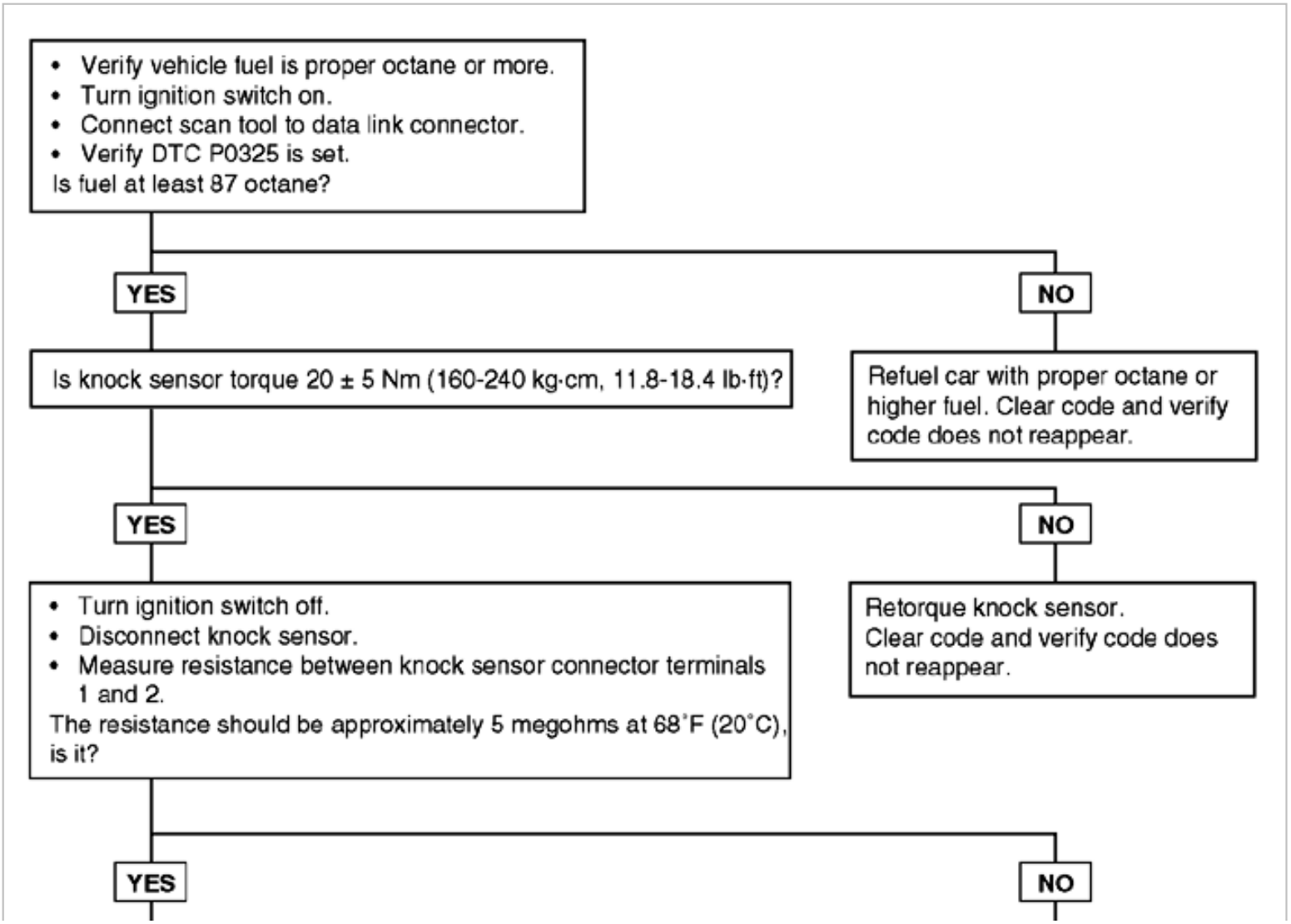
The ECM will set a code (Malfunction Indicator Lamp will Not turn on) if during two driving cycles the knock sensor's output voltage falls below 650 millivolts during a 4 second check when the following conditions are met:

- Starter is not engaged.
- Engine speed is above 3000 RPM.
- Engine coolant temperature is above 104°F (40°C).
- Engine load is greater than 2.5 milliseconds.

This code indicates an unexpected vibration is being read by the knock sensor or ECM under normal engine operation.

CIRCUIT DIAGRAM

TEST PROCEDURE



YES

- Ignition off.
- Knock sensor disconnected.
- ECM connector disconnected.
- Ground knock sensor harness terminals 1 and 2.
- Measure resistance between ground and ECM harness connector terminals 30 and 10.

Resistance measured should be approximately 1 ohm or less, is it?

NO

Replace knock sensor if the resistance measurement indicates an open or a short circuit. Clear code and verify code does not reappear.

YES

A

CONTINUED ON NEXT PAGE

NO

Repair open circuit in wire between knock sensor harness connector terminal 1 and ECM harness connector terminal 10 or between knock sensor harness connector terminal 2 and ECM harness connector terminal 30. Clear code and verify code does not reappear.

CONTINUED FROM PREVIOUS PAGE

A

- Ignition off.
- Knock sensor disconnected.
- Disconnect ECM connector.
- Measure resistance between ground and knock sensor harness connector terminal 1.

Resistance should indicate an open circuit, does it?

YES

Verify ECM connector is secure. If OK, replace knock sensor with a known good component. Clear code and verify code does not reappear. If problem persists, replace ECM.

NO

Repair short to ground in wire between knock sensor harness connector terminal 1 and ECM harness connector terminal 10.
Clear code and verify code does not reappear.

DTC	Diagnostic item
P0335	Crankshaft Position Sensor Circuit Malfunction

DESCRIPTION

The Crankshaft Position (CKP) sensor consists of a magnet and coil located next to the flywheel. The sensing wheel teeth are used by the CKP sensor to generate a signal. The voltage signal from CKP sensor allows the Engine ControlModule (ECM) to determine engine RPM and crankshaft position.

FAILURE CONDITIONS

The ECM will set P0335 and the MIL will turn on if the CKP signal voltage remains at 0.0 volts with the starter engaged for 4 seconds or 8 revolutions and the Camshaft Position (CMP) sensor signal indicating engine rotation This check is made every time the engine starts. This code indicates no crankshaft signal is being read by the CKP sensor or the ECM while a CMP sensor signalverifies engine rotation.

CIRCUIT DIAGRAM

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0335 is set.

- Turn ignition switch off.
- Disconnect Crankshaft Position (CKP) sensor.
- Measure resistance between CKP sensor connector terminals 2 and 1.

The resistance should be between 486 and 594 ohms at 68˚F (20˚C), is it?

YES

- Ignition off.
- CKP sensor disconnected.
- ECM connector disconnected.
- Measure resistance between ground and both CKP sensor harness connector terminals 2 and 1.

The resistance between both terminals and ground should indicate an open circuit, does it?

YES

- Ignition off.
- CKP sensor disconnected.
- ECM connector disconnected.
- Ground CKP sensor harness connector terminals 1 and 2. Measure resistance between ground and ECM harness connector terminals 27 and 29. Note resistance value.

Resistance measured should be approximately 1 ohm or less, is it?

YES

Verify ECM connector is secure. If OK, replace CKP sensor with known good component. Clear code and verify code does not reappear.
If problem persists, replace ECM.

NO

Repair open circuit in wire between CKP sensor harness terminal 1 and ECM harness connector terminal 29 or between CKP terminal 2 and ECM terminal 27. Clear code and verify code does not reappear.

NO

Repair short to ground in wire between CKP sensor harness terminal 1 and ECM harness connector terminal 29 or between CKP terminal 2 and ECM terminal 27.
Clear code and verify code does not reappear.

NO

Replace CKP sensor.
Clear code and verify CKP sensor is within normal parameters.

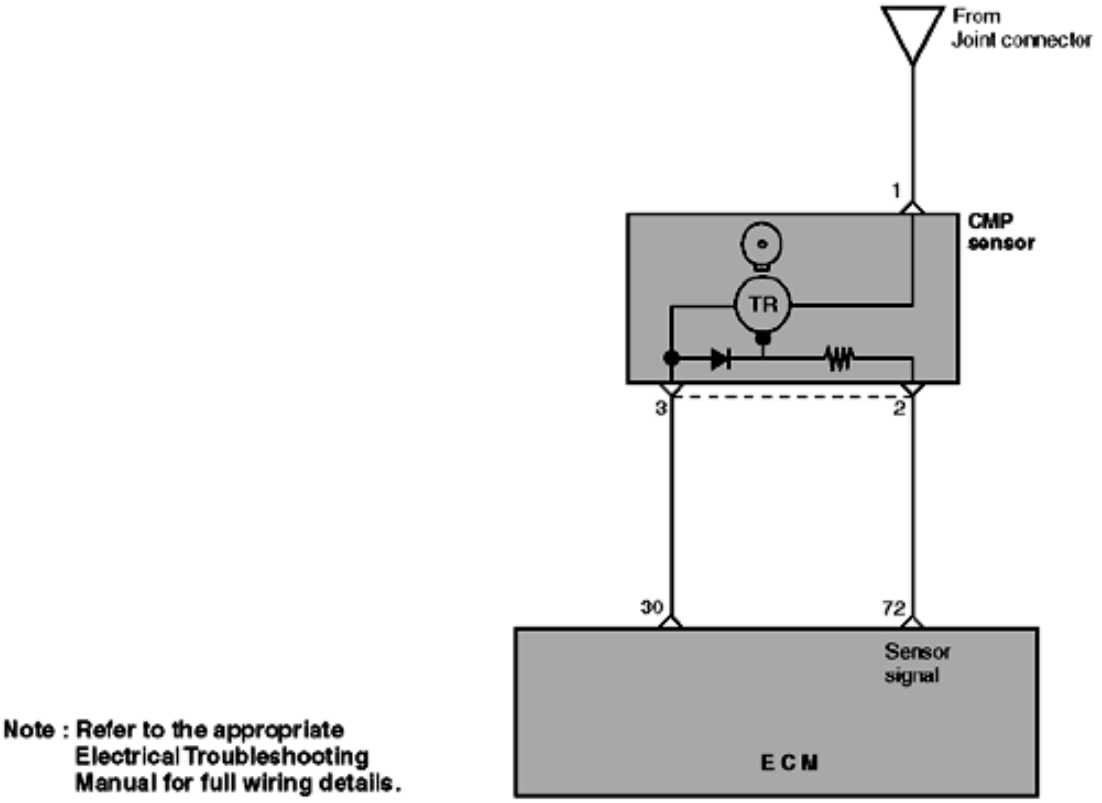
DTC	Diagnostic item
P0340	Camshaft Position Sensor Circuit Malfunction(Bank1 or Single Sensor)

DESCRIPTION

The Camshaft Position (CMP) sensor senses the Top Dead Center (TDC) point of the #1 cylinder in the compression stroke. The CMP sensor signal allows the Engine Control Module (ECM) to determine the fuel injector sequencestarting point.

FAILURE CONDITIONS

CIRCUIT DIAGRAM



TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to Data Link Connector.
- Verify DTC P0340 is set.

- Camshaft Position (CMP) sensor connected.
- Ignition on.
- Measure voltage between ground and CMP sensor harness connector terminal 1.

Battery voltage should be measured, is it?

YES

- CMP sensor connected.
- Ignition on and engine running.
- Measure voltage between CMP sensor harness connector terminals 2 and 3 with the engine running between 700 to 3000 RPM.

The voltage should vary between 0 and 5 volts, does it?

YES

- Ignition off.
- Disconnect CMP sensor.
- Ground CMP sensor harness connector terminal 2.
- Measure resistance between ground and ECM harness connector terminal 72.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Ignition off.
- CMP sensor disconnected.
- Disconnect ECM connector.
- Measure resistance between ground and CMP sensor harness connector terminal 2.

Resistance should indicate an open circuit, does it?

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NO

Repair open circuit in wire between CMP sensor harness connector terminal 1 and Engine compartment junction block.
Clear code and verify CMP sensor signal is within normal parameters.

NO

Replace CMP sensor.
Clear code and verify CMP sensor signal is within normal parameters.

NO

Repair open circuit in wire between CMP sensor harness connector terminal 2 and ECM connector terminal 72.
Clear code and verify CMP sensor signal is within normal parameters.

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YES

- Ignition off.
- CMP sensor disconnected.
- Measure resistance between ground and CMP harness connector terminal 3.

Resistance measured should be approximately 1 ohm or less, is it?

NO

Repair short to ground in wire between CMP sensor harness connector terminal 2 and ECM connector terminal 72.
Clear code and verify CMP sensor signal is within normal parameters.

YES

- Inspect CMP sensor for debris or misadjustment. Also check engine timing (shop manual section EM).

Is CMP sensor and timing OK?

NO

Repair open or poor connection between CMP sensor harness connector terminal 3 and ground. Clear code and verify CMP sensor signal is within normal parameters.

YES

Verify ECM connector is secure. If OK, replace ECM. Clear code and verify CMP sensor signal is within normal parameters.

NO

Repair or replace CMP sensor as needed. Clear code and verify CMP sensor signal is within normal paramters.

DTC	Diagnostic item
P0420	Catalyst System Efficiency below Threshold (Bank 1)

DESCRIPTION

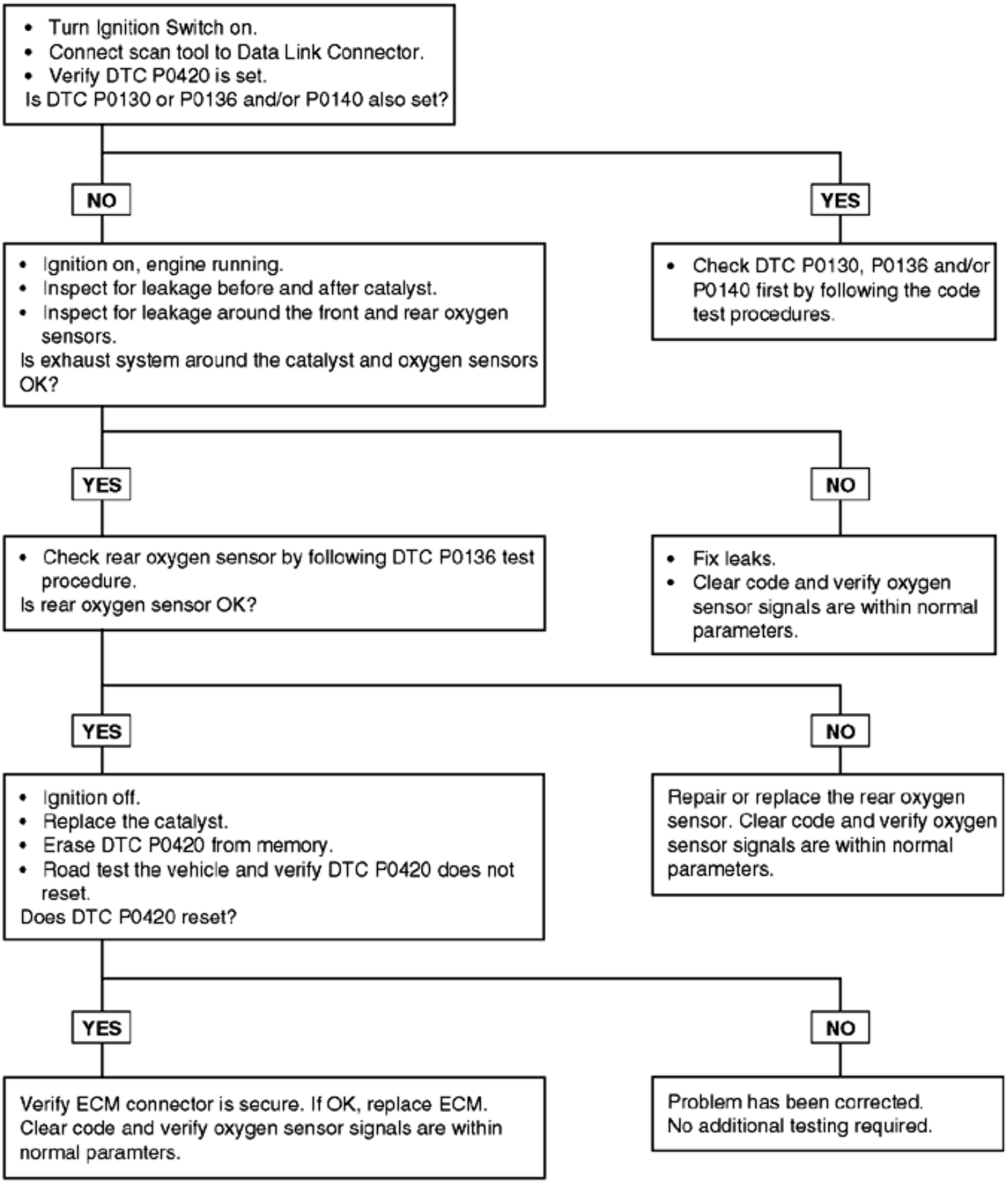
The catalyst's efficiency is demonstrated in its ability to oxidize CO and HC emissions. The Engine Control Module (ECM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert HC and CO into H2O and CO2 with the same efficiency as when it was new. A completely worncatalyst shows a 100% match between front and rear sensor outputs.

FAILURE CONDITIONS

The efficiency of the catalytic converter is measured by comparing the activity of the front and rear oxygen sensors. The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if the front and rear oxygen sensor signals match more than 60% of the time in two of four 170 second monitoring periods during two driving cycles. The measurements are taken when the followingconditions are met:

1. The ECM is operating in closed loop.
2. The engine speed is between 1800 and 3200 PRM.
3. The catalyst temperature is above 702°F (372°C).
4. The canister purge function is greater than 0.9.
5. The vehicle is not shifting gears.
6. The engine load is between 1.4 milliseconds and 4.5 milliseconds.

TEST PROCEDURE


• Turn Ignition Switch on.
• Connect scan tool to Data Link Connector.
• Verify DTC P0420 is set.
Is DTC P0130 or P0136 and/or P0140 also set?
NO
YES
• Ignition on, engine running.
• Inspect for leakage before and after catalyst.
• Inspect for leakage around the front and rear oxygen sensors.
Is exhaust system around the catalyst and oxygen sensors OK?
• Check DTC P0130, P0136 and/or P0140 first by following the code test procedures.
YES
NO
• Check rear oxygen sensor by following DTC P0136 test procedure.
Is rear oxygen sensor OK?
• Fix leaks.
• Clear code and verify oxygen sensor signals are within normal parameters.
YES
NO
• Ignition off.
• Replace the catalyst.
• Erase DTC P0420 from memory.
• Road test the vehicle and verify DTC P0420 does not reset.
Does DTC P0420 reset?
Repair or replace the rear oxygen sensor. Clear code and verify oxygen sensor signals are within normal parameters.
YES
NO
Verify ECM connector is secure. If OK, replace ECM. Clear code and verify oxygen sensor signals are within normal paramters.
Problem has been corrected.
No additional testing required.

DTC	Diagnostic item
P0444 P0445	Evap. Emission Ctrl. System - Purge Ctrl. Valve Circuit Open Evap. Emission Ctrl. System - Purge Ctrl. Valve Circuit Shorted

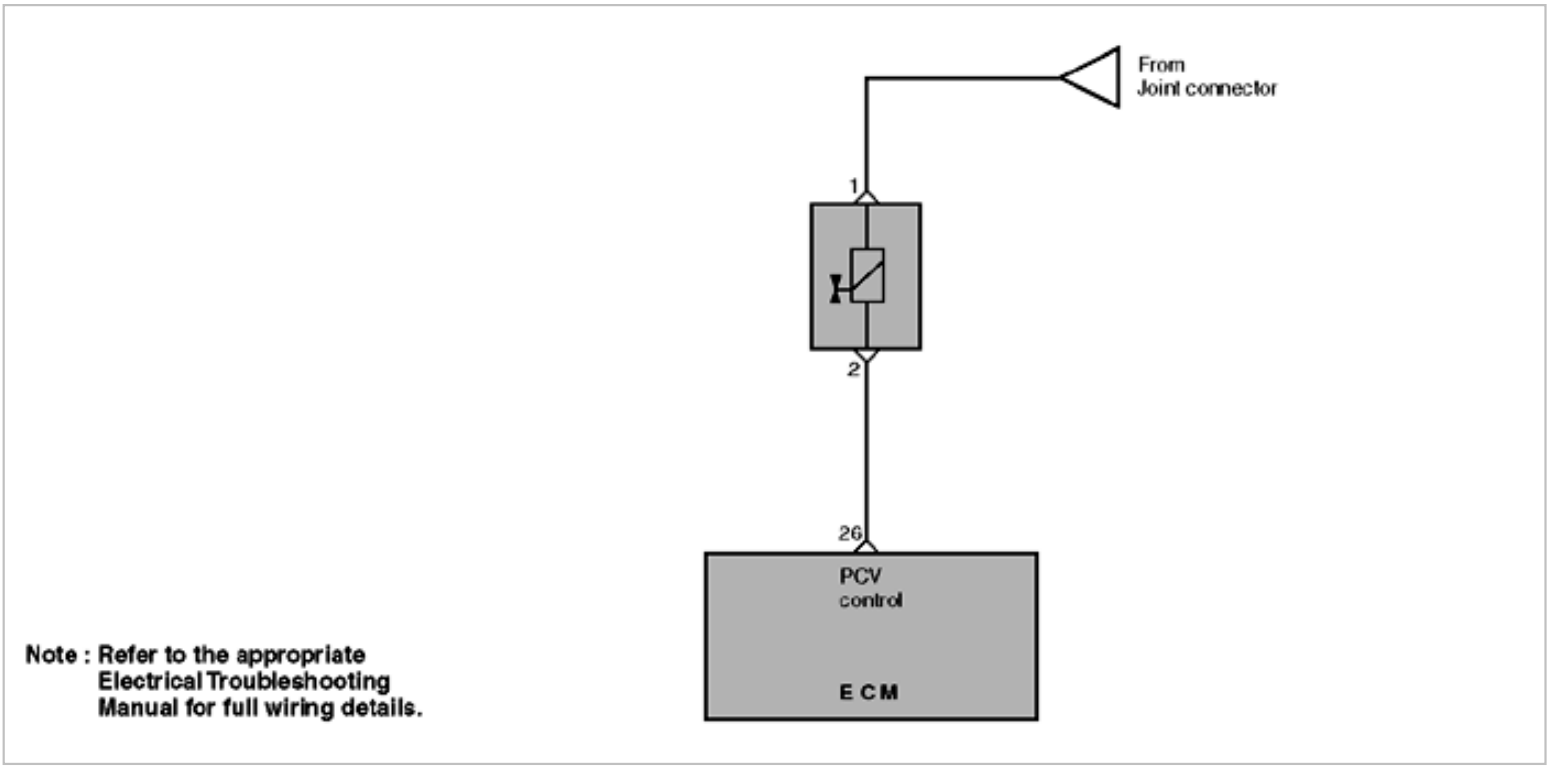
DESCRIPTION

The Purge Control Solenoid Valve is part of the Evaporative Emission Control System. The solenoid controls purge air from the evaporative emissioncanister.

FAILURE CONDITIONS

The ECM will set P0444 and the MIL will turn on if an open circuit is detected in the driver stage of the purge control solenoid circuit duringtwo driving cycles.
The ECM will set P0445 and the MIL will turn on if a short circuit is detected in the driver stage of the purge control solenoid circuit duringtwo driving cycles.

CIRCUIT DIAGRAM



TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0444 or P0445 is set.

- Turn ignition off.
- Disconnect the purge control solenoid valve connector.
- Turn ignition on.
- Measure voltage between ground and the purge control solenoid valve harness connector terminal 1.

Battery voltage should be present, is it?

YES

- Purge control solenoid valve disconnected.
- Disconnect ECM connector.
- Turn ignition off.
- Ground purge control solenoid valve harness connector terminal 2.
- Measure resistance between ground and ECM harness connector terminal 26.

Resistance measured should be approximatley 1 ohm or less, is it?

YES

- Ignition off.
- Purge control solenoid valve disconnected.
- Disconnect ECM connector.
- Measure resistance between ground and purge control solenoid valve harness connector terminal 2.

Resistance should indicate an open circuit, does it?

YES

- Ignition off.
- Purge control solenoid valve disconnected.
- Measure resistance between the purge control solenoid valve connector terminals 1 and 2.

Resistance should be approximately 26 ohms, is it?

YES

Verify ECM connector is secure. If OK, replace purge control solenoid valve with a known good component. Clear code and verify purge control solenoid valve is within normal parameters. If problem persists, replace ECM.

NO

Repair open or short to ground in wire between Engine compartment junction block and purge control solenoid valve connector terminal 1. Clear code and verify code does not reappear.

NO

Repair open in wire between ECM connector terminal 26 and purge control solenoid valve connector terminal 2. Clear code and verify code does not reappear.

NO

Repair short to ground or another circuit in the between ECM connector terminal 26 and purge control solenoid valve connector terminal 2. Clear code and verify code does not reappear.

NO

Replace purge control solenoid valve. Clear code and verify purge control solenoid valve is within normal parameters.

DTC	Diagnostic item
P0501	Vehicle Speed Sensor Range / Performance

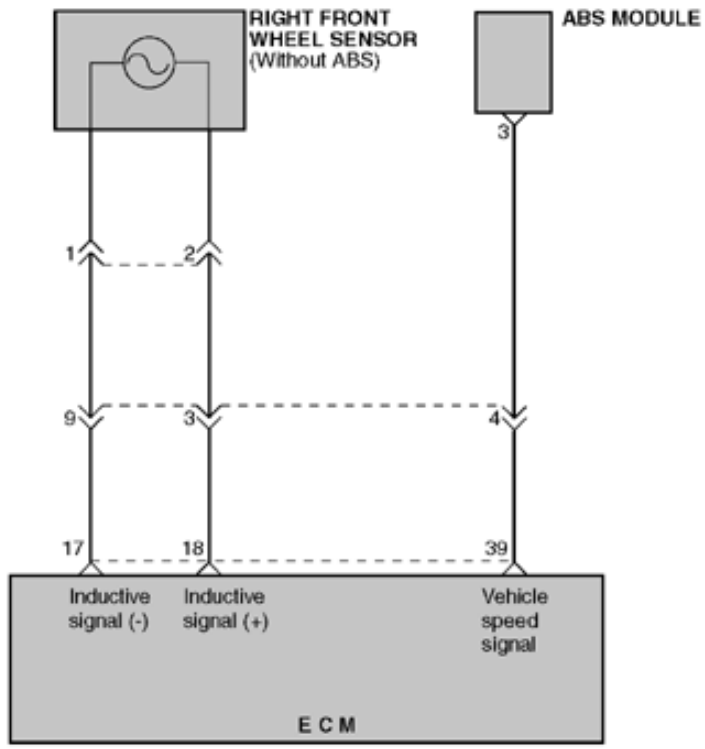
DESCRIPTION

The Vehicle Speed Sensor is a wheel speed sensor that is built near the wheel disc. The sensor converts the transaxle gear revolutions of thedisc into a pulse signal which is sent to the ECM.

FAILURE CONDITIONS

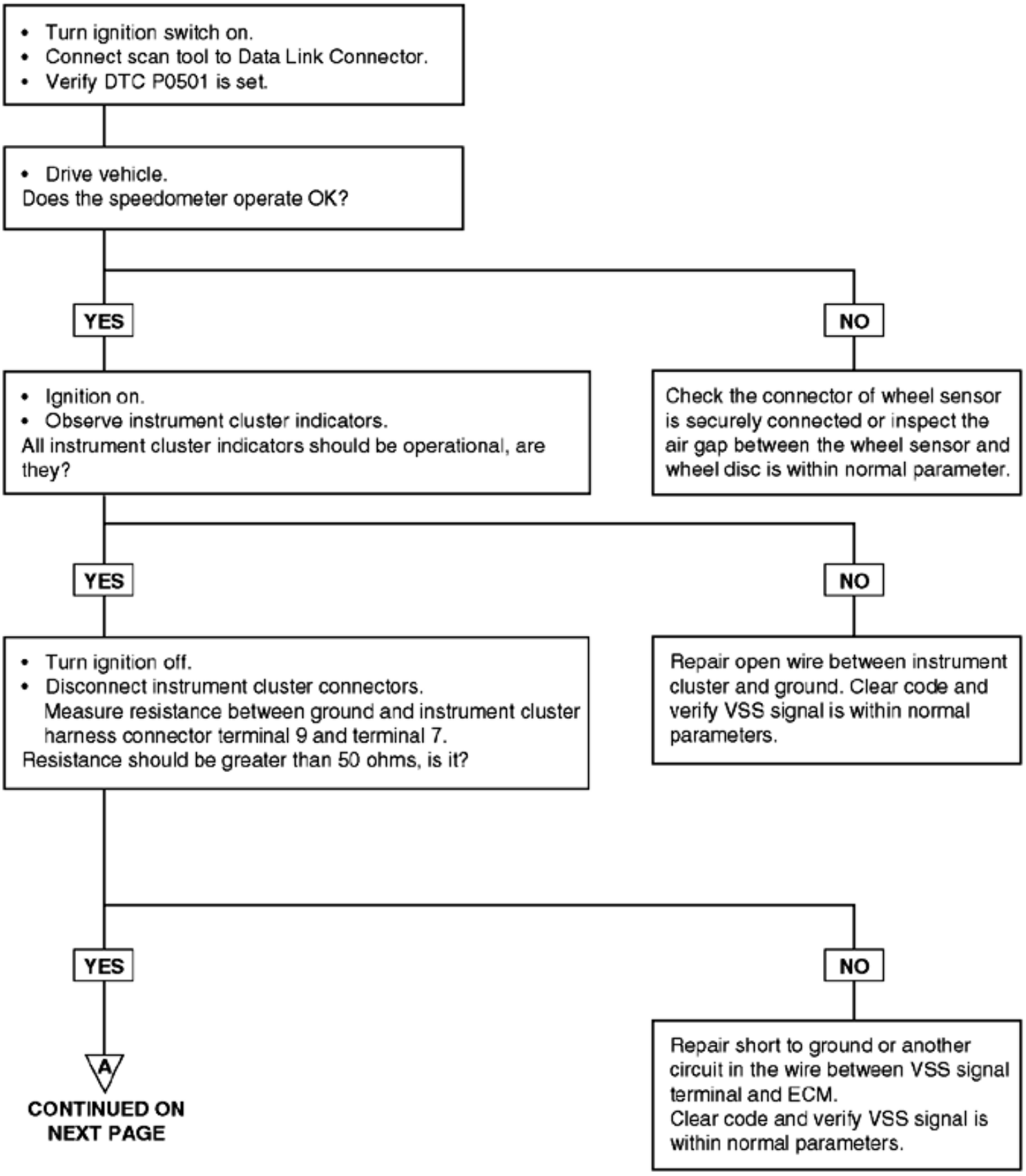
The ECM will set a code and the Malfunction Indicator Lamp (MIL) will turn on if there is no vehicle speed sensor output signal for 20 seconds duringtwo driving cycles when the following conditions are met:

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE


• Turn ignition switch on.
• Connect scan tool to Data Link Connector.
• Verify DTC P0501 is set.
• Drive vehicle.
Does the speedometer operate OK?
YES
NO
Check the connector of wheel sensor is securely connected or inspect the air gap between the wheel sensor and wheel disc is within normal parameter.
• Ignition on.
• Observe instrument cluster indicators.
All instrument cluster indicators should be operational, are they?
YES
NO
Repair open wire between instrument cluster and ground. Clear code and verify VSS signal is within normal parameters.
• Turn ignition off.
• Disconnect instrument cluster connectors.
Measure resistance between ground and instrument cluster harness connector terminal 9 and terminal 7.
Resistance should be greater than 50 ohms, is it?
YES
NO
Repair short to ground or another circuit in the wire between VSS signal terminal and ECM.
Clear code and verify VSS signal is within normal parameters.
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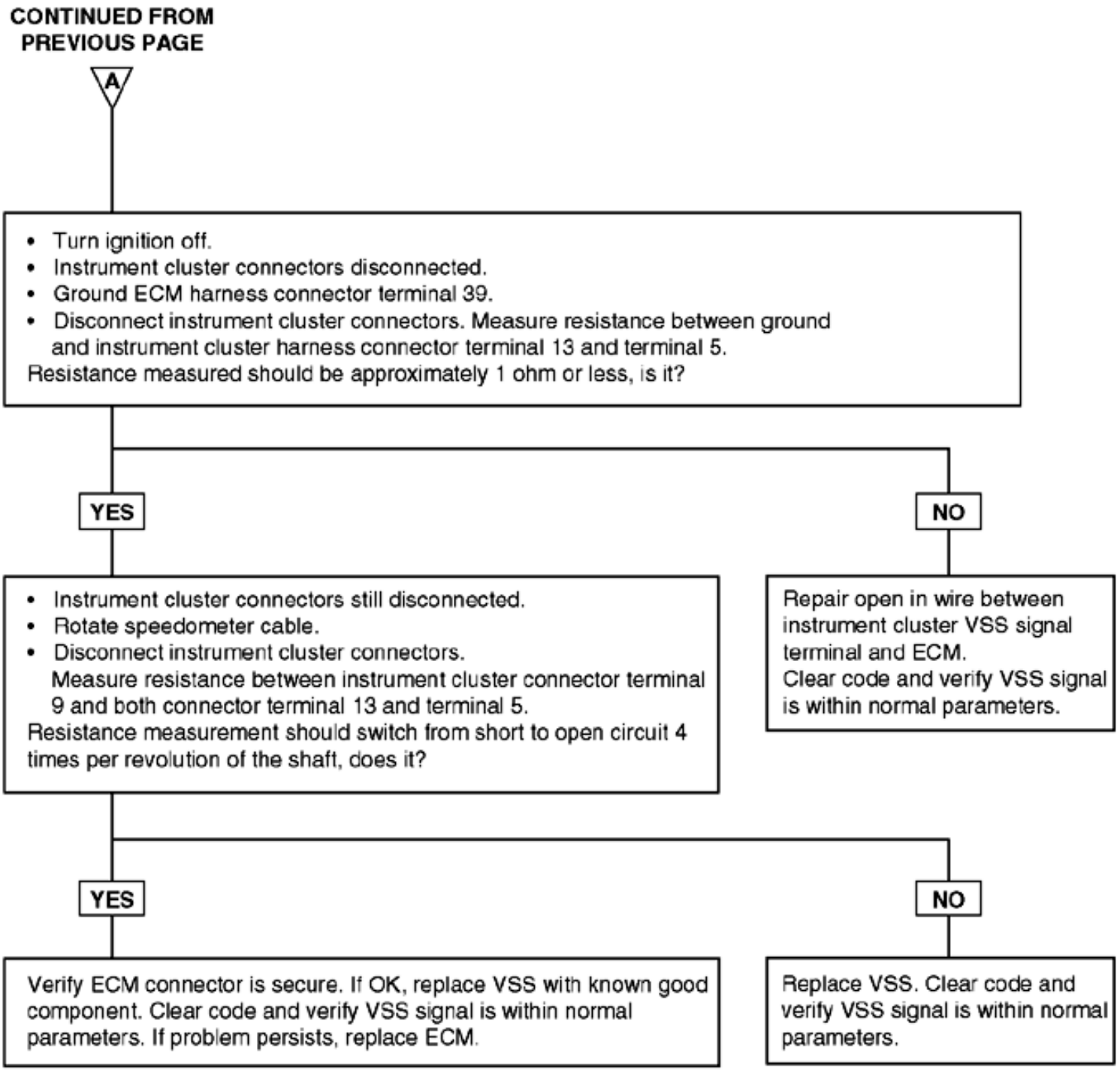
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• Turn ignition off.
• Instrument cluster connectors disconnected.
• Ground ECM harness connector terminal 39.
• Disconnect instrument cluster connectors. Measure resistance between ground and instrument cluster harness connector terminal 13 and terminal 5.
Resistance measured should be approximately 1 ohm or less, is it?
YES
NO
• Instrument cluster connectors still disconnected.
• Rotate speedometer cable.
• Disconnect instrument cluster connectors.
Measure resistance between instrument cluster connector terminal 9 and both connector terminal 13 and terminal 5.
Resistance measurement should switch from short to open circuit 4 times per revolution of the shaft, does it?
Repair open in wire between instrument cluster VSS signal terminal and ECM.
Clear code and verify VSS signal is within normal parameters.
YES
NO
Verify ECM connector is secure. If OK, replace VSS with known good component. Clear code and verify VSS signal is within normal parameters. If problem persists, replace ECM.
Replace VSS. Clear code and verify VSS signal is within normal parameters.

DTC	Diagnostic item
P0506 P0507	Idle Control System - RPM lower than expected Idle Control System - RPM higher than expected

DESCRIPTION

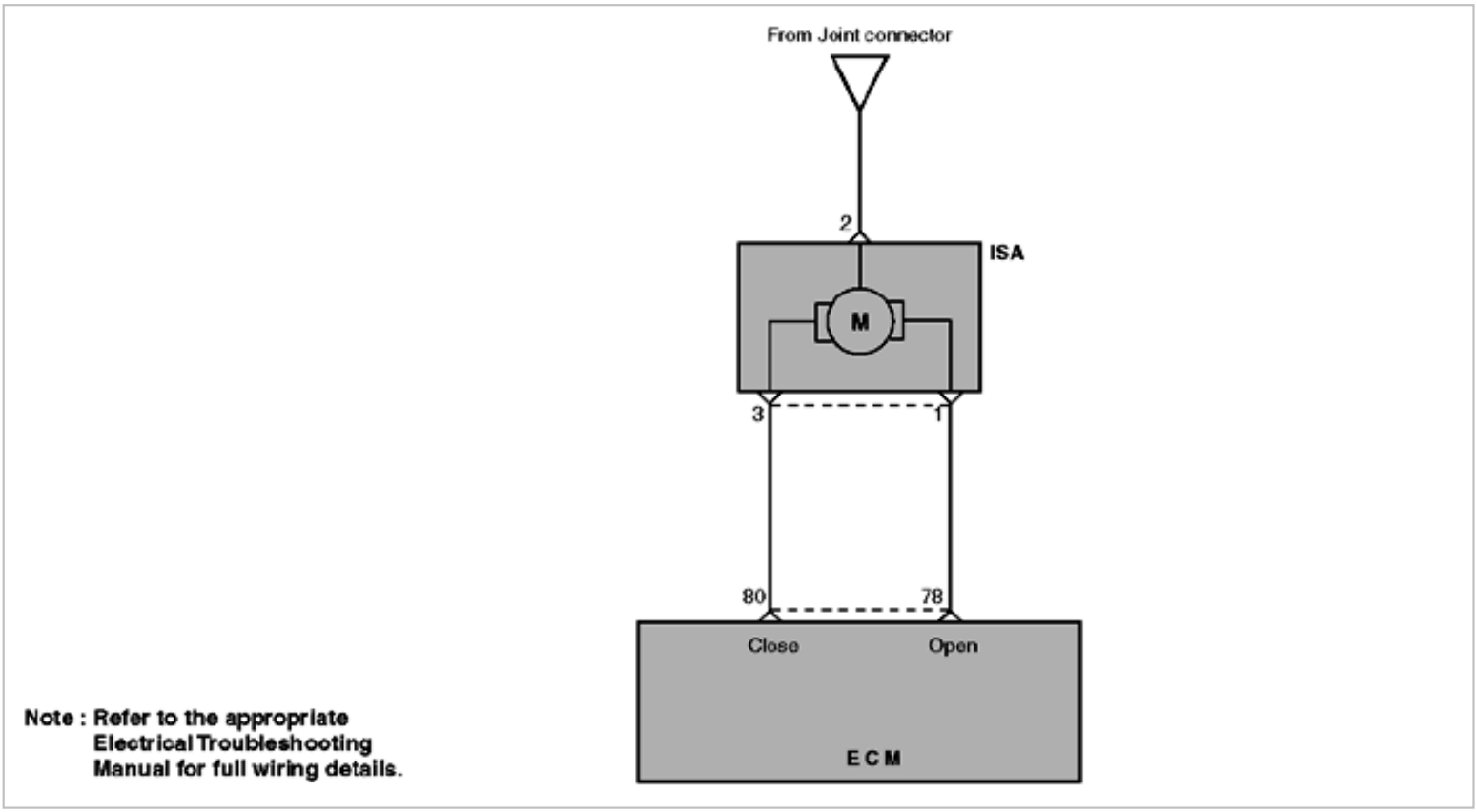
The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic forces of the two coils which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line isarranged where the ISC actuator is inserted.

FAILURE CONDITIONS

The ECM will set P0506 or P0507 and the MIL will turn on if for 15 seconds the ISC actuator driver circuit values and engine idle speed are not in agreement with values stored in the ECM during two driving cycles when the followingconditions are met:

1. The ISC actuator passes idle air at a rate above 4.1 g/s. [for P0506] or 1.7 g/s [for P0507].
2. Engine speed deviation is below 200 RPM.
3. Vehicle speed is zero.
4. Engine coolant temperature is above 167°F (75°C).

CIRCUIT DIAGRAM



TEST PROCEDURE

- Turn ignition switch on.
- Connector scan tool to data link connector.
- Verify DTC P0506 or P0507 is set.

Is DTC P0121, P0122 or P0123 also set?

NO

- Disconnect Idle Speed Control (ISC) actuator connector.
- Ignition on.
- Measure voltage between ISC actuator harness connector terminals 2 and ground.

Battery voltage should be present, is it?

YES

- Turn ignition off.
- ISC actuator connector disconnected.
- Ground ISC actuator harness connector terminals 1 and 3.
- Measure resistance between ground and ECM harness connector terminal 78 and 80.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Ignition off.
- ISC actuator connector disconnected.
- Measure resistance between ground and both ISC actuator harness connector terminals 1 and 3.

Resistance should indicate an open circuit for each measurement, does it?

YES

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NO

Repair short to ground or other circuit in wire between ECM harness connector terminal 78 and ISC actuator connector terminal 1 or between ECM terminal 80 and ISC terminal 3. Clear code and verify code does not reappear.

NO

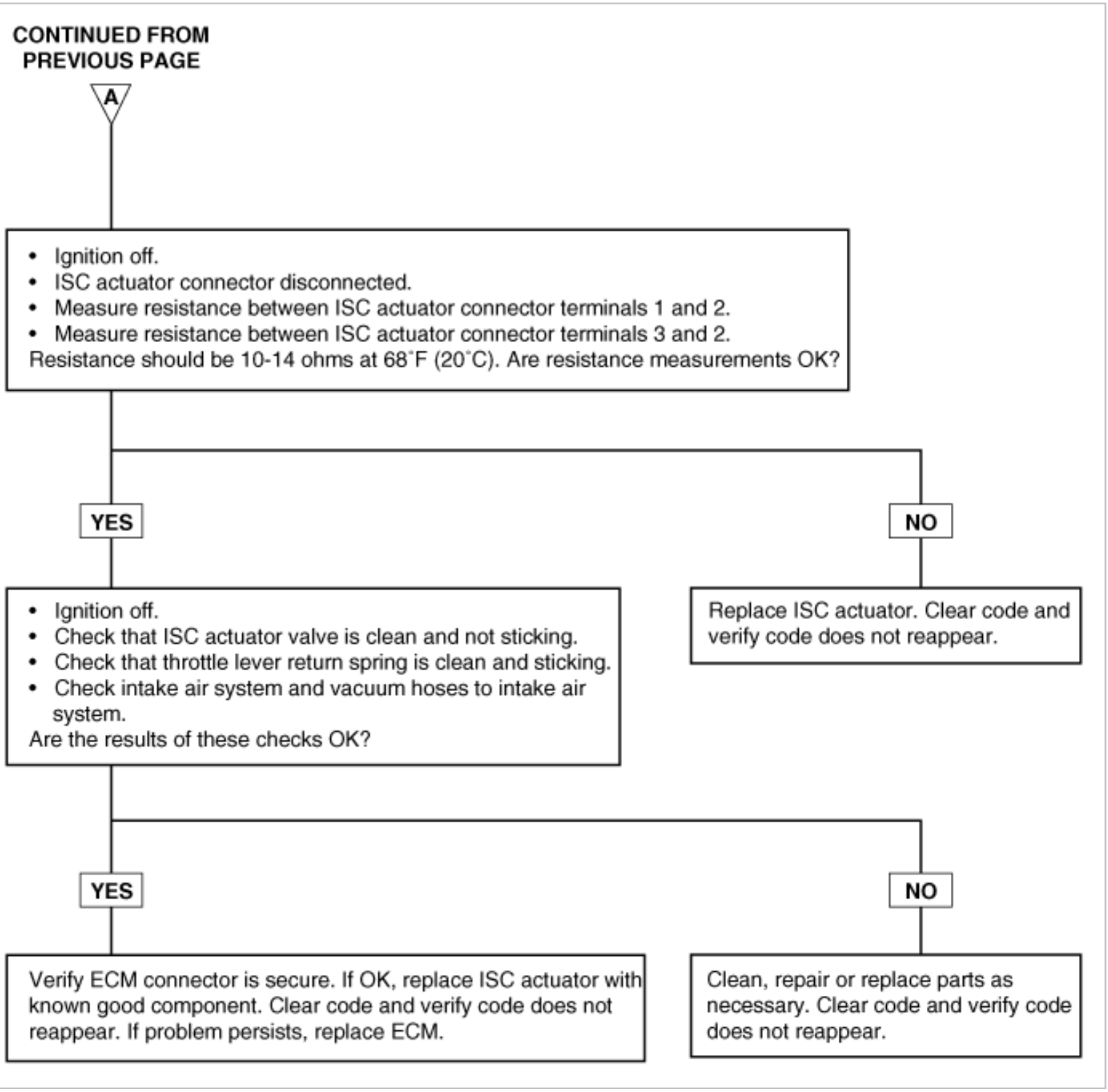
Repair open in wire between ECM harness connector terminal 78 and ISC actuator connector terminal 1 or between ECM terminal 80 and ISC terminal 3. Clear code and verify code does not reappear.

NO

Repair open circuit wire between Engine compartment junction block and ISC actuator terminal 2. Clear code and verify code does not reappear.

YES

Perform DTC P0121, P0122 and/or P0123 test procedure.



DTC	Diagnostic item
P1505	Idle Charge Actuator Signal Low of Coil #1
P1506	Idle Charge Actuator Signal High of Coil #1
P1507	Idle Charge Actuator Signal Low of Coil #2
P1508	Idle Charge Actuator Signal High of Coil #2

DESCRIPTION

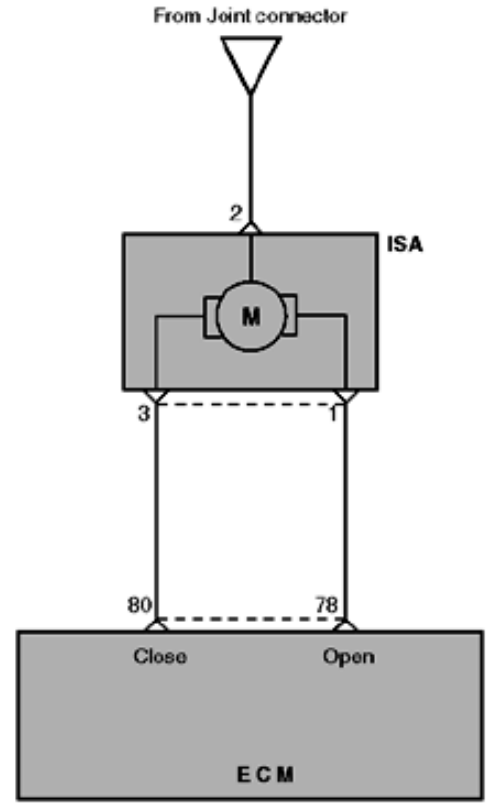
The Idle Speed Control (ISC) actuator has two coils that are driven by separate ECM driver stages. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different directions for the magnetic

forces of the two coils which will result in different positions for the actuator. In parallel to the throttle valve, a bypass hose line isarranged where the ISC actuator is inserted.

FAILURE CONDITIONS

The ECM will set a code and the MIL will turn on if ISC actuator's opening coil driver stage [for P1505, P1506] or closing coil driver stage [for P1507,P1508] is shorted to battery voltage during two driving cycles.

CIRCUIT DIAGRAM



Note : Refer to the appropriate Electrical Troubleshooting Manual for full wiring details.

TEST PROCEDURE

- Turn ignition switch on.
- Connector scan tool to data link connector.
- Verify DTC P1505, P1506, P1507 or P1508 is set.

- Disconnect Idle Speed Control (ISC) actuator connector.
- Ignition on.
- Measure voltage between ISC actuator harness connector terminals 2 and ground.

Battery voltage should be present, is it?

YES

- Ignition on.
- ISC actuator connector disconnected.
- Measure voltage between ground and ISC actuator harness connector terminal 1.
- Measure voltage between ground and ISC actuator harness connector terminal 3.

Both voltage measurements should be less than 0.5 volts, are they?

YES

- Ignition off.
- ISC actuator connector disconnected.
- Measure resistance between ISC actuator connector terminals 1 and 2.
- Measure resistance between ISC actuator connector terminals 2 and 3.

Resistance should be 10-14 ohms at 68°F (20°C).
Are resistance measurements OK?

YES

Verify ECM connector is secure.
If OK, replace ISC actuator with known good component.
Clear code and verify code does not reappear.
If problem persists, replace ECM.

NO

Replace ISC actuator. Clear code and verify code does not reappear.

NO

Repair open circuit in wire between ECM harness connector terminal 80 and ISC actuator connector terminal 3 or between ECM terminal 78 and ISC terminal 1.
Clear code and verify code does not reappear.

NO

Repair open wire between Engine compartment junction block and ISC actuator harness connector terminal 2.
Clear code and verify code does not reappear.