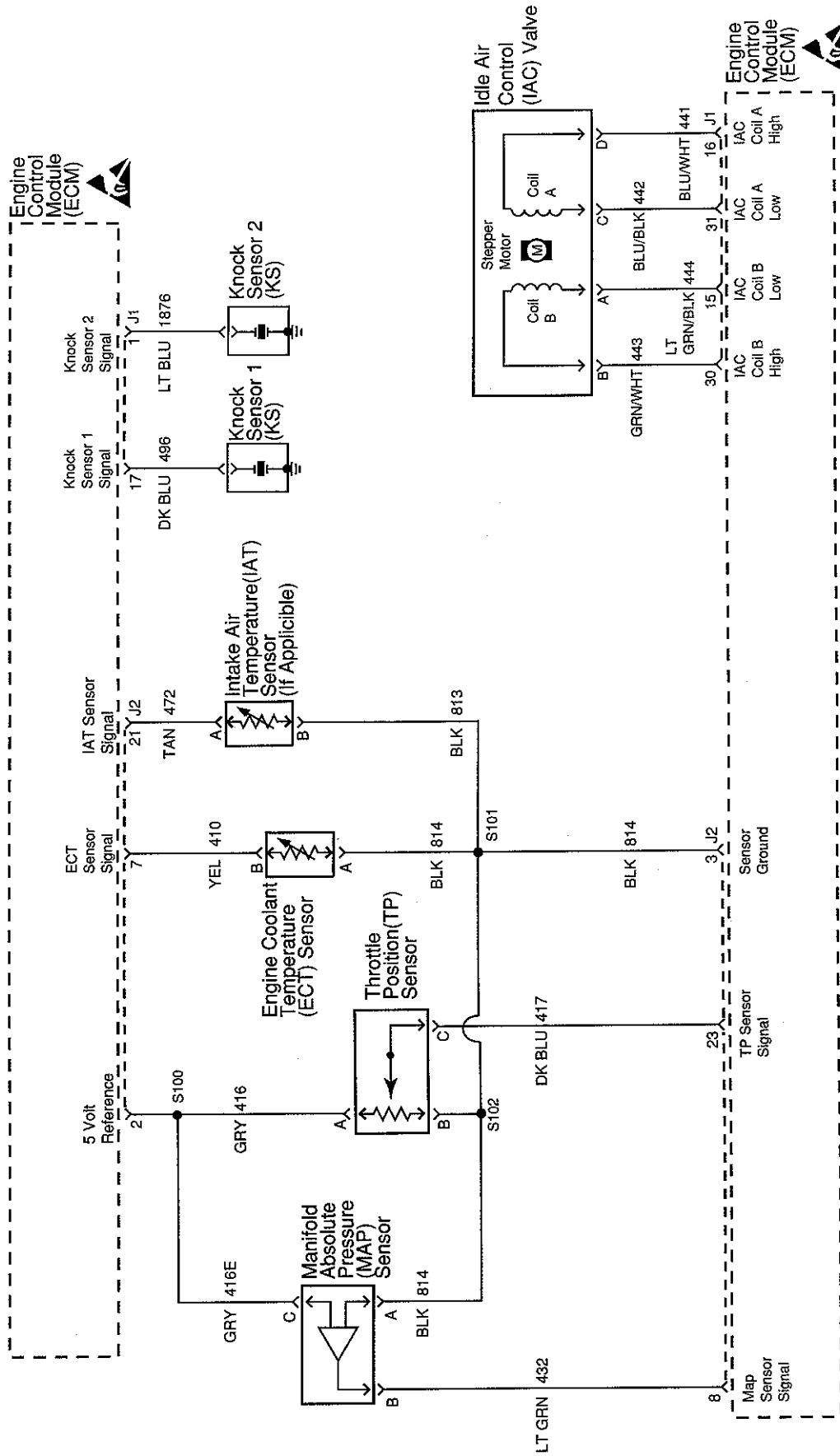
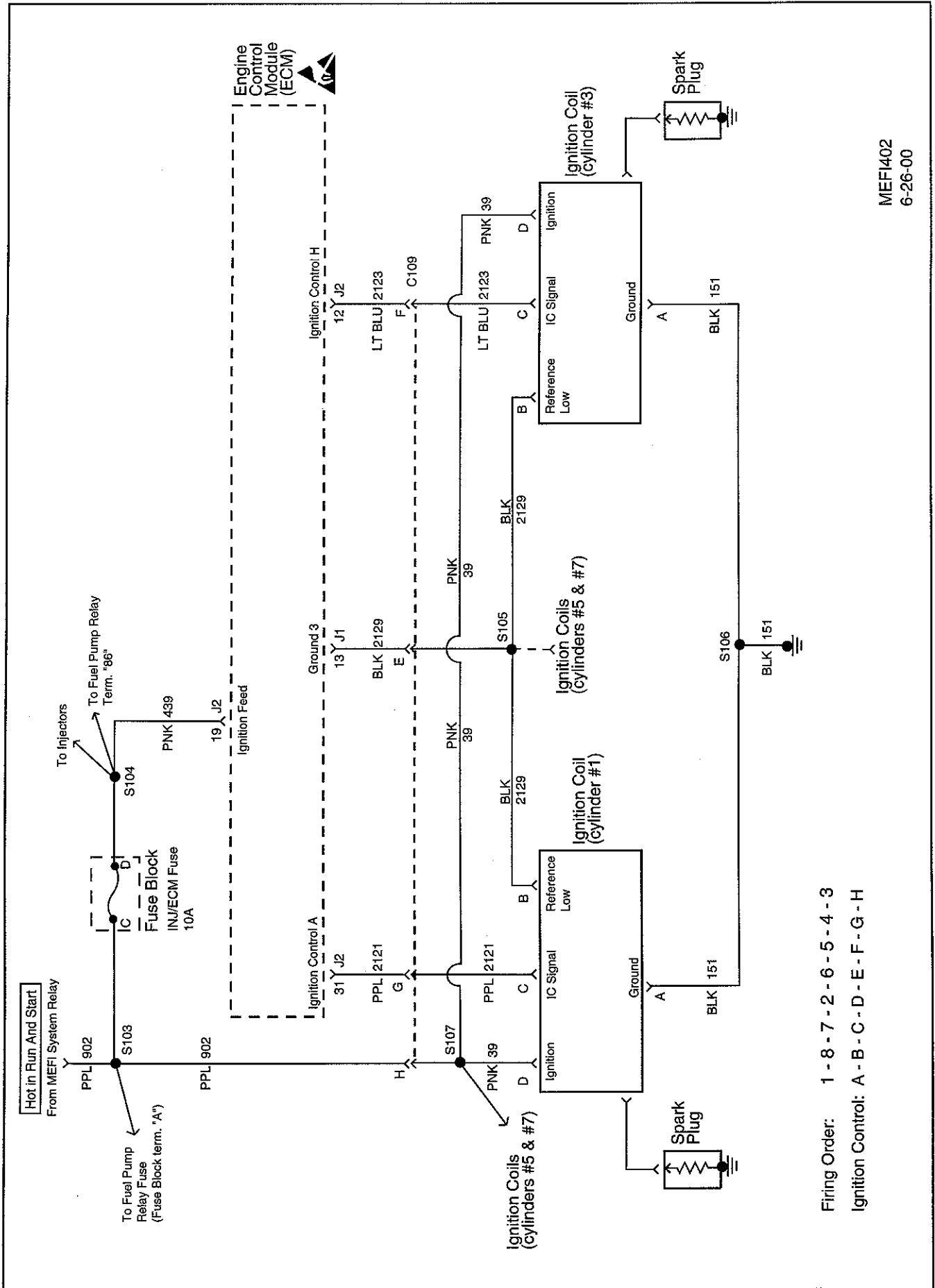


Engine Controls Schematics (8.1L - Sensors)



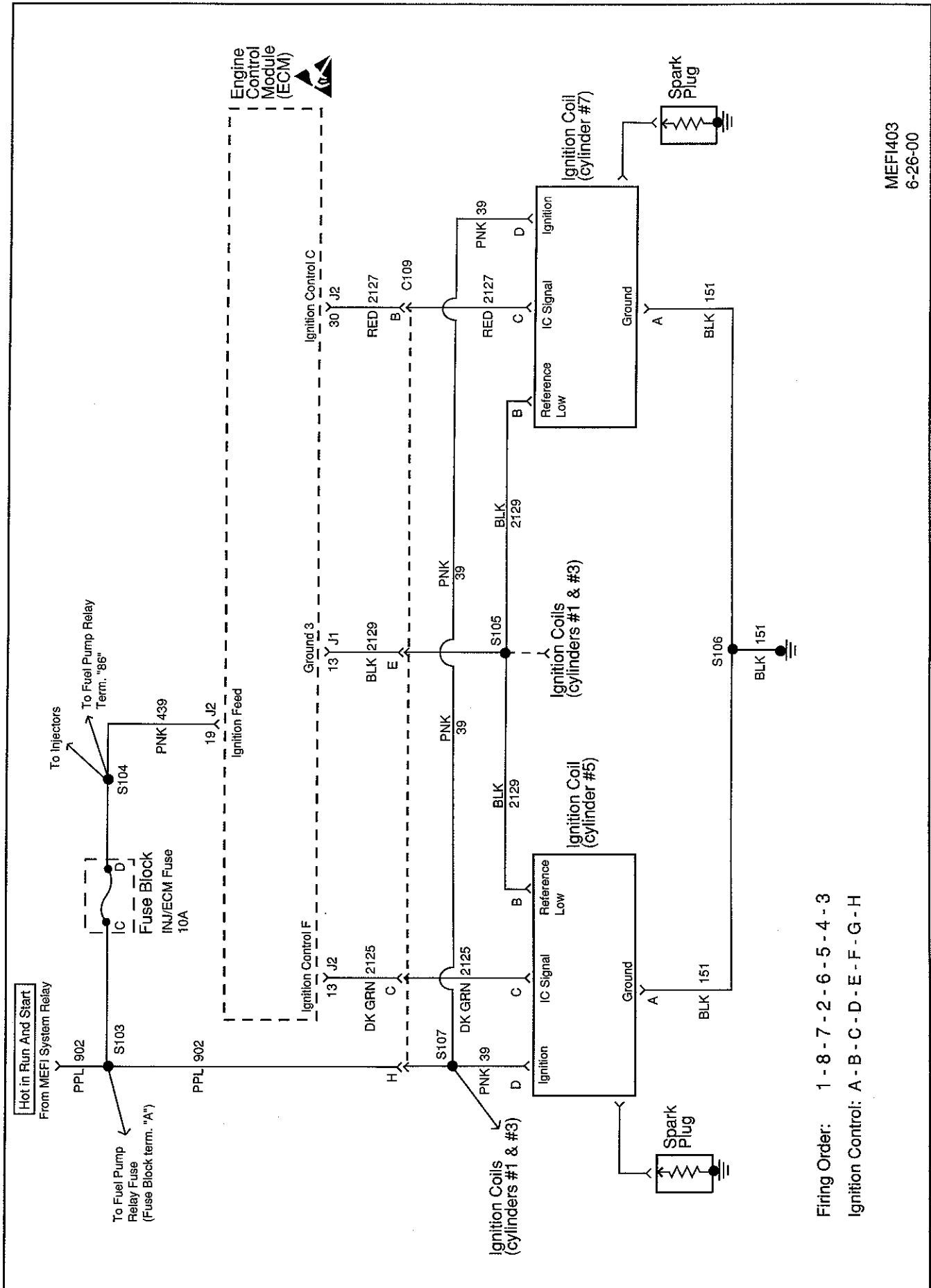
MEFI401
5-17-00

Engine Controls Schematics (8.1L - Ignition Coils 1 & 3)



Firing Order: 1 - 8 - 7 - 2 - 6 - 5 - 4 - 3
 Ignition Control: A - B - C - D - E - F - G - H

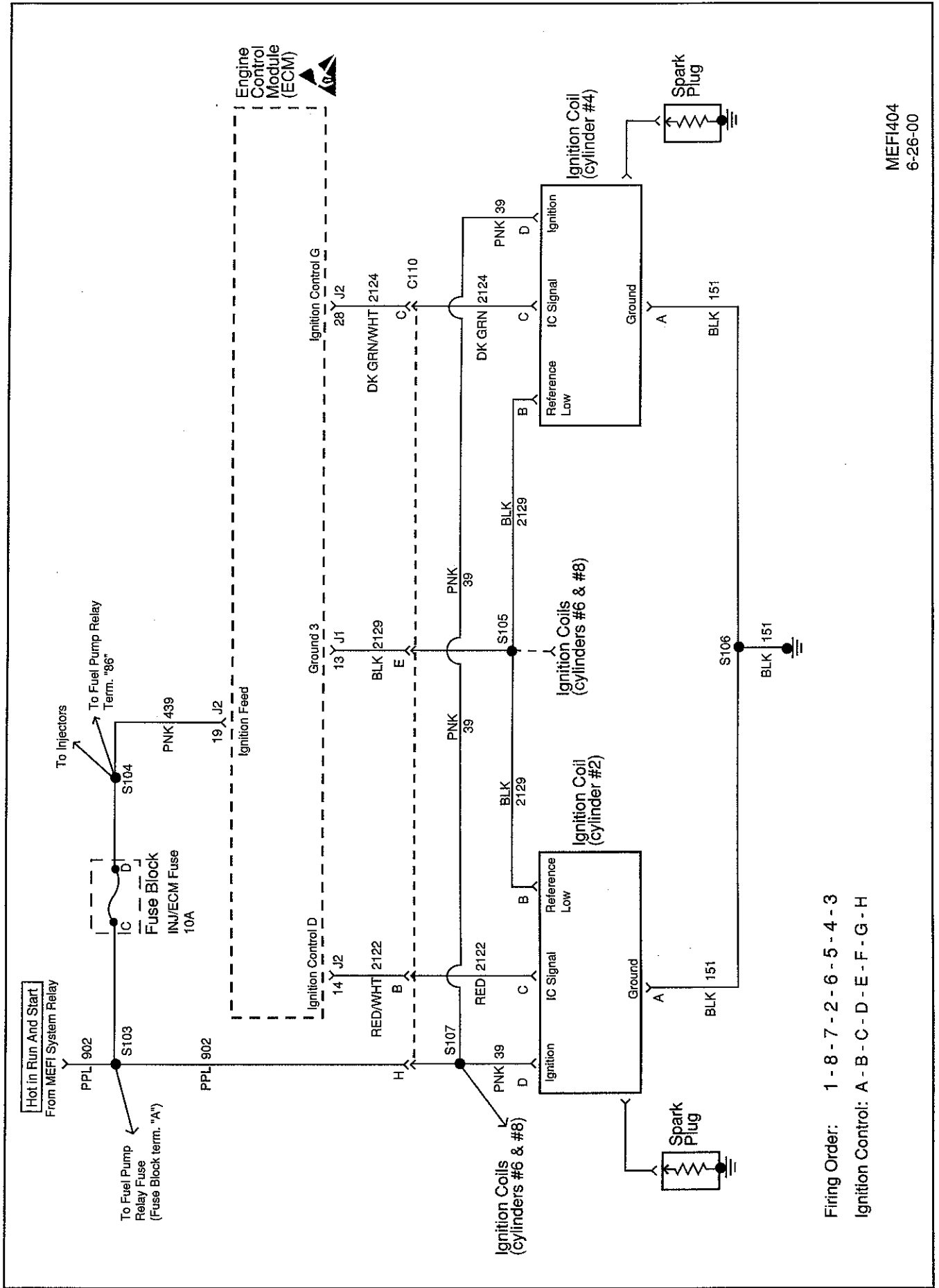
Engine Controls Schematics (8.1L - Ignition Coils 5 & 7)



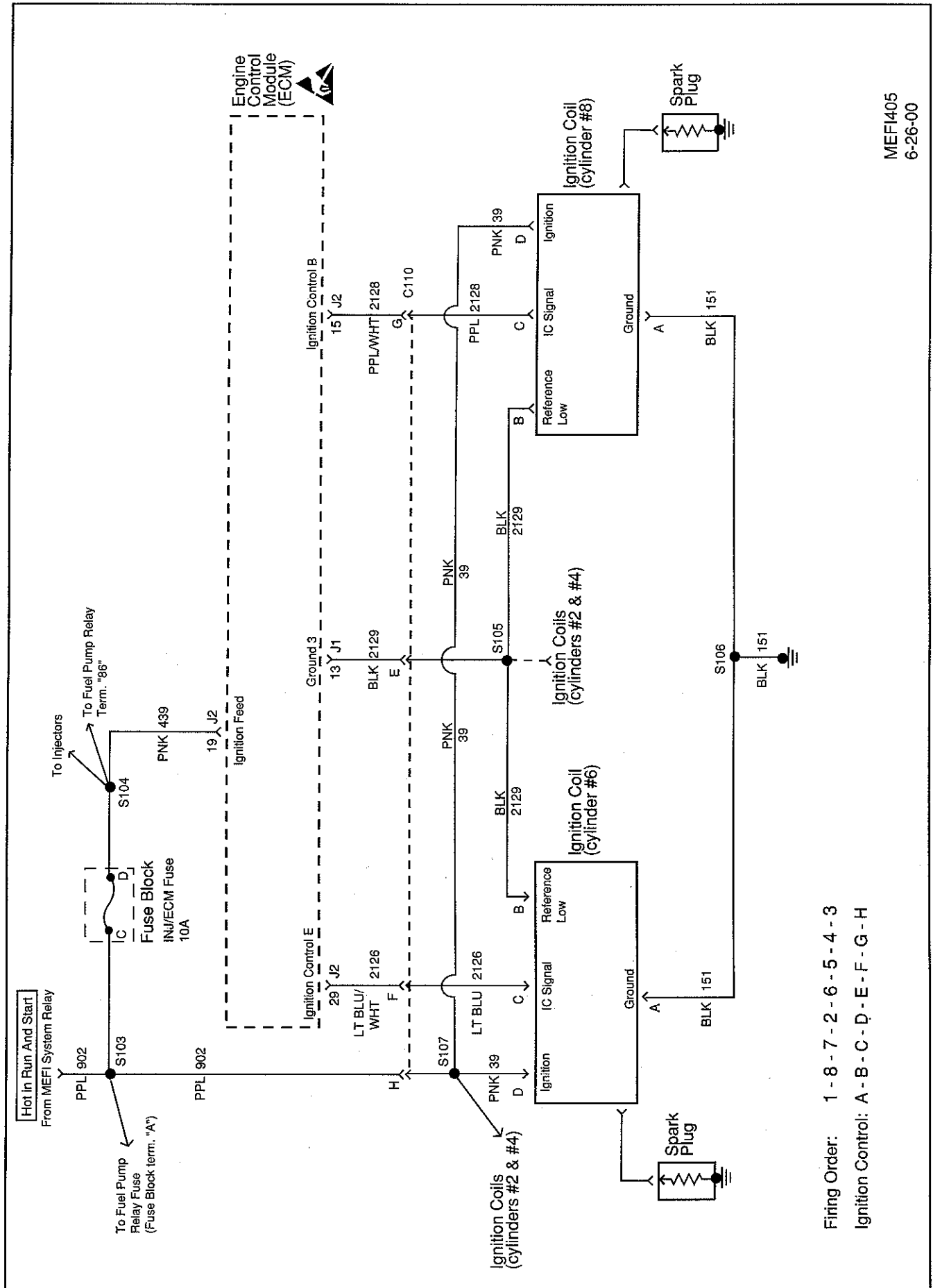
Firing Order: 1 - 8 - 7 - 2 - 6 - 5 - 4 - 3
 Ignition Control: A - B - C - D - E - F - G - H

MEFI403
 6-26-00

Engine Controls Schematics (8.1L - Ignition Coils 2 & 4)



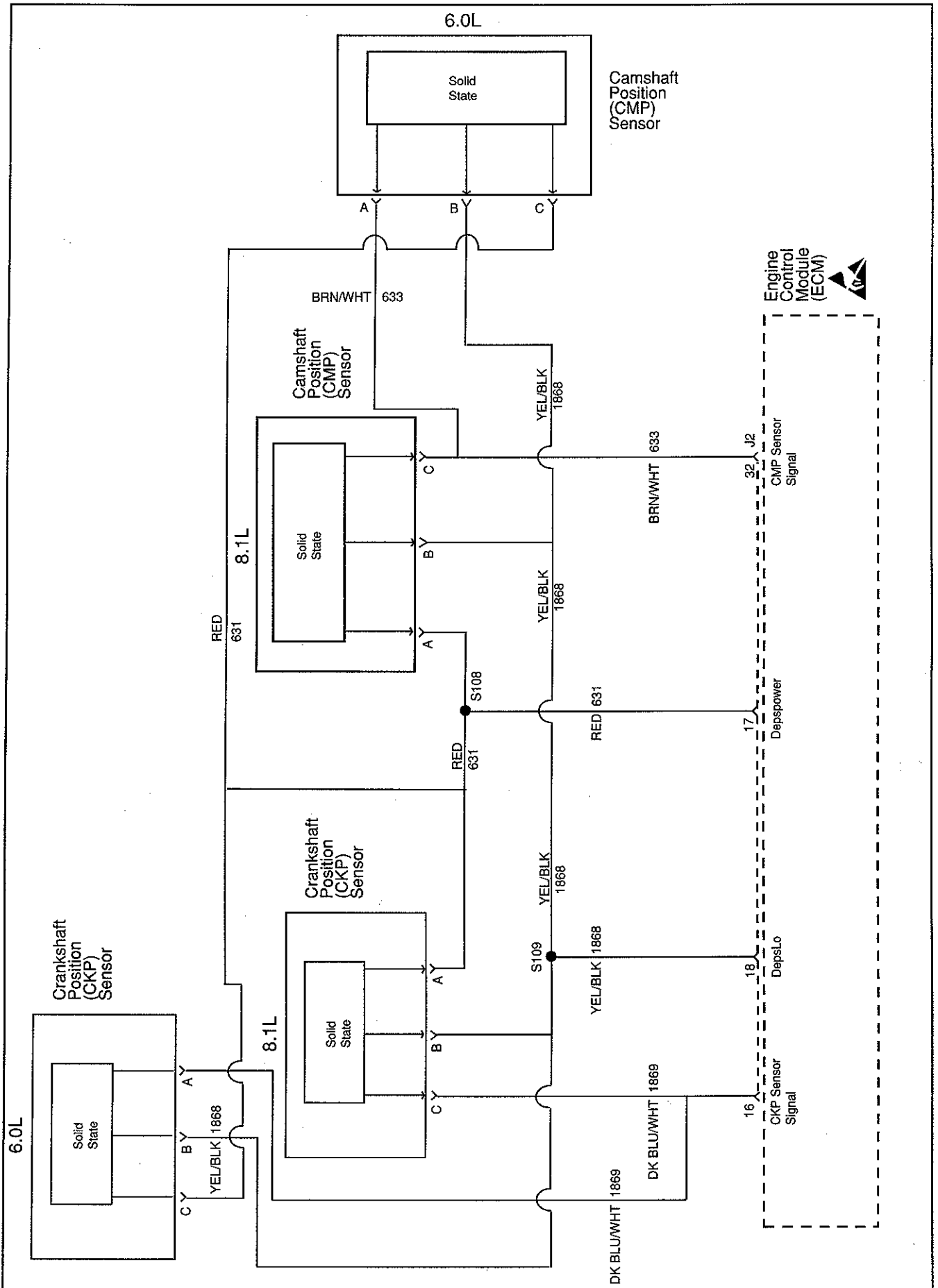
Engine Controls Schematics (8.1L - Ignition Coils 6 & 8)



MEFI405
6-26-00

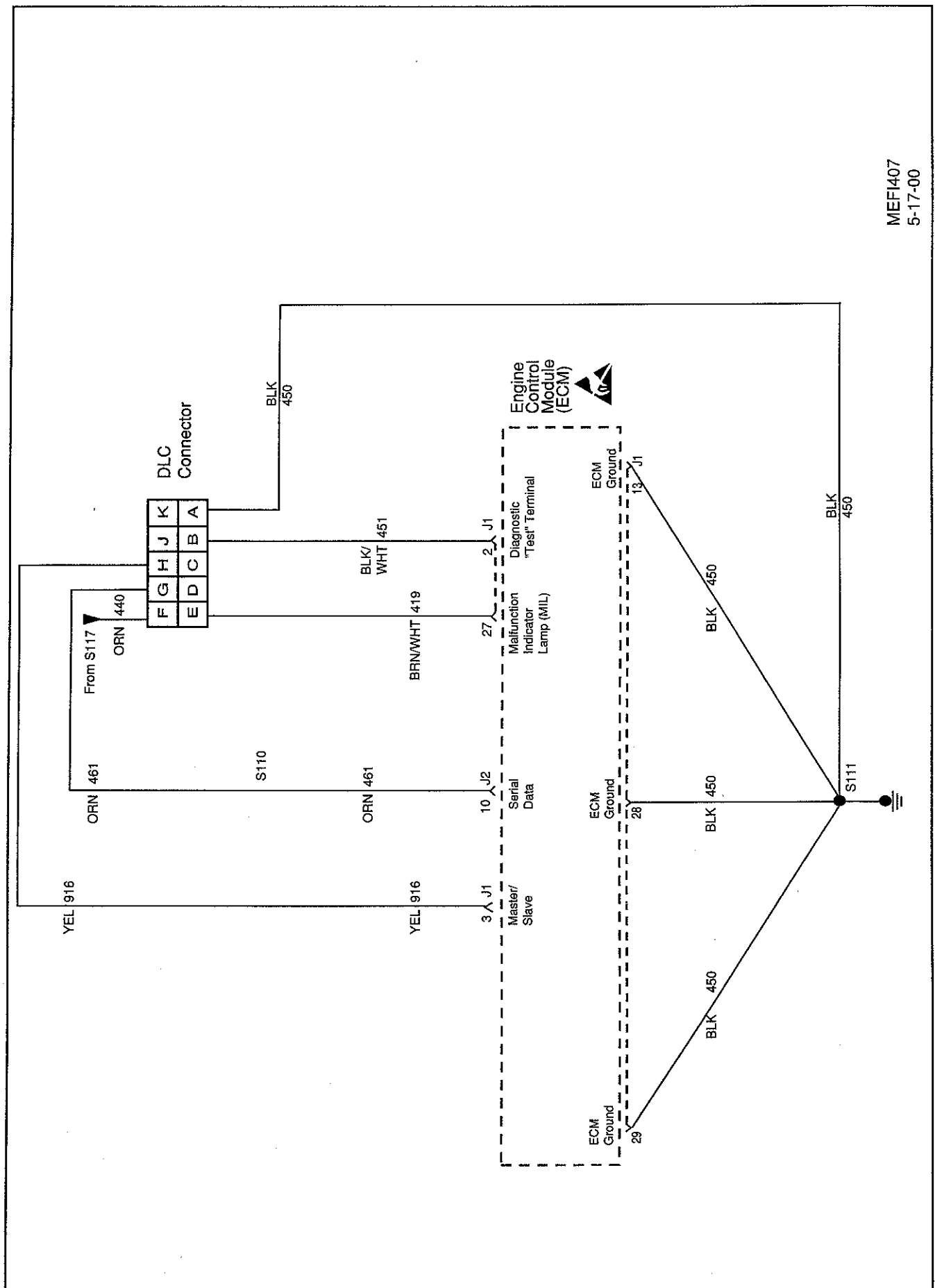
Firing Order: 1 - 8 - 7 - 2 - 6 - 5 - 4 - 3
Ignition Control: A - B - C - D - E - F - G - H

Engine Controls Schematics (CMP & CKP Sensors)

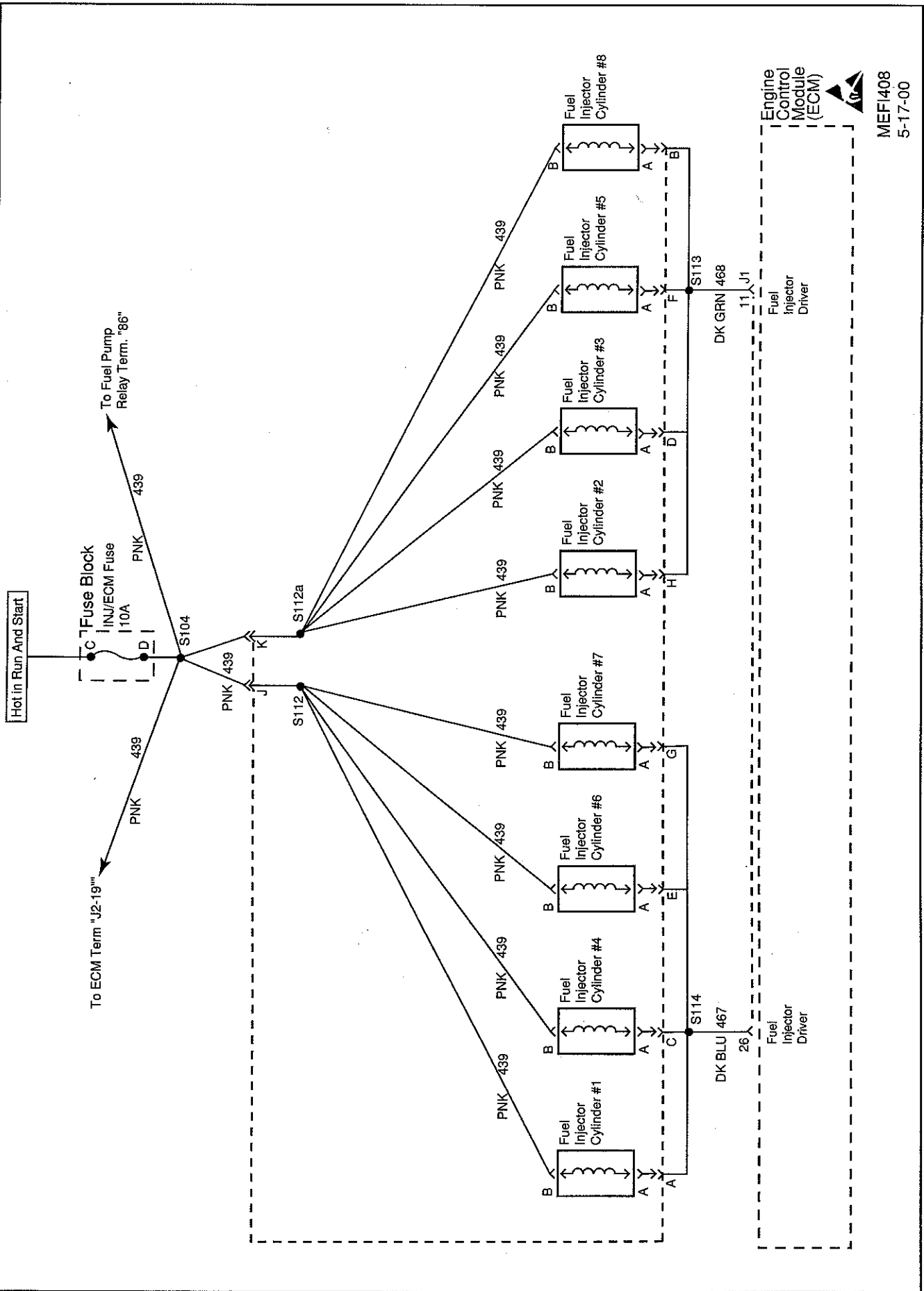


Engine Controls Schematics (8.1L - DLC Connector)

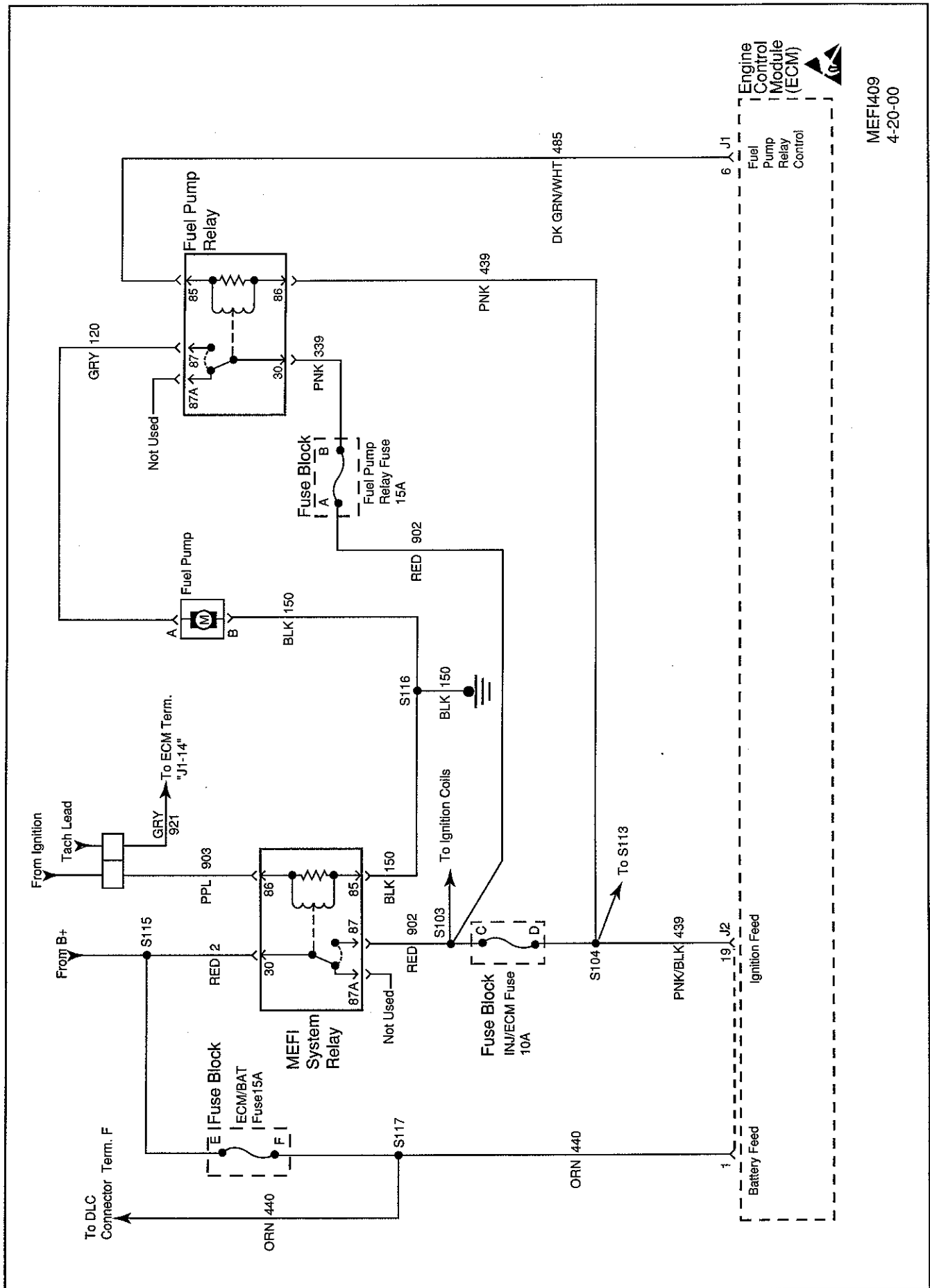
MEFI407
5-17-00



Engine Controls Schematics (8.1L - Fuel Injectors)

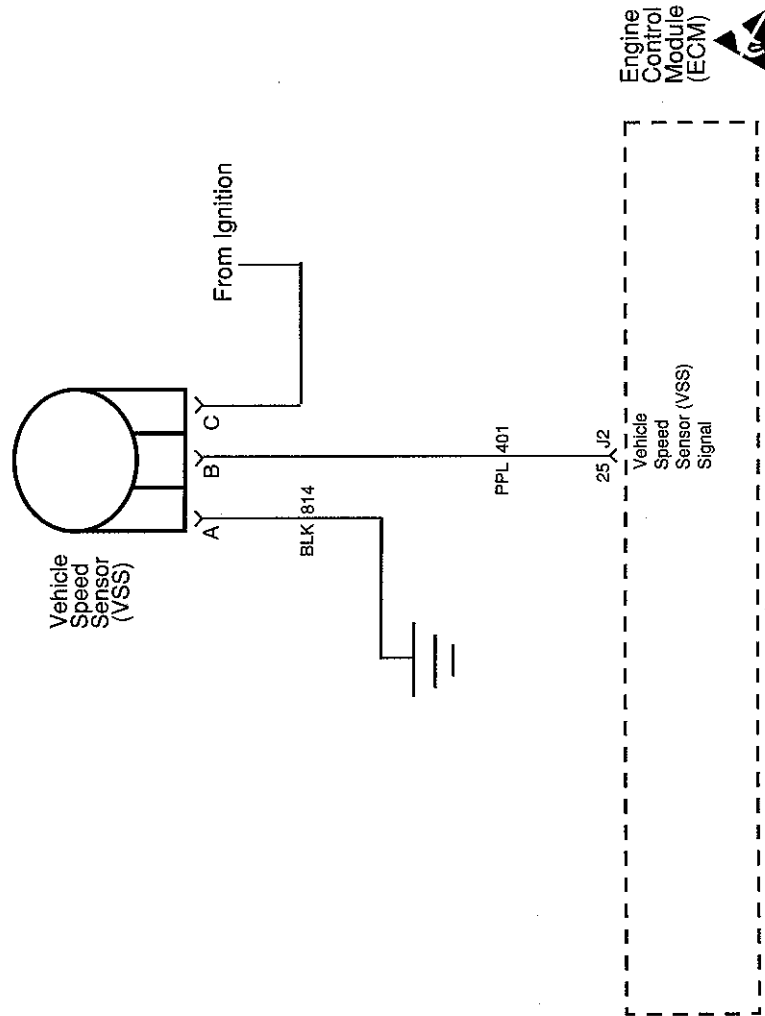


Engine Controls Schematics (8.1L - MEFI System Relay & Fuel Pump)



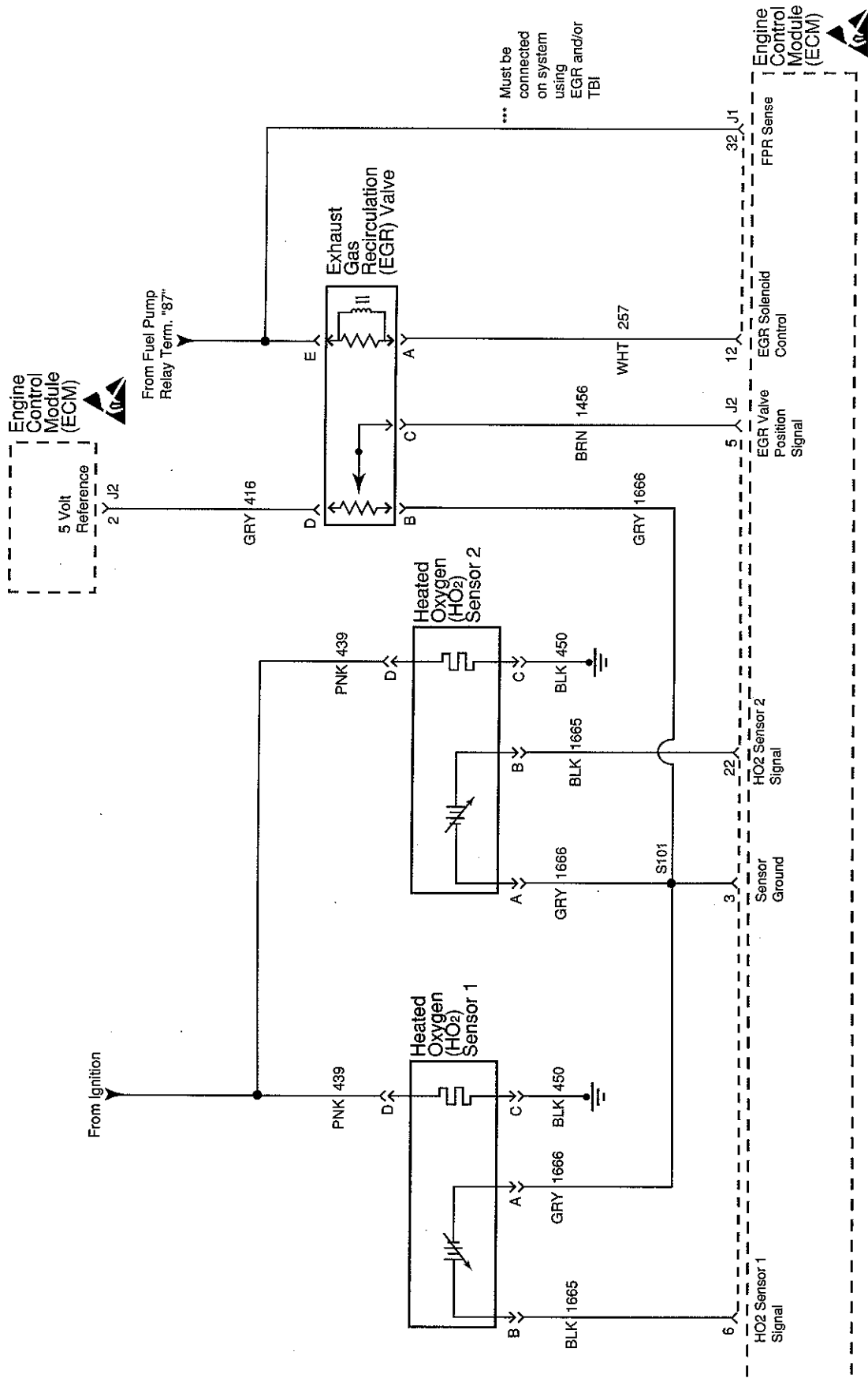
MEFI409
4-20-00

Engine Controls Schematics (8.1L - VSS Circuit)



MEFI4012a
7-01-00

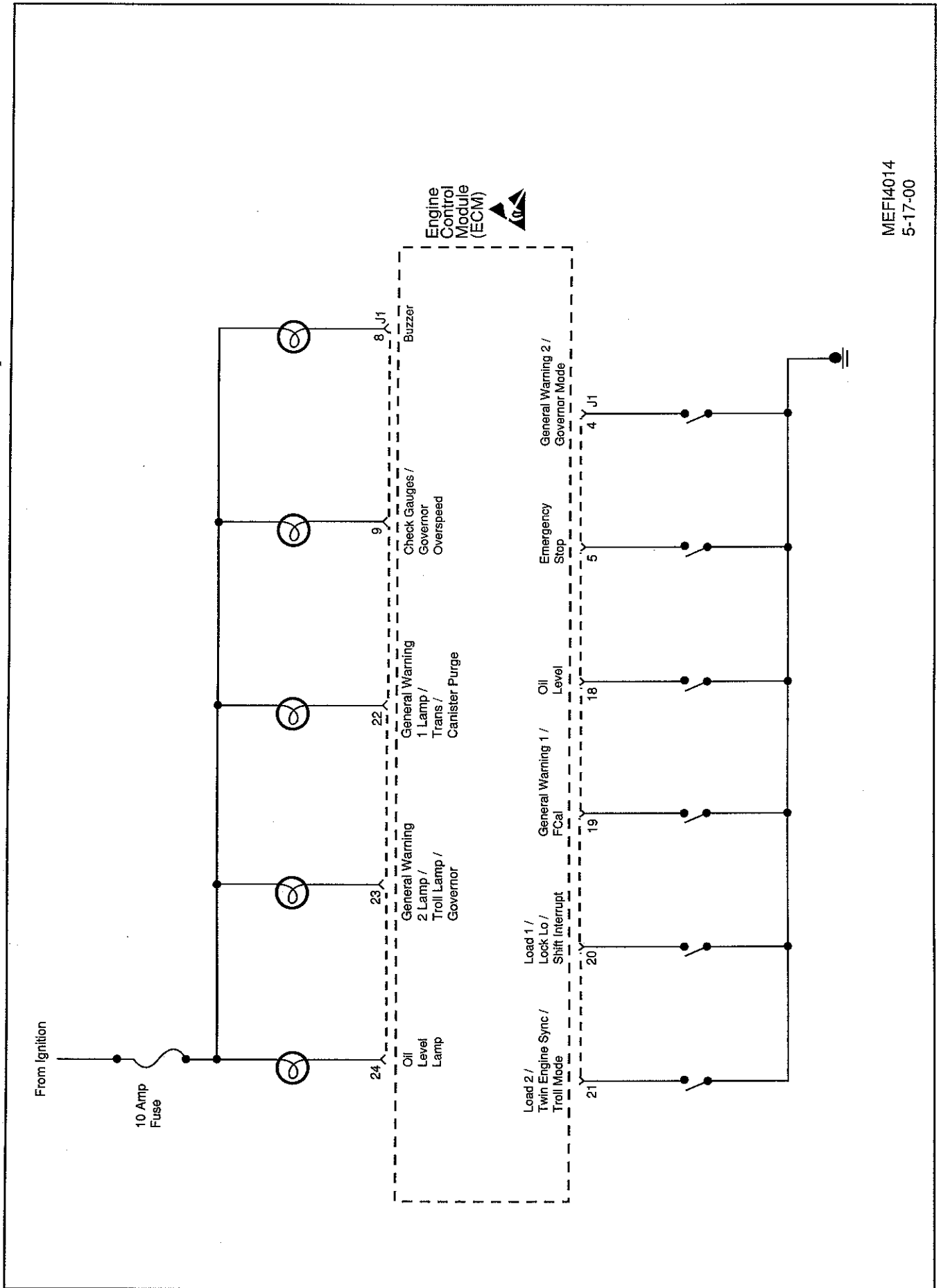
Engine Controls Schematics (8.1L - HO2S & EGR Valve)



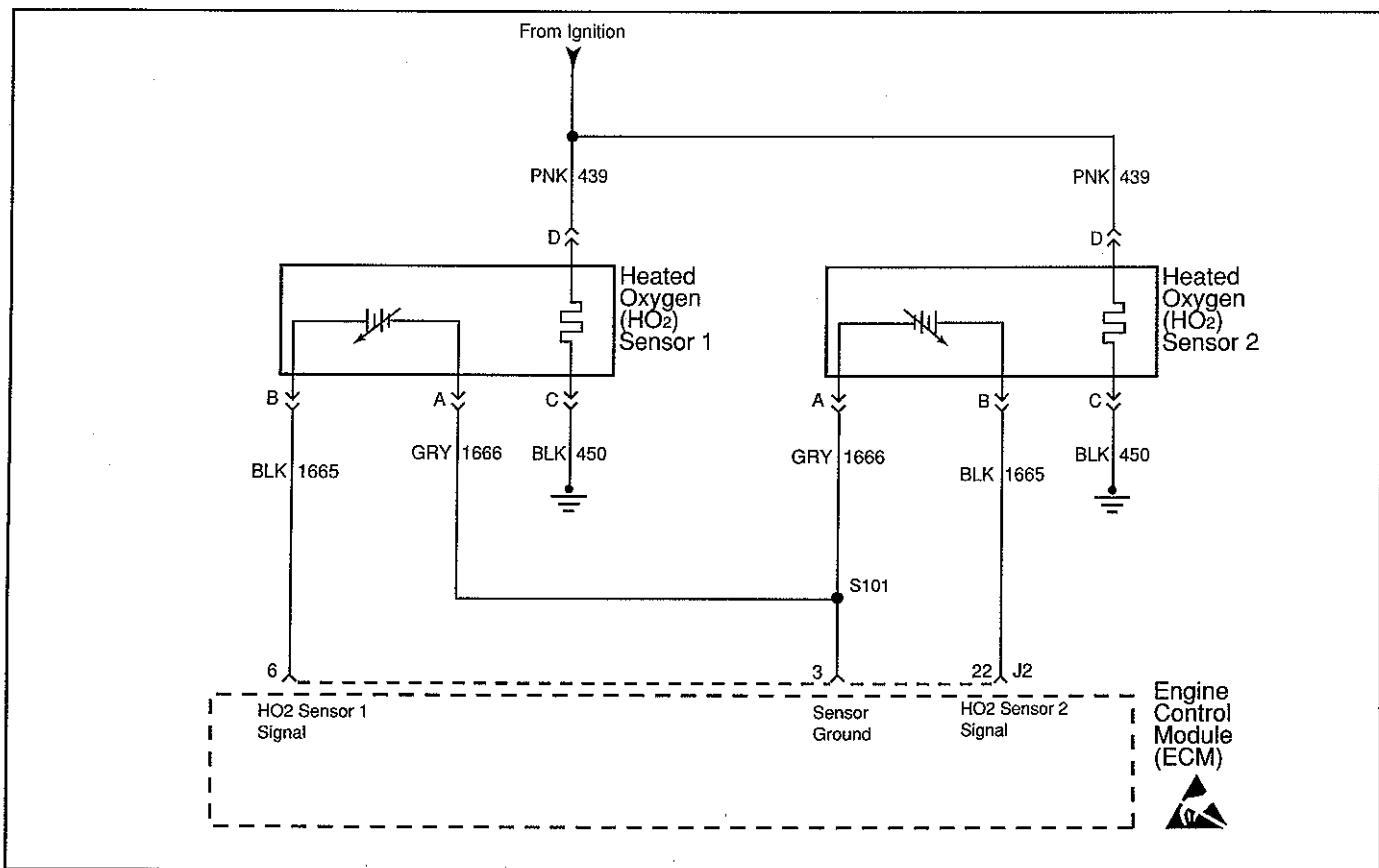
... Must be connected on system using EGR and/or TBI

MEFI4015
6-25-00

Engine Controls Schematics (8.1L - Discrete Inputs & Outputs)



**This Page Was
Intentionally Left
Blank**



MEFI4313
4-26-00

DTC 13 - Heated Oxygen (HO₂) Sensor 1 Circuit Inactive (Scan Diagnostics)

Circuit Description

The Heated Oxygen (HO₂) Sensor varies voltage within a range from about 1.0 volt if the exhaust is rich, down to about 0.1 volt if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 360° C (600° F). An open oxygen sensor circuit or cold oxygen sensor causes an Open Loop operation.

The heater provides for a faster sensor warm-up. This allows the sensor to become active in a shorter period of time and remain active during a long extended idle.

DTC 13 determines if the heated oxygen sensor circuit has developed an open. With an active DTC 13 set, the system operates in an Open Loop mode and the Malfunction Indicator Lamp (MIL) is turned on.

Diagnostic Aids

Check for the following conditions:

- **Poor connection in harness.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- A faulty HO₂ heater or heater circuit. With ignition "ON," engine "OFF," the HO₂ voltage displayed on the scan tool should gradually drop to below 0.150 volt, indicating that the heater works properly. If not, disconnect the HO₂

sensor connector and connect a test light between harness terminals "C" and "D." If the test light does not illuminate brightly, repair the open in the ignition feed or ground for the HO₂ heater circuit. If the test light illuminates brightly, replace the HO₂ sensor.

Never solder the HO₂ wires. For proper wire and connection repairs, refer to "Wiring Repair."

After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. With ignition "ON", engine "OFF", the HO₂ Sensor Voltage displayed on the scan tool should gradually decrease down to approximately 0.150 volt, indicating that the heater is working properly. The HO₂ voltage may rise as high as 0.975 volt before it toggles back down. The main thing to look for is a change.
3. Probing terminal "D" of the HO₂ sensor harness connector verifies if the voltage is available to the HO₂ sensor heater.
5. If conditions for setting DTC 13 exist, the system will not go into Closed Loop Fuel.
7. This test checks the continuity of the HO₂ signal circuit.

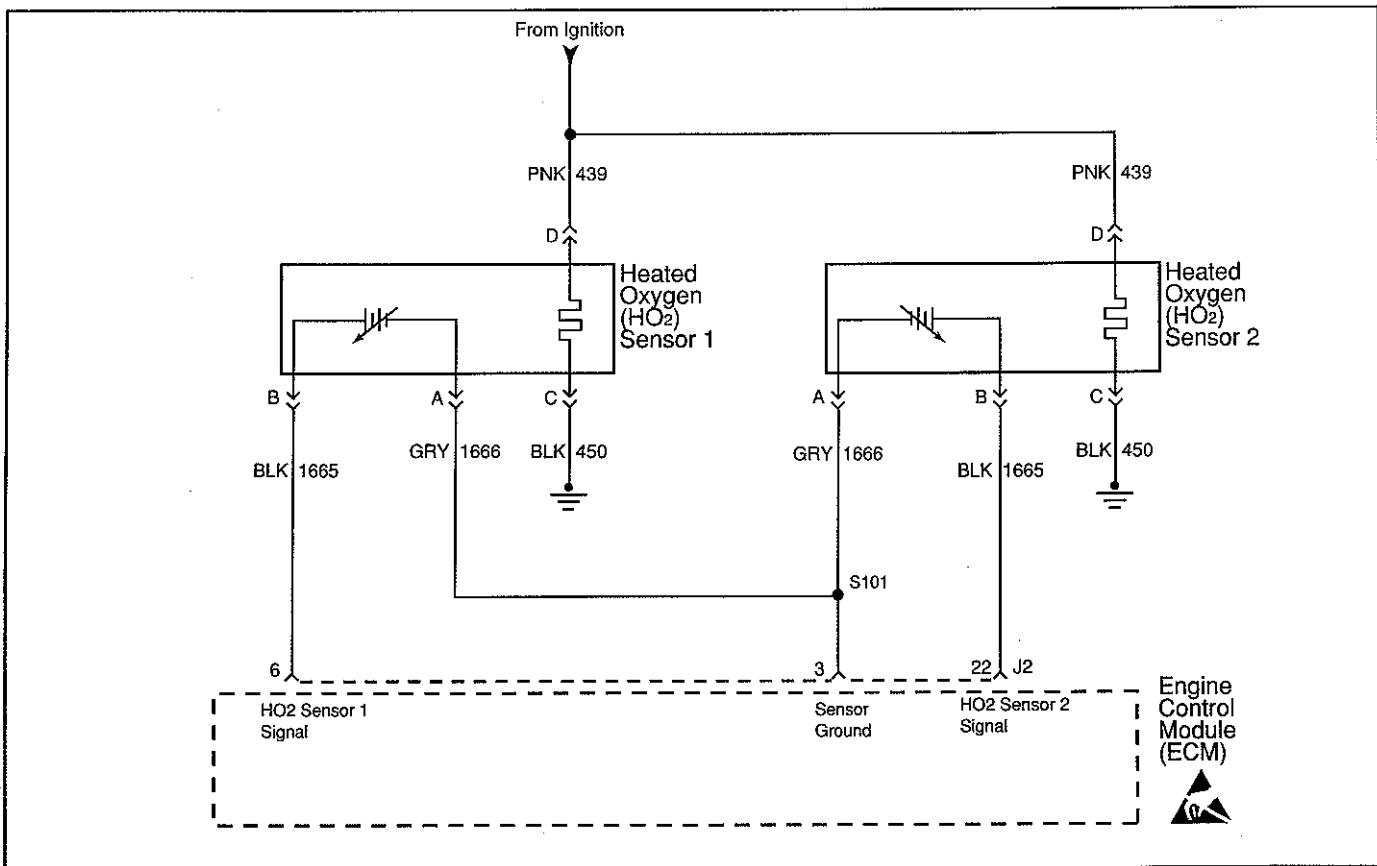
DTC 13 - Heated Oxygen (HO₂) Sensor 1 Circuit Inactive (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostics"(OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Connect scan tool. 2. Ignition turned ON. 3. Monitor the HO ₂ Sensor 1 Voltage. Does the voltage displayed gradually decrease down to approximately the specified value?	0.150 volt	Go to Step 5	Go to Step 3
3	1. Disconnect the HO ₂ sensor 1 electrical connector. 2. Using a test light connected to a known good ground, probe terminal "D" of the ECM harness connector. Does the test light illuminate brightly?	—	Go to Step 4	Go to Step 9
4	Connect test light between terminals "C" and "D" of the HO ₂ sensor 1 harness connector. Does the test light illuminate brightly?	—	Go to Step 5	Go to Step 10
5	1. Reconnect HO ₂ sensor 1 electrical connector. 2. Connect scan tool. 3. Run the engine at the normal operating temperature. 4. Run the engine above the specified value for 2 minutes. Does the scan tool indicate Closed Loop Fuel control?	1200 RPM	Go to Step 8	Go to Step 6
6	1. Disconnect the Heated Oxygen (HO ₂) sensor 1 electrical connector. 2. Install a jumper between the HO ₂ sensor 1 signal and ground circuit on the ECM harness side. 3. Ignition turned ON. Does the scan tool HO ₂ Sensor 1 Voltage display indicate a voltage less than the specified value?	0.100 volt	Go to Step 13	Go to Step 7
7	1. Turn ignition OFF. 2. Remove the jumpers. 3. Using a test light connected to B+, probe the HO ₂ sensor 1 ground circuit on the ECM harness side. Does the test light illuminate brightly?	—	Go to Step 11	Go to Step 12
8	DTC 13 is intermittent. If no additional DTC's are stored, refer to the Diagnostic Aids. If any additional DTC's are stored, refer to those table(s) first.	—	Go to Applicable DTC Table	—
9	Locate and repair open or short to ground in the ignition feed circuit for the HO ₂ heater. Is action complete?	—	Verify Repair	—
10	Locate and repair open in the ground circuit for the HO ₂ heater. Is action complete?	—	Verify Repair	—

DTC 13 - Heated Oxygen (HO₂) Sensor 1 Circuit Inactive (Scan Diagnostics)

Step	Action	Value	Yes	No
11	Locate and repair open in the HO ₂ sensor 1 signal circuit. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 14
12	Locate and repair open in the HO ₂ sensor 1 ground circuit. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 14
13	Check for faulty HO ₂ sensor 1 connections. If OK, replace HO ₂ sensor. Is action complete?	—	Verify Repair	—
14	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—

**This Page Was
Intentionally Left
Blank**



MEFI4313
4-26-00

DTC 13 - Heated Oxygen (HO₂) Sensor 2 Circuit Inactive (Scan Diagnostics)

Circuit Description

The Heated Oxygen (HO₂) Sensor varies voltage within a range from about 1.0 volt if the exhaust is rich, down to about 0.1 volt if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 360° C (600° F). An open oxygen sensor circuit or cold oxygen sensor causes an Open Loop operation.

The heater provides for a faster sensor warm-up. This allows the sensor to become active in a shorter period of time and remain active during a long extended idle.

DTC 13 determines if the heated oxygen sensor circuit has developed an open. With an active DTC 13 set, the system operates in an Open Loop mode and the Malfunction Indicator Lamp (MIL) is turned on.

Diagnostic Aids

Check for the following conditions:

- **Poor connection in harness.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **A faulty HO₂ heater or heater circuit.** With ignition "ON," engine "OFF," the HO₂ voltage displayed on the scan tool should gradually drop to below 0.150 volt, indicating that the heater works properly. If not, disconnect the HO₂

sensor connector and connect a test light between harness terminals "C" and "D." If the test light does not illuminate brightly, repair the open in the ignition feed or ground for the HO₂ heater circuit. If the test light illuminates brightly, replace the HO₂ sensor.

Never solder the HO₂ wires. For proper wire and connection repairs, refer to "Wiring Repair."

After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. With ignition "ON", engine "OFF", the HO₂ Sensor Voltage displayed on the scan tool should gradually decrease down to approximately 0.150 volt, indicating that the heater is working properly. The HO₂ voltage may rise as high as 0.975 volt before it toggles back down. The main thing to look for is a change.
3. Probing terminal "D" of the HO₂ sensor harness connector verifies if the voltage is available to the HO₂ sensor heater.
5. If conditions for setting DTC 13 exist, the system will not go into Closed Loop Fuel.
7. This test checks the continuity of the HO₂ signal circuit.

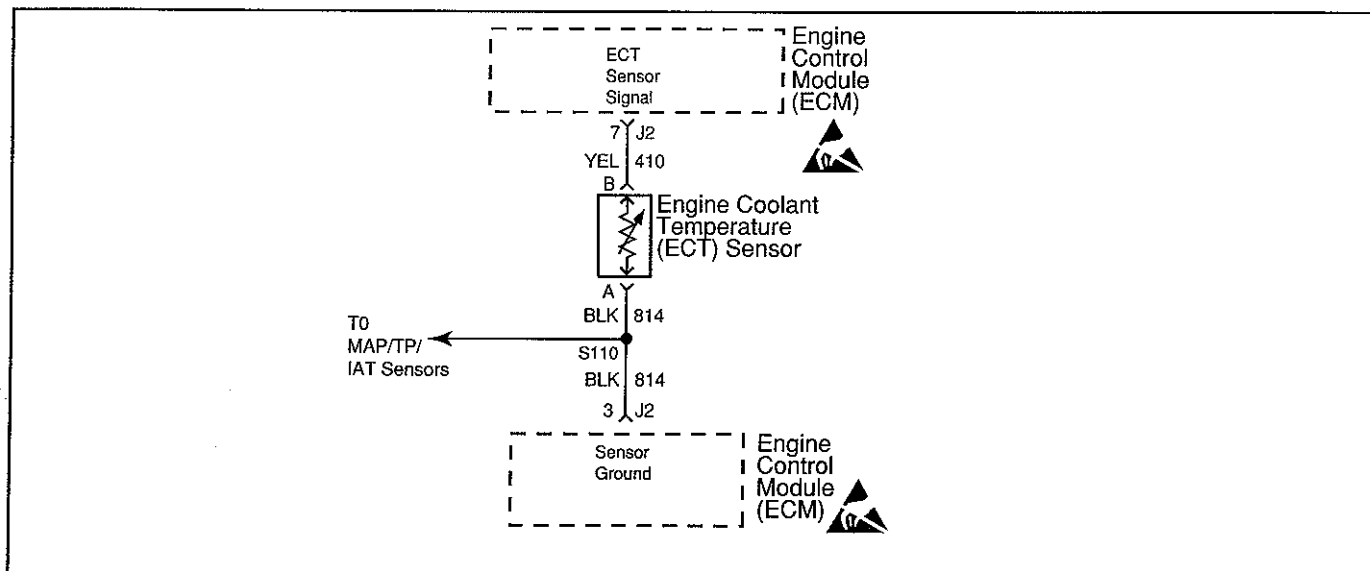
DTC 13 - Heated Oxygen (HO₂) Sensor 2 Circuit Inactive (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostics"(OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Connect scan tool. 2. Ignition turned ON. 3. Monitor the HO ₂ Sensor 2 Voltage. Does the voltage displayed gradually decrease down to approximately the specified value?	0.150 volt	Go to Step 5	Go to Step 3
3	1. Disconnect the HO ₂ sensor 2 electrical connector. 2. Using a test light connected to a known good ground, probe terminal "D" of the ECM harness connector. Does the test light illuminate brightly?	—	Go to Step 4	Go to Step 9
4	Connect test light between terminals "C" and "D" of the HO ₂ sensor 1 harness connector. Does the test light illuminate brightly?	—	Go to Step 5	Go to Step 10
5	1. Reconnect HO ₂ sensor 2 electrical connector. 2. Connect scan tool. 3. Run the engine at the normal operating temperature. 4. Run the engine above the specified value for 2 minutes. Does the scan tool indicate Closed Loop Fuel control?	1200 RPM	Go to Step 8	Go to Step 6
6	1. Disconnect the Heated Oxygen (HO ₂) sensor 2 electrical connector. 2. Install a jumper between the HO ₂ sensor 2 signal and ground circuit on the ECM harness side. 3. Ignition turned ON. Does the scan tool HO ₂ Sensor 2 Voltage display indicate a voltage less than the specified value?	0.100 volt	Go to Step 13	Go to Step 7
7	1. Turn ignition OFF. 2. Remove the jumpers. 3. Using a test light connected to B+, probe the HO ₂ sensor 2 ground circuit on the ECM harness side. Does the test light illuminate brightly?	—	Go to Step 11	Go to Step 12
8	DTC 13 is intermittent. If no additional DTC's are stored, refer to the Diagnostic Aids. If any additional DTC's are stored, refer to those table(s) first.	—	Go to Applicable DTC Table	—
9	Locate and repair open or short to ground in the ignition feed circuit for the HO ₂ heater. Is action complete?	—	Verify Repair	—
10	Locate and repair open in the ground circuit for the HO ₂ heater. Is action complete?	—	Verify Repair	—

DTC 13 - Heated Oxygen (HO₂) Sensor 2 Circuit Inactive (Scan Diagnostics)

Step	Action	Value	Yes	No
11	Locate and repair open in the HO ₂ sensor 2 signal circuit. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 14
12	Locate and repair open in the HO ₂ sensor 2 ground circuit. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 14
13	Check for faulty HO ₂ sensor 2 connections. If OK, replace HO ₂ sensor. Is action complete?	—	Verify Repair	—
14	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—

**This Page Was
Intentionally Left
Blank**



MEFI 4307
4-20-00

DTC 14 - Engine Coolant Temperature (ECT) Sensor Circuit - Low Temp Indicated (Scan Diagnostics)

Circuit Description

The Engine Coolant Temperature (ECT) sensor uses a thermistor to control the signal voltage to the ECM. The ECM applies 5 volts on CKT 410 to the sensor. When the engine coolant is cold, the sensor (thermistor) resistance is high. As the engine coolant warms up, the sensor resistance becomes less. See engine coolant temperature sensor table under "Diagnostic Aids." At normal operating temperature (85°C - 95°C or 185°F - 203°F), the voltage will measure about 1.5-2.0 volts.

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the scan tool while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.
- The scan tool displays engine coolant temperature in degrees celsius and fahrenheit. If the engine is cold (not running within 8 hours), the scan tool should display a ECT sensor value within a few degrees of outside air temperature. This may help aid in diagnosing a "shifted" coolant sensor. After engine is started, the temperature should rise steadily and then stabilize at operating temperature when the thermostat opens.
- If DTC 33 is also set, check for open ground CKT 814.

After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

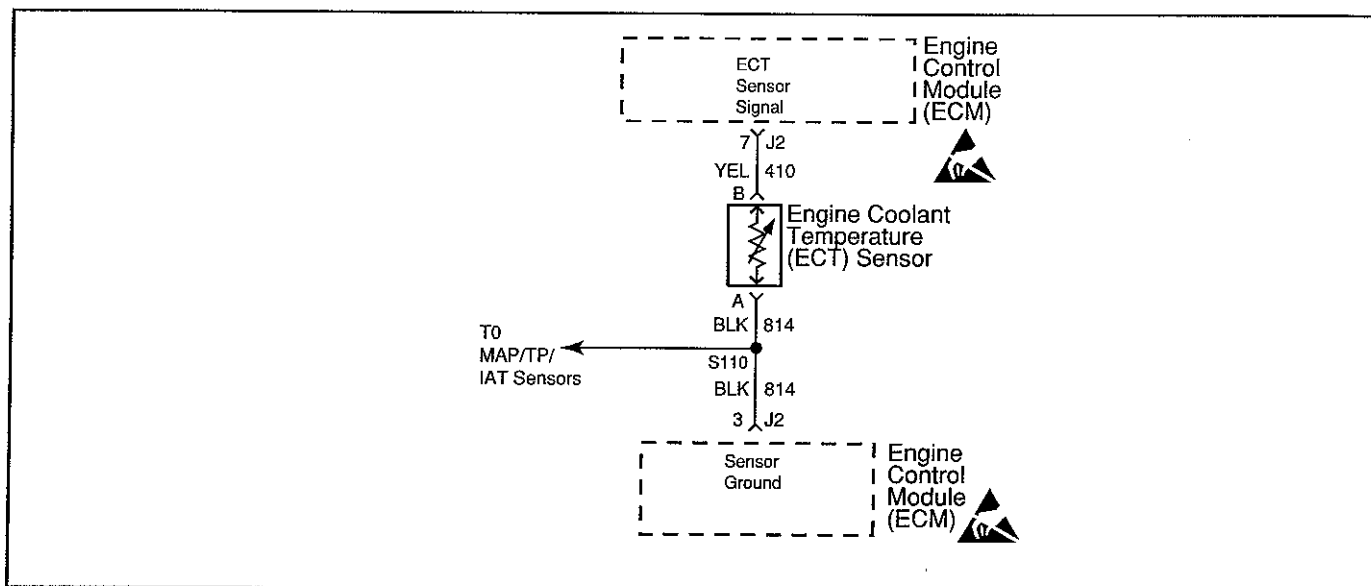
2. DTC 14 will set if signal voltage indicates a coolant temperature below -30°C (-22°F).
3. This test simulates a DTC 15. If the ECM recognizes the low voltage signal and displays a high temperature, the ECM and wiring are OK.

Engine Coolant Temperature Sensor Table

°C	°F	OHMS
Temperature vs Resistance Values (Approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
-5	23	12300
-15	5	21450
-30	-22	52700
-40	-40	100700

**DTC 14 - Engine Coolant Temperature (ECT) Sensor Circuit - Low Temp Indicated
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Turn ignition ON, leaving engine OFF. Does scan tool display a coolant temperature less than the specified value?	-30°C (-22°F)	Go to Step 3	Go to Step 4
3	1. Turn ignition OFF. 2. Disconnect the ECT sensor harness connector. 3. Connect a jumper wire from harness terminal "A" (CKT 814) to harness terminal "B" (CKT 410). 4. Turn ignition ON, leaving engine OFF. Does scan tool display a coolant temperature above the specified value?	130°C (266°F)	Go to Step 6	Go to Step 5
4	DTC 14 is intermittent. Locate and repair intermittent faulty connections. • Refer to "Diagnostic Aids."	—	Verify Repair	—
5	Locate and repair open in CKT 410 or CKT 814. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 7
6	Repair faulty ECT sensor. Is action complete?	—	Verify Repair	—
7	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—

MEFI 4307
4-20-00

DTC 15 - Engine Coolant Temperature (ECT) Sensor Circuit - High Temp Indicated (Scan Diagnostics)

Circuit Description

The Engine Coolant Temperature (ECT) sensor uses a thermistor to control the signal voltage to the ECM. The ECM applies 5 volts on CKT 410 to the sensor. When the engine coolant is cold, the sensor (thermistor) resistance is high. As the engine coolant warms up, the sensor resistance becomes less. See engine coolant temperature sensor table under "Diagnostic Aids." At normal operating temperature (85°C - 95°C or 185°F - 203°F), the voltage will measure about 1.5-2.0 volts.

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the scan tool while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.
- The scan tool displays engine coolant temperature in degrees celsius and fahrenheit. If the engine is cold (not running within 8 hours), the scan tool should display a ECT sensor value within a few degrees of outside air temperature. This may help aid in diagnosing a "shifted" coolant sensor. After engine is started, the temperature should rise steadily and then stabilize at operating temperature when the thermostat opens.

- Check harness routing for a potential short to ground in CKT 410.

After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

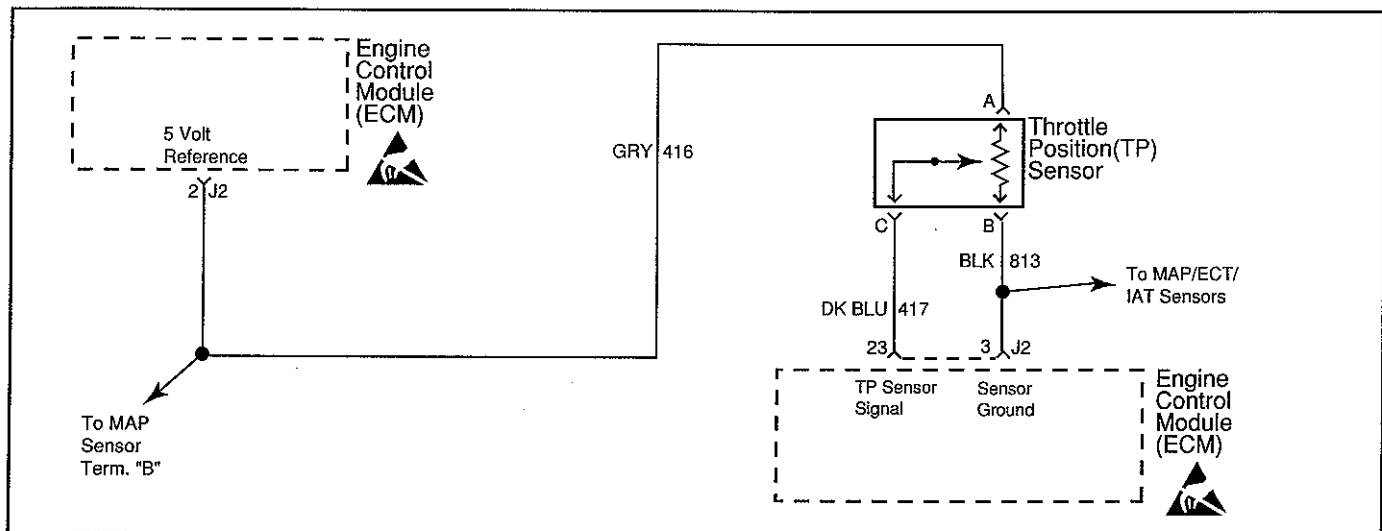
2. DTC 15 will set if signal voltage indicates a coolant temperature above 130°C or 266°F.
3. This test simulates a DTC 14. If the ECM recognizes the high voltage signal and displays a low temperature, the ECM and wiring are OK.

Engine Coolant Temperature Sensor Table

°C	°F	OHMS
Temperature vs Resistance Values (Approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
-5	23	12300
-15	5	21450
-30	-22	52700
-40	-40	100700

**DTC 15 - Engine Coolant Temperature (ECT) Sensor Circuit - High Temp Indicated
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Turn ignition ON, leaving engine OFF. Does scan tool display a coolant temperature greater than the specified value?	130°C (266°F)	Go to Step 3	Go to Step 4
3	1. Turn ignition OFF. 2. Disconnect ECT sensor harness connector. 3. Turn ignition ON, leaving engine OFF. Does scan tool display a coolant temperature below the specified value?	-30°C (-22°F)	Go to Step 6	Go to Step 5
4	DTC 15 is intermittent. Locate and repair intermittent faulty connections. • Refer to "Diagnostic Aids."	—	Verify Repair	—
5	Locate and repair short to ground in CKT 410. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 7
6	Repair faulty ECT sensor. Is action complete?	—	Verify Repair	—
7	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—

MEFI4308
4-20-00

DTC 21 - Throttle Position (TP) Sensor Circuit - Signal Voltage High (Scan Diagnostics)

Circuit Description

The Throttle Position (TP) sensor is a potentiometer that provides a voltage signal that changes relative to the throttle blade. Signal voltage should vary from about .7 volt at idle to about 4.8 volts at Wide Open Throttle (WOT).

The TP sensor signal is one of the most important inputs used by the ECM for fuel control and for IAC control.

The ECM supplies a 5 volt signal to the sensor through CKT 416. CKT 813 is the TP sensor ground circuit. The TP sensor will send a voltage signal back to the ECM, through CKT 417, according to where the throttle blades are positioned.

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor display on the scan tool while moving connectors and wiring harnesses related to the TP sensor. A change in the TP sensor display will indicate the location of the fault.
- The scan tool reads throttle position in voltage and percentage relative to the throttle blade opening. With ignition "ON," engine "OFF," throttle blades closed (idle), the voltage should be 0.3-0.9 volts. The voltage should steadily increase as the throttle is moved toward Wide Open Throttle (WOT).
- If a TP sensor circuit failure is present, the MAP sensor default value will be used along with the TP sensor default value.

After repairs, clear DTC's following "Clear DTC's Procedure."

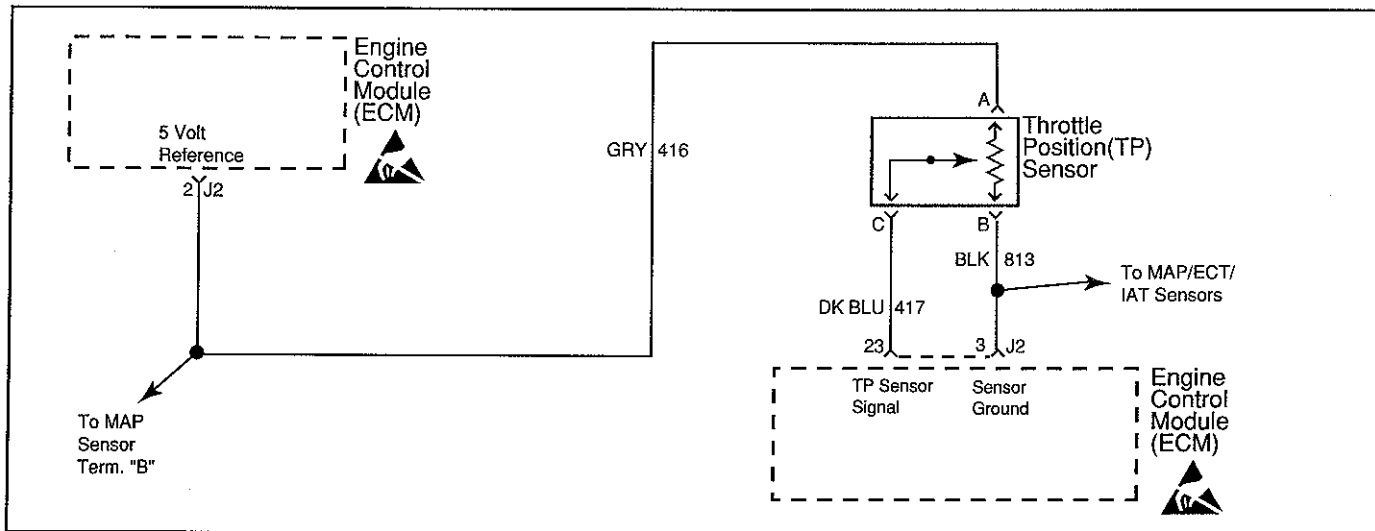
Failure to do so may result in DTC's not properly being cleared.

Test Description

2. With the throttle closed, the TP sensor voltage should read 0.3-0.9 volt. If it does not, check the throttle cable adjustment or for bent or binding linkage.
3. This test simulates a DTC 22. If the ECM recognizes the low voltage signal, the ECM and wiring are OK.
4. Using DVOM from harness terminal "A" (CKT 416) harness terminal "B" (CKT 813) checks the sensor ground circuit. A faulty sensor ground CKT 813 will cause a DTC 21.

DTC 21 - Throttle Position (TP) Sensor Circuit - Signal Voltage High (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Throttle closed. 2. Turn ignition ON, leaving engine OFF. Does scan tool indicate TP sensor voltage greater than the specified value?	4 volts	Go to Step 3	Go to Step 5
3	1. Turn ignition OFF. 2. Disconnect TP sensor harness connector. 3. Turn ignition ON, leaving engine OFF. Does DVOM indicate a voltage less than the specified value?	.36 volt	Go to Step 4	Go to Step 6
4	Connect DVOM from harness terminal "A" (CKT 416) to harness terminal "B" (CKT 813). Does DVOM indicate a voltage greater than the specified value?	4 volts	Go to Step 8	Go to Step 7
5	DTC 21 is intermittent. Locate and repair intermittent faulty connections. • Refer to "Diagnostic Aids."	—	—	—
6	Locate and repair short to voltage in CKT 417. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 9
7	Locate and repair open in ground CKT 813. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 9
8	Replace faulty TP sensor. Is action complete?	—	Verify Repair	—
9	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—

MEFI4308
4-20-00

DTC 22 - Throttle Position (TP) Sensor Circuit - Signal Voltage Low (Scan Diagnostics)

Circuit Description

The Throttle Position (TP) sensor is a potentiometer that provides a voltage signal that changes relative to the throttle blade. Signal voltage should vary from about .7 volt at idle to about 4.8 volts at Wide Open Throttle (WOT).

The TP sensor signal is one of the most important inputs used by the ECM for fuel control and for IAC control.

The ECM supplies a 5 volt signal to the sensor through CKT 416. CKT 813 is the TP sensor ground circuit. The TP sensor will send a voltage signal back to the ECM, through CKT 417, according to where the throttle blades are positioned.

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor display on the scan tool while moving connectors and wiring harnesses related to the TP sensor. A change in the TP sensor display will indicate the location of the fault.

- The scan tool reads throttle position in voltage and percentage relative to the throttle blade opening. With ignition "ON," engine "OFF," throttle blades closed (idle), the voltage should be 0.3-0.9 volts. The voltage should steadily increase as the throttle is moved toward Wide Open Throttle (WOT).
- If DTC 34 is also set, check for a short to ground in CKT 416 or CKT 416E.
- If a TP sensor circuit failure is present, the MAP sensor default value will be used along with the TP sensor default value.

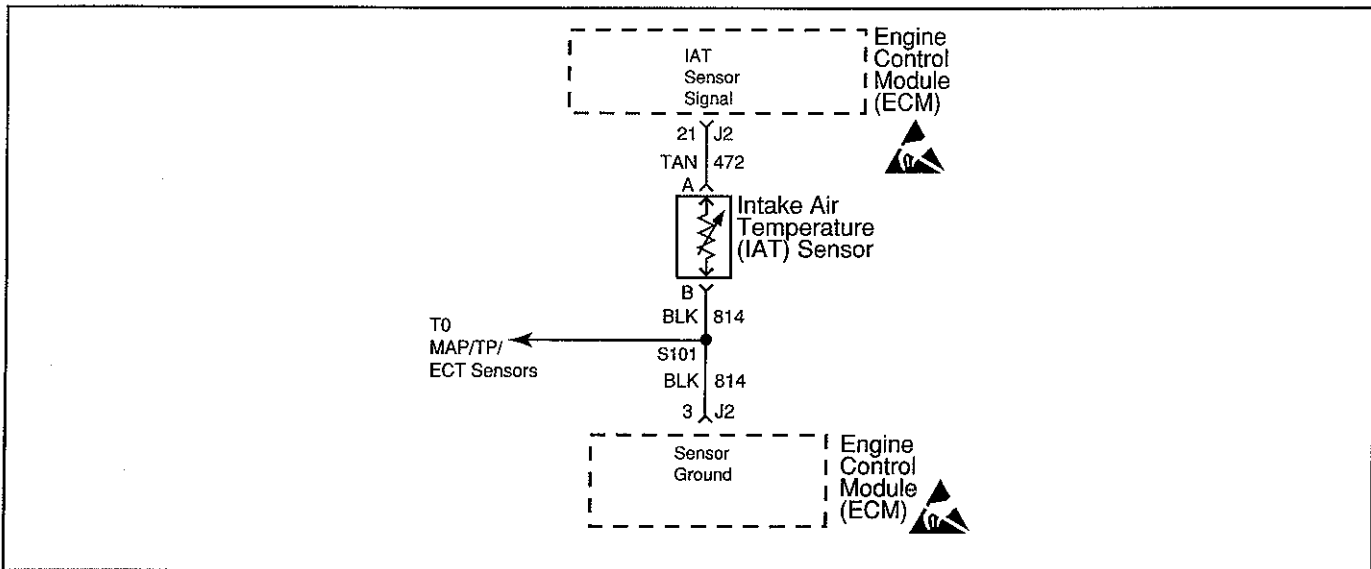
After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. With the throttle closed, the TP sensor voltage should read 0.3-0.9 volt. If it does not, check the throttle cable adjustment or for bent or binding linkage.
3. This test simulates a DTC 21. If the ECM recognizes the high signal voltage, the ECM and wiring are OK.
4. This test checks for the 5 volt reference on CKT 416.

DTC 22 - Throttle Position (TP) Sensor Circuit - Signal Voltage Low (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Throttle closed. 2. Turn ignition ON, leaving engine OFF. Does scan tool indicate TP sensor voltage less than the specified value?	.36 volt	Go to Step 3	Go to Step 5
3	1. Turn ignition OFF. 2. Disconnect TP sensor harness connector. 3. Connect a jumper wire from harness terminal "A" (CKT 416) to harness terminal "C" (CKT 417). 4. Turn ignition ON, leaving engine OFF. Does scan tool indicate TP sensor voltage greater than the specified value?	4 volts	Go to Step 8	Go to Step 4
4	1. Turn ignition OFF. 2. Connect DVOM from harness terminal "A" (CKT 416) to a known good ground. 3. Turn ignition ON, leaving engine OFF. Does DVOM indicate a voltage greater than the specified value?	4 volts	Go to Step 7	Go to Step 6
5	DTC 22 is intermittent. Locate and repair intermittent faulty connections. • Refer to "Diagnostic Aids."	—	—	—
6	Locate and repair open or short to ground in CKT 416. Also check CKT 416E to the MAP sensor for a short to ground. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
7	Locate and repair open or short to ground in CKT 417. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
8	Replace faulty TP sensor. Is action complete?	—	Verify repair	—
9	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify repair	—



MEFI 4322
6-11-00

DTC 23 - Intake Air Temperature (IAT) Sensor Circuit - Low Temp Indicated (Scan Diagnostics)

Circuit Description

The Intake Air Temperature (IAT) sensor uses a thermistor to control the signal voltage to the ECM. The ECM applies 5 volts on CKT 472 to the sensor. When the intake air temperature is cold, the sensor (thermistor) resistance is high. As the intake air temperature warms up, the sensor resistance becomes less. See intake air temperature sensor table under "Diagnostic Aids."

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the scan tool while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.
- The scan tool displays intake air temperature in degrees celsius and fahrenheit. If the engine is cold (not running within 8 hours), the scan tool should display a IAT sensor value within a few degrees of outside air temperature. This may help aid in diagnosing a "shifted" IAT sensor.
- If DTC 33 is also set, check for open ground CKT 814.

After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. DTC 23 will set if signal voltage indicates a intake air

temperature below -30°C (-22°F).

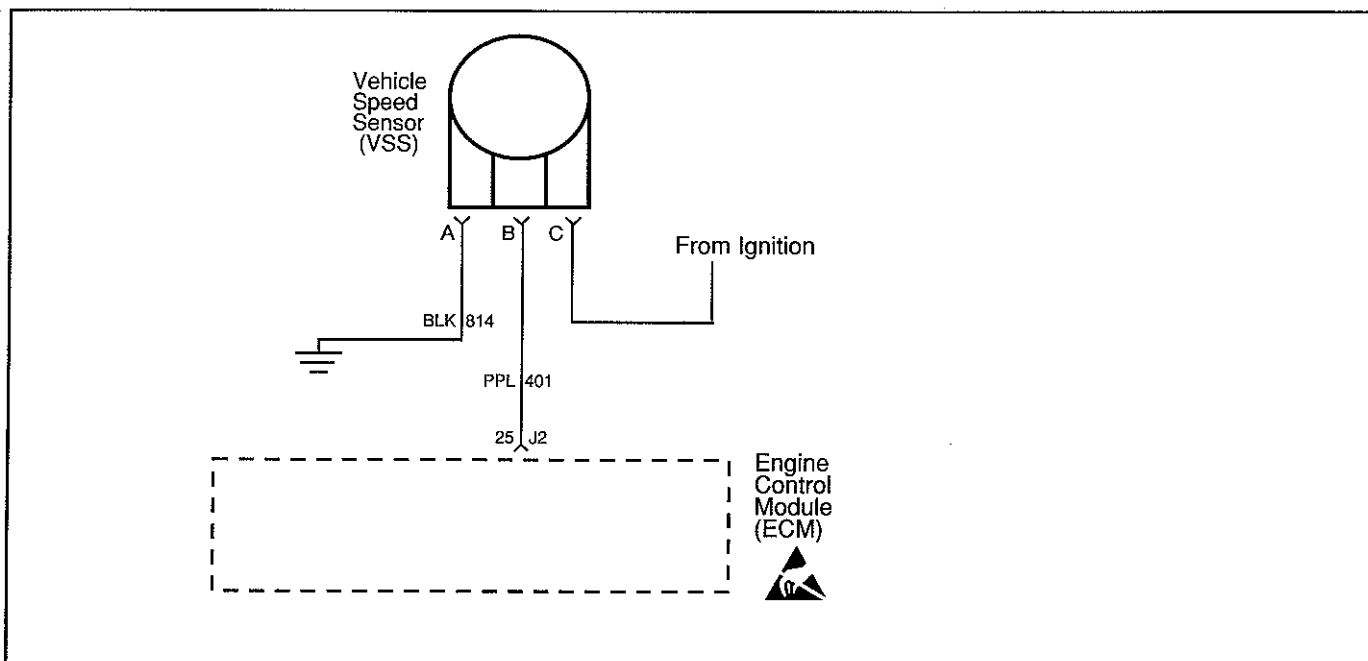
3. This test simulates a DTC 25. If the ECM recognizes the low voltage signal and displays a high temperature, the ECM and wiring are OK.

Intake Air Temperature Sensor Table

°C	°F	OHMS
Temperature vs Resistance Values (Approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
-5	23	12300
-15	5	21450
-30	-22	52700
-40	-40	100700

**DTC 23 - Intake Air Temperature (IAT) Sensor Circuit - Low Temp Indicated
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Turn ignition ON, leaving engine OFF. Does scan tool display an intake air temperature less than the specified value?	-30°C (-22°F)	Go to Step 3	Go to Step 4
3	1. Turn ignition OFF. 2. Disconnect IAT sensor harness connector. 3. Connect a jumper wire from harness terminal "A" (CKT 472) to harness terminal "B" (CKT 814). 4. Turn ignition ON, leaving engine OFF. Does scan tool display a coolant temperature above the specified value?	130°C (266°F)	Go to Step 6	Go to Step 5
4	DTC 23 is intermittent. Locate and repair intermittent faulty connections. • Refer to "Diagnostic Aids."	—	Verify Repair	—
5	Locate and repair open in CKT 472 or CKT 814. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 7
6	Repair faulty IAT sensor. Is action complete?	—	Verify Repair	—
7	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—



MEFI4314
4-26-00

DTC 24 - Vehicle Speed Sensor (VSS) Circuit (Scan Diagnostics)

Circuit Description

The vehicle speed is provided to the ECM by means of the Vehicle Speed Sensor (VSS). The sensor may be mounted in the transmission, but the actual location depends on the application. The sensor produces a 12 volt digital signal whenever the vehicle is moving. The number of pulses increases with vehicle speed. The ECM converts this signal into MPH, which can be monitored with a scan tool. This information may be used by the ECM for several reasons such as governing the vehicle speed to a maximum road speed.

The sensor is a three-wire sensor. Terminal "A" of the sensor is provided a ground on CKT 814 through the ECM. Terminal "C" of the sensor is provided ignition voltage. Terminal "B" of the sensor is the signal to the ECM through CKT 401.

Diagnostic Aids

Check for the following conditions:

- Poor connection in harness. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.

Check VSS circuits for proper connections and the harness is routed properly.

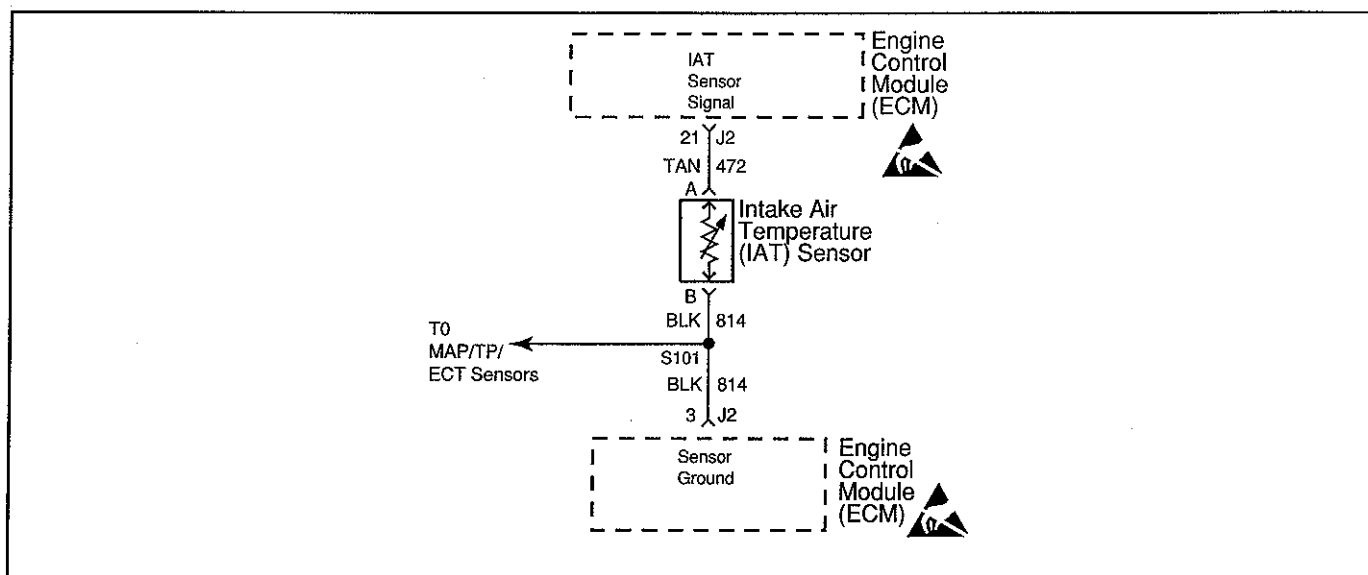
After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. This step determines if the VSS is receiving ignition voltage.
3. This step checks for a good ground circuit.

DTC 24 - Vehicle Speed Sensor (VSS) Circuit (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Disconnect the vehicle speed sensor harness connector. 2. Turn ignition ON, leaving engine OFF. 3. Using a test light connected to a known good ground, probe ECM harness terminal "C". Does the test light illuminate brightly?	—	Go to Step 3	Go to Step 7
3	1. Turn ignition ON, leaving engine OFF. 2. Using a test light connected to B+, probe ECM harness terminal "A". Does the test light illuminate brightly?	—	Go to Step 4	Go to Step 8
4	1. Turn ignition OFF. 2. Reconnect VSS harness connector. 3. Turn ignition ON, leaving engine OFF. 4. Raise and support the vehicle drive wheel(s) per manufacturer's recommendations. 5. Using a DMM connected to a known good ground, back probe ECM harness connector terminal "J2-25". 6. While observing the DMM, slowly rotate the drive wheel(s). Does the DMM indicate a voltage changing as the wheels are rotated?	—	Go to Step 9	Go to Step 5
5	Locate and repair open or short to ground on CKT 401. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	Replace faulty VSS. Is action complete?	—	Verify repair	—
7	Locate and repair open or short to ground in the ignition circuit to the VSS. Is action complete?	—	Verify Repair	—
8	Locate and repair open in the ground circuit to the VSS. Is action complete?	—	Verify Repair	—
9	DTC 24 may be intermittent. Clear DTC and drive the vehicle. If DTC 24 returns, repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—

MEFI 4322
6-11-00

DTC 25 - Intake Air Temperature (IAT) Sensor Circuit - High Temp Indicated (Scan Diagnostics)

Circuit Description

The Intake Air Temperature (IAT) sensor uses a thermistor to control the signal voltage to the ECM. The ECM applies 5 volts on CKT 472 to the sensor. When the intake air temperature is cold, the sensor (thermistor) resistance is high. As the intake air temperature warms up, the sensor resistance becomes less. See intake air temperature sensor table under "Diagnostic Aids."

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the scan tool while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.
- The scan tool displays intake air temperature in degrees celsius and fahrenheit. If the engine is cold (not running within 8 hours), the scan tool should display an IAT sensor value within a few degrees of outside air temperature. This may help aid in diagnosing a "shifted" IAT sensor.
- Check harness routing for a potential short to ground in CKT 472.

After repairs, clear DTC's following "Clear DTC's Procedure. Failure to do so may result in DTC's not properly being cleared.

Test Description

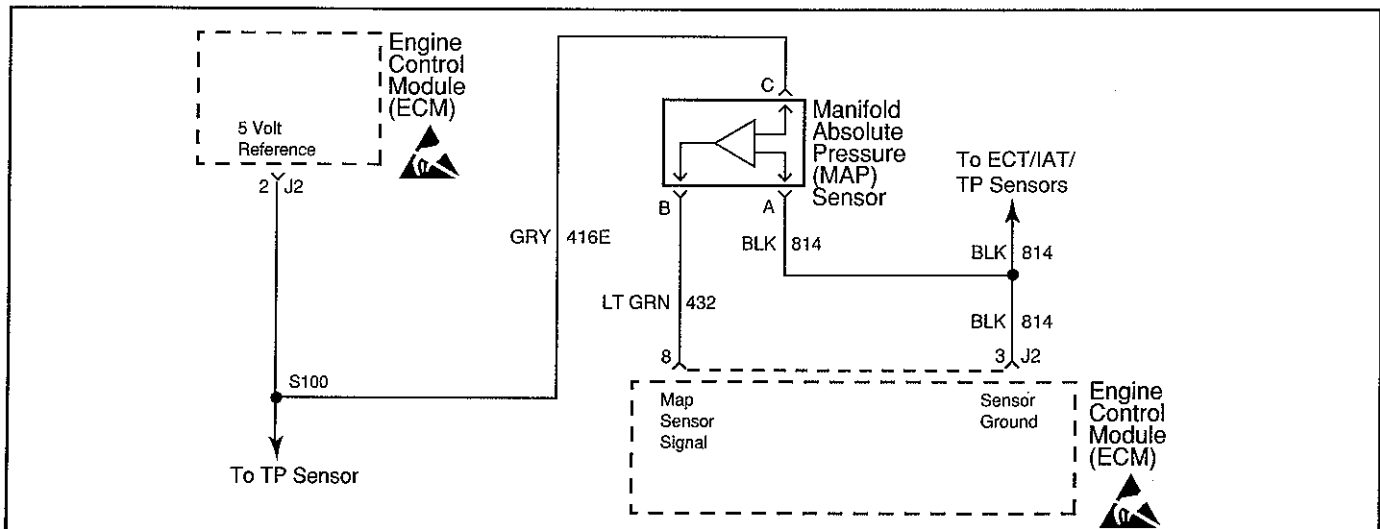
2. DTC 25 will set if signal voltage indicates an intake air temperature above 130°C or 266°F.
3. This test simulates a DTC 23. If the ECM recognizes the high voltage signal and displays a low temperature, the ECM and wiring are OK.

Intake Air Temperature Sensor Table

°C	°F	OHMS
Temperature vs Resistance Values (Approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
-5	23	12300
-15	5	21450
-30	-22	52700
-40	-40	100700

**DTC 25 - Intake Air Temperature (IAT) Sensor Circuit - High Temp Indicated
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Turn ignition ON, leaving engine OFF. Does scan tool display an intake air temperature greater than the specified value?	130°C (266°F)	Go to Step 3	Go to Step 4
3	1. Turn ignition OFF. 2. Disconnect IAT sensor harness connector. 3. Turn ignition ON, leaving engine OFF. Does scan tool display an intake air temperature below the specified value?	-30°C (-22°F)	Go to Step 6	Go to Step 5
4	DTC 25 is intermittent. Locate and repair intermittent faulty connections. • Refer to "Diagnostic Aids."	—	Verify Repair	—
5	Locate and repair short to ground in CKT 472. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 7
6	Repair faulty IAT sensor. Is action complete?	—	Verify Repair	—
7	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—

MEFI4309
4-20-00

DTC 33 - Manifold Absolute Pressure (MAP) Sensor Circuit - Signal Voltage High (Scan Diagnostics)

Circuit Description

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from about 1.0-1.5 volts at idle to about 4.0-4.5 volts at Wide Open Throttle (WOT).

If the MAP sensor fails, the ECM will substitute a default MAP value that will vary with RPM.

The MAP sensor voltage of 5 volts is delivered to the MAP sensor through CKT 416E. CKT 814 is the ground circuit for the MAP sensor. The MAP signal CKT 432 will send a voltage signal back to the ECM according to what the manifold pressure is.

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP sensor display on the scan tool while moving connectors and wiring harnesses related to the MAP sensor. A change in the MAP sensor display will indicate the location of the fault.

- If the idle is rough or unstable, refer to *Symptoms* for items which may cause an unstable idle.
- With the ignition "ON," engine "OFF," the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of altitude and is referred to as BARO. Comparison of this BARO reading, with a known good MAP sensor, is a good way to check the accuracy of a "suspect" sensor. Reading should be the same, plus or minus 0.4 volt.
- If DTC 14 is also set, check for open in ground CKT 814.
- If a MAP sensor circuit failure is present, the TP sensor default value will be used along with the MAP sensor default value.

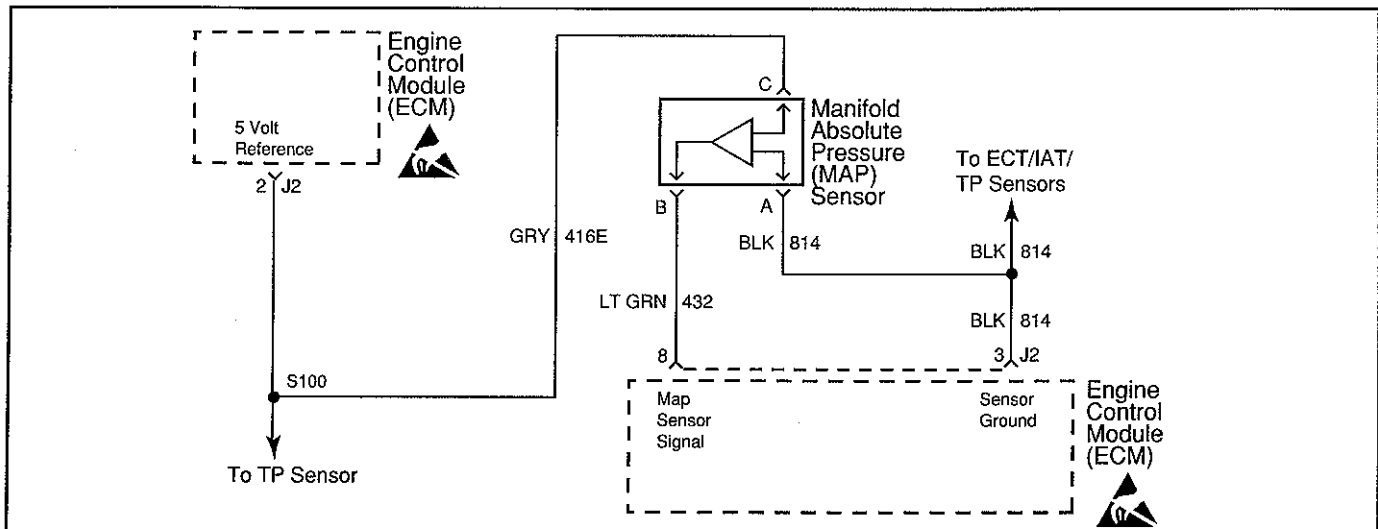
After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. This step will determine if there is an adequate vacuum supply to the MAP sensor. If the vacuum gauge reading is erratic, refer to the "Rough or Unstable Idle" symptom.
4. This step simulates a DTC 34. If the ECM recognizes the low signal voltage and sets a DTC 34, the ECM and wiring are OK.
5. This step checks for an open in ground CKT 814.

**DTC 33 - Manifold Absolute Pressure (MAP) Sensor Circuit - Signal Voltage High
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install a vacuum gauge to a manifold vacuum source. 2. Start engine and raise to about 1000 RPM in neutral. 3. The vacuum reading should be steady. Is the vacuum gauge reading steady and above the specified value?	14" Hg (45.5 kPa)	Go to Step 3	Go to Step 6
3	1. Install a scan tool. 2. Start the engine and allow engine to idle. Does scan tool indicate MAP sensor voltage greater than the specified value?	4 volts	Go to Step 4	Go to Step 7
4	1. Turn the ignition OFF. 2. Disconnect MAP sensor harness connector. 3. Turn the ignition ON, leaving the engine OFF. Does scan tool indicate MAP sensor voltage less than the specified value?	1 volt	Go to Step 5	Go to Step 8
5	1. Turn the ignition OFF. 2. Connect DMM from harness terminal "A" (CKT 814) to harness terminal "C" (CKT 416E). 3. Turn the ignition ON, leaving the engine OFF. Does DMM indicate a voltage greater than the specified value?	4 volts	Go to Step 10	Go to Step 9
6	Repair low or unsteady vacuum problem. Is action complete?	—	Verify Repair	—
7	DTC 33 is intermittent. Locate and repair intermittent faulty connections. • Refer to "Diagnostic Aids."	—	—	—
8	Locate and repair short to voltage in CKT 432. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 11
9	Locate and repair open in CKT 814. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 11
10	Check for plugged or leaking sensor vacuum fitting. If OK, replace faulty MAP sensor. Is action complete?	—	Verify Repair	—
11	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—

MEFI4309
4-20-00

DTC 34 - Manifold Absolute Pressure (MAP) Sensor Circuit - Signal Voltage Low (Scan Diagnostics)

Circuit Description

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from about 1.0-1.5 volts at idle to about 4.0-4.5 volts at Wide Open Throttle (WOT).

If the MAP sensor fails, the ECM will substitute a default MAP value that will vary with RPM.

The MAP sensor voltage of 5 volts is delivered to the MAP sensor through CKT 416E. CKT 814 is the ground circuit for the MAP sensor. The MAP signal CKT 432 will send a voltage signal back to the ECM according to what the manifold pressure is.

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP sensor display on the scan tool while moving connectors and wiring harnesses related to the MAP sensor. A change in the MAP sensor display will indicate the location of the fault.

- If the idle is rough or unstable, refer to *Symptoms* for items which may cause an unstable idle.
- With the ignition "ON," engine "OFF," the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of altitude and is referred to as BARO. Comparison of this BARO reading, with a known good MAP sensor, is a good way to check the accuracy of a "suspect" sensor. Reading should be the same, plus or minus 0.4 volt.
- If a MAP sensor circuit failure is present, the TP sensor default value will be used along with the MAP sensor default value.

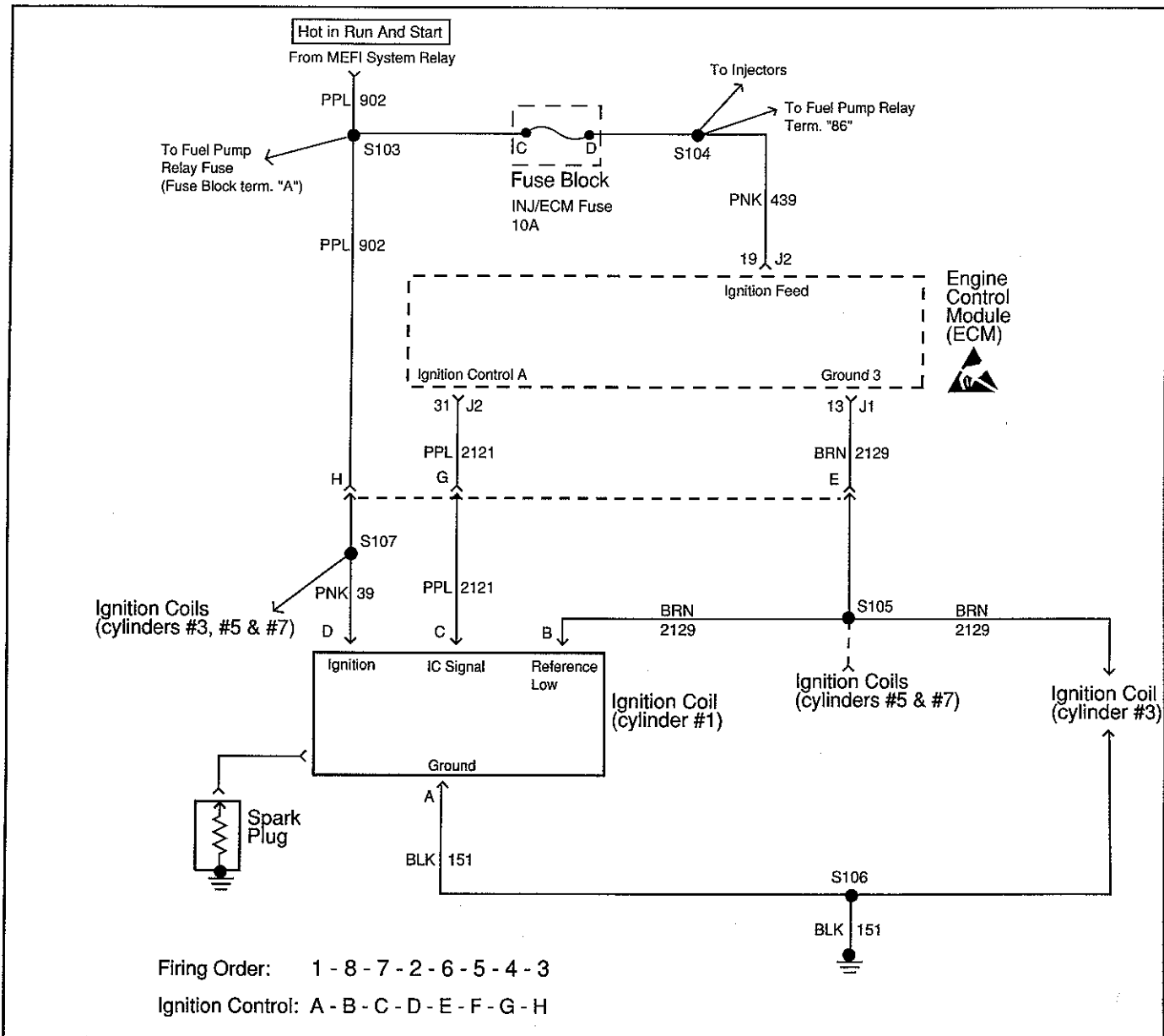
After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. This step will determine if there is an adequate vacuum supply to the MAP sensor. If the vacuum gauge reading is erratic, refer to the "Rough or Unstable Idle" symptom.
3. This step determines if DTC 34 is the result of a hard failure or an intermittent condition. A DTC will set when MAP signal voltage is too low with engine running.
4. This step simulates a DTC 33. If the ECM recognizes the high signal voltage, the ECM and wiring are OK.
5. This step checks for the 5 volt reference on CKT 416E.

DTC 34 - Manifold Absolute Pressure (MAP) Sensor Circuit - Signal Voltage Low (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Turn the ignition OFF. 2. Install a vacuum gauge to a manifold vacuum source. 3. Start engine and raise to about 1000 RPM in neutral. 4. The vacuum reading should be steady. Is the vacuum gauge reading steady and above the specified value?	14" Hg (45.5 kPa)	Go to Step 3	Go to Step 6
3	1. Install a scan tool. 2. Start the engine and allow the engine to idle. Does scan tool indicate MAP sensor voltage less than the specified value?	1 volt	Go to Step 4	Go to Step 7
4	1. Turn the ignition OFF. 2. Disconnect MAP sensor harness connector. 3. Connect a jumper wire from harness terminal "B" (CKT 432) to harness terminal "C" (CKT 416E). 4. Turn the ignition ON, leaving the engine OFF. Does scan tool indicate MAP sensor voltage greater than the specified value?	4 volts	Go to Step 10	Go to Step 5
5	1. Turn OFF the ignition. 2. Connect DMM from harness terminal "C" (CKT 416E) to a known good ground. 3. Turn ON the ignition, leaving the engine OFF. Does DMM indicate a voltage greater than the specified value?	4 volts	Go to Step 9	Go to Step 8
6	Repair low or unsteady vacuum problem. Is action complete?	—	Verify Repair	—
7	DTC 34 is intermittent. Locate and repair intermittent faulty connections. • Refer to "Diagnostic Aids."	—	—	—
8	Locate and repair open or short to ground in CKT 416E. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 11
9	Locate and repair open or short to ground in CKT 432. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 11
10	Check for plugged or leaking sensor vacuum fitting. If OK, replace faulty MAP sensor. Is action complete?	—	Verify Repair	—
11	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—



MEFI4311
7-01-00

DTC 41 - Ignition Coil 1 Control Circuit

Circuit Description

The ignition system on this engine uses an individual ignition coil/module for each cylinder. The ECM controls the ignition system operation. The ECM controls each coil using one of eight Ignition Control (IC) circuits. The ECM commands the IC circuit low when a spark event is requested. This causes the IC module to energize the ignition coil to create a spark at the spark plug. Each ignition coil/module has the following circuits:

- A power feed
- A ground circuit
- An Ignition Control (IC) circuit
- A reference low circuit

Sequencing and timing are ECM controlled. This DTC sets

when the IC circuit is out of range.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

Test Description

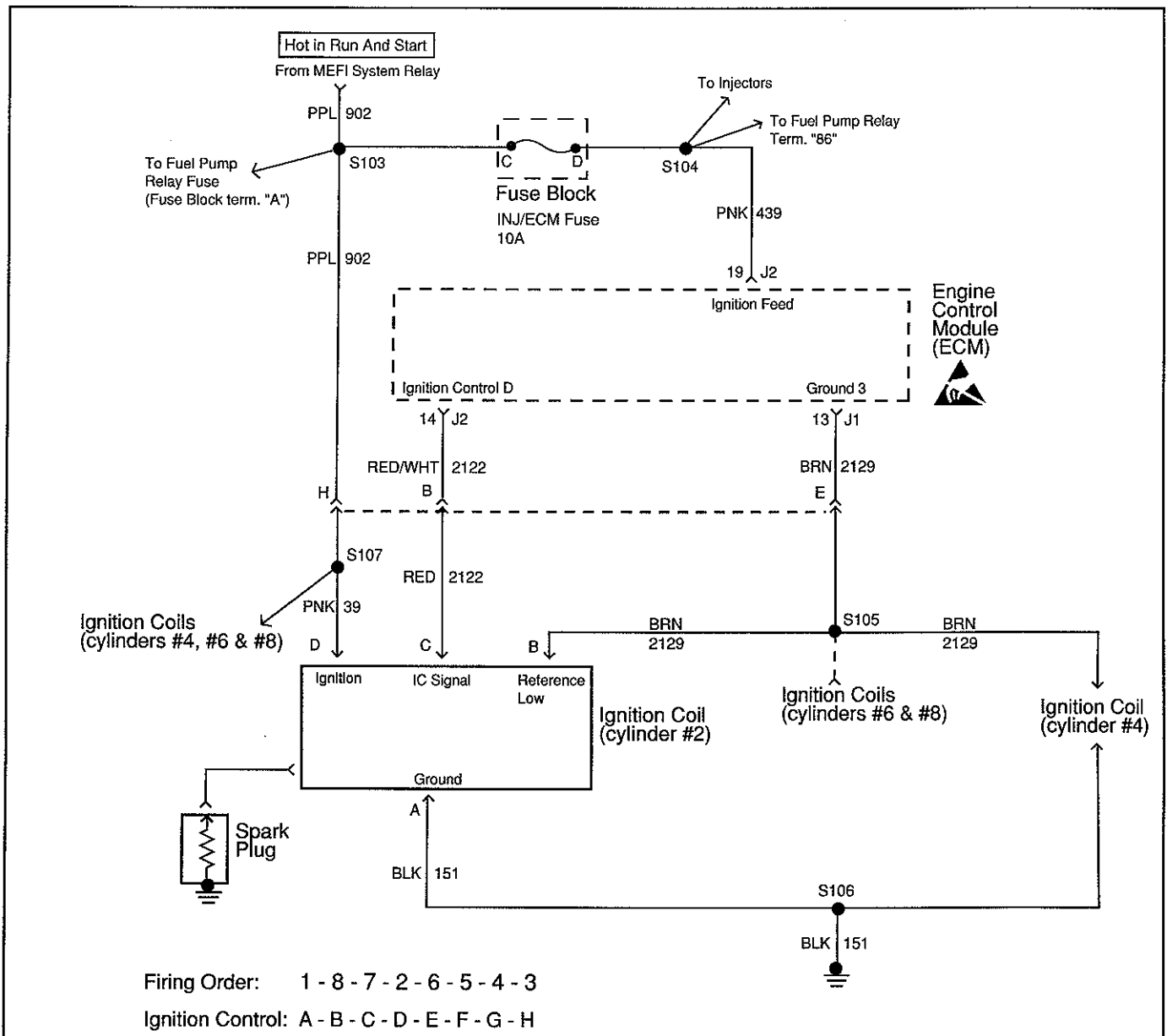
2. This step verifies the fault is present.
4. This step tests the integrity of the IC circuit and the ECM output.
5. This step tests for a short to ground on the IC signal circuit.

DTC 41 - Ignition Coil 1 Control Circuit

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits for an open. 1. Install a scan tool. 2. Using a scan tool, clear DTCs. 3. Start and idle the engine for 2 minutes. 4. Check for DTCs. Does the scan tool indicate a DTC 41 for ignition coil 1?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the engine. 2. Disconnect the ignition coil electrical harness. 3. Measure the frequency at the ignition control signal circuit using the DVOM J 39200 on the DC Hertz scale. Is the frequency within the specified range?	3.0-20 Hz	Go to Step 7	Go to Step 4
4	Measure the voltage at the ignition control signal circuit using the DVOM J 39200. Is the voltage greater than the specified value?	1.0 volts	Go to Step 8	Go to Step 5
5	1. Turn OFF the engine. 2. Disconnect the ECM connector J2. 3. Test the continuity from the IC circuit (at the ignition coil harness connector) to the ECM connector using the DVOM J 39200. Does the DVOM indicate continuity?	—	Go to Step 6	Go to Step 9
6	Test the resistance from the IC circuit (at the ignition coil harness connector) to ground using the DVOM J 39200. Does the DVOM indicate OL?	—	Go to Step 10	Go to Step 9
7	Replace the ignition coil. Is the action complete?	—	Go to Step 12	—
8	Repair the Ignition Control circuit for a short to voltage. Is the action complete?	—	Go to Step 12	—
9	Repair the Ignition Control circuit for an open or grounded circuit. Is the action complete?	—	Go to Step 12	—
10	1. Inspect for poor connections at the ECM connector. 2. Replace the terminal if necessary. Did you find and correct the problem?	—	Go to Step 12	Go to Step 11

DTC 41 - Ignition Coil 1 Control Circuit (cont'd)

Step	Action	Value	Yes	No
11	Replace the ECM. Is the action complete?	—	Go to Step 12	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC information option using the scan tool. 2. Idle the engine at the normal operating temperature. Is DTC 41 indicated?	—	Go to Step 2	Go to Step 13
13	Select the Diagnostic Trouble Code (DTC) option. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK



MEFI4312
7-01-00

DTC 41 - Ignition Coil 2 Control Circuit

when the IC circuit is out of range.

Circuit Description

The ignition system on this engine uses an individual ignition coil/module for each cylinder. The ECM controls the ignition system operation. The ECM controls each coil using one of eight Ignition Control (IC) circuits. The ECM commands the IC circuit low when a spark event is requested. This causes the IC module to energize the ignition coil to create a spark at the spark plug. Each ignition coil/module has the following circuits:

- A power feed
- A ground circuit
- An Ignition Control (IC) circuit
- A reference low circuit

Sequencing and timing are ECM controlled. This DTC sets

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

Test Description

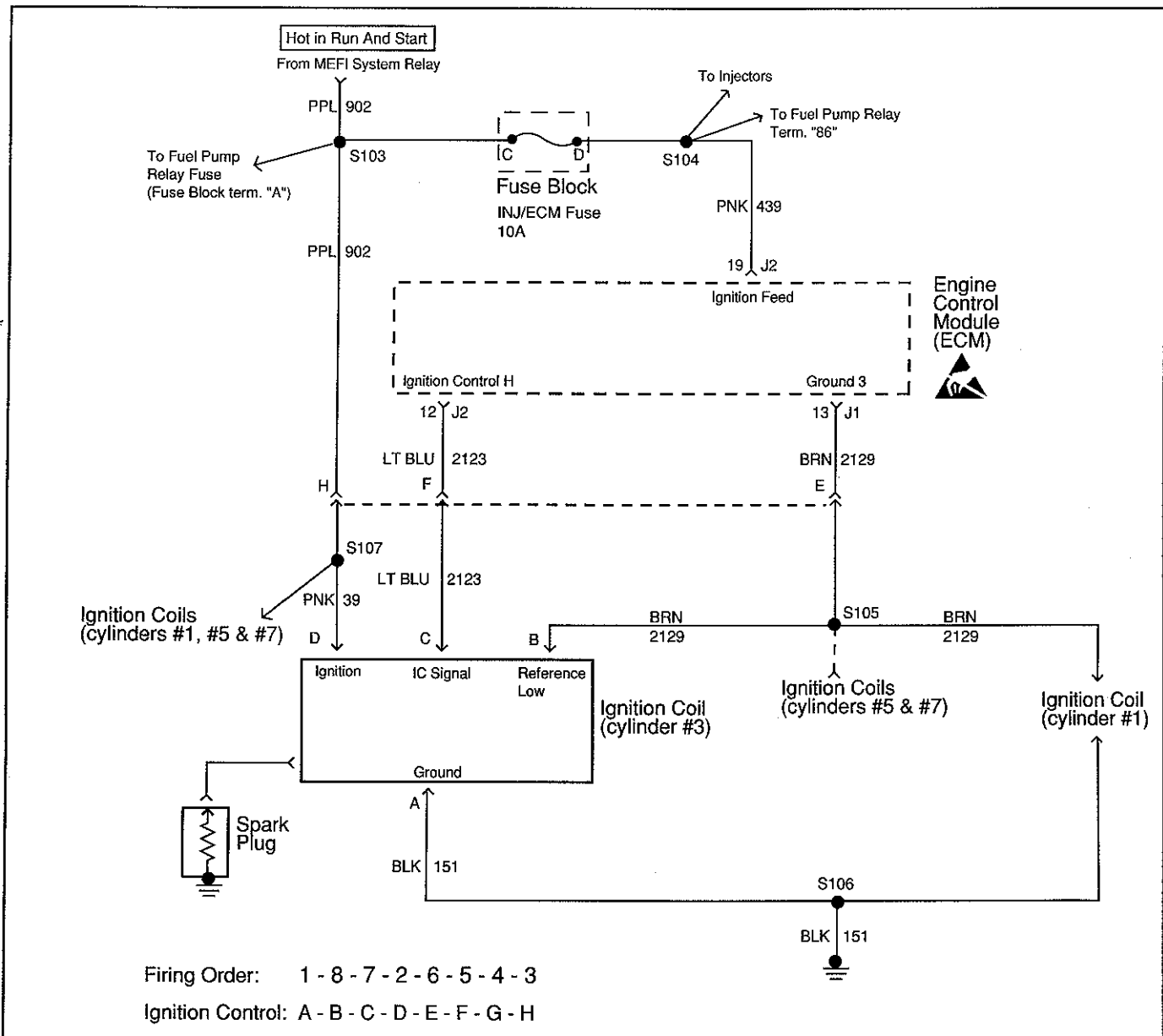
2. This step verifies the fault is present.
4. This step tests the integrity of the IC circuit and the ECM output.
5. This step tests for a short to ground on the IC signal circuit.

DTC 41 - Ignition Coil 2 Control Circuit

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits for an open. 1. Install a scan tool. 2. Using a scan tool, clear DTCs. 3. Start and idle the engine for 2 minutes. 4. Check for DTCs. Does the scan tool indicate a DTC 41 for ignition coil 2?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the engine. 2. Disconnect the ignition coil electrical harness. 3. Measure the frequency at the ignition control signal circuit using the DVOM J 39200 on the DC Hertz scale. Is the frequency within the specified range?	3.0-20 Hz	Go to Step 7	Go to Step 4
4	Measure the voltage at the ignition control signal circuit using the DVOM J 39200. Is the voltage greater than the specified value?	1.0 volts	Go to Step 8	Go to Step 5
5	1. Turn OFF the engine. 2. Disconnect the ECM connector J2. 3. Test the continuity from the IC circuit (at the ignition coil harness connector) to the ECM connector using the DVOM J 39200. Does the DVOM indicate continuity?	—	Go to Step 6	Go to Step 9
6	Test the resistance from the IC circuit (at the ignition coil harness connector) to ground using the DVOM J 39200. Does the DVOM indicate OL?	—	Go to Step 10	Go to Step 9
7	Replace the ignition coil. Is the action complete?	—	Go to Step 12	—
8	Repair the Ignition Control circuit for a short to voltage. Is the action complete?	—	Go to Step 12	—
9	Repair the Ignition Control circuit for an open or grounded circuit. Is the action complete?	—	Go to Step 12	—
10	1. Inspect for poor connections at the ECM connector. 2. Replace the terminal if necessary. Did you find and correct the problem?	—	Go to Step 12	Go to Step 11

DTC 41 - Ignition Coil 2 Control Circuit (cont'd)

Step	Action	Value	Yes	No
11	Replace the ECM. Is the action complete?	—	<i>Go to Step 12</i>	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC information option using the scan tool. 2. Idle the engine at the normal operating temperature. Is DTC 41 indicated?	—	<i>Go to Step 2</i>	<i>Go to Step 13</i>
13	Select the Diagnostic Trouble Code (DTC) option. Does the scan tool display any DTCs that you have not diagnosed?	—	<i>Go to the applicable DTC table</i>	System OK



MEFI4315
4-26-00

DTC 41 - Ignition Coil 3 Control Circuit

Circuit Description

The ignition system on this engine uses an individual ignition coil/module for each cylinder. The ECM controls the ignition system operation. The ECM controls each coil using one of eight Ignition Control (IC) circuits. The ECM commands the IC circuit low when a spark event is requested. This causes the IC module to energize the ignition coil to create a spark at the spark plug. Each ignition coil/module has the following circuits:

- A power feed
- A ground circuit
- An Ignition Control (IC) circuit
- A reference low circuit

Sequencing and timing are ECM controlled. This DTC sets

when the IC circuit is out of range.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

Test Description

2. This step verifies the fault is present.
4. This step tests the integrity of the IC circuit and the ECM output.
5. This step tests for a short to ground on the IC signal circuit.

DTC 41 - Ignition Coil 3 Control Circuit

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits for an open. 1. Install a scan tool. 2. Using a scan tool, clear DTCs. 3. Start and idle the engine for 2 minutes. 4. Check for DTCs. Does the scan tool indicate a DTC 41 for ignition coil 3?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the engine. 2. Disconnect the ignition coil electrical harness. 3. Measure the frequency at the ignition control signal circuit using the DVOM J 39200 on the DC Hertz scale. Is the frequency within the specified range?	3.0-20 Hz	Go to Step 7	Go to Step 4
4	Measure the voltage at the ignition control signal circuit using the DVOM J 39200. Is the voltage greater than the specified value?	1.0 volts	Go to Step 8	Go to Step 5
5	1. Turn OFF the engine. 2. Disconnect the ECM connector J2. 3. Test the continuity from the IC circuit (at the ignition coil harness connector) to the ECM connector using the DVOM J 39200. Does the DVOM indicate continuity?	—	Go to Step 6	Go to Step 9
6	Test the resistance from the IC circuit (at the ignition coil harness connector) to ground using the DVOM J 39200. Does the DVOM indicate OL?	—	Go to Step 10	Go to Step 9
7	Replace the ignition coil. Is the action complete?	—	Go to Step 12	—
8	Repair the Ignition Control circuit for a short to voltage. Is the action complete?	—	Go to Step 12	—
9	Repair the Ignition Control circuit for an open or grounded circuit. Is the action complete?	—	Go to Step 12	—
10	1. Inspect for poor connections at the ECM connector. 2. Replace the terminal if necessary. Did you find and correct the problem?	—	Go to Step 12	Go to Step 11

DTC 41 - Ignition Coil 3 Control Circuit (cont'd)

Step	Action	Value	Yes	No
11	Replace the ECM. Is the action complete?	—	<i>Go to Step 12</i>	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC information option using the scan tool. 2. Idle the engine at the normal operating temperature. Is DTC 41 indicated?	—	<i>Go to Step 2</i>	<i>Go to Step 13</i>
13	Select the Diagnostic Trouble Code (DTC) option. Does the scan tool display any DTCs that you have not diagnosed?	—	<i>Go to the applicable DTC table</i>	System OK

Test Description

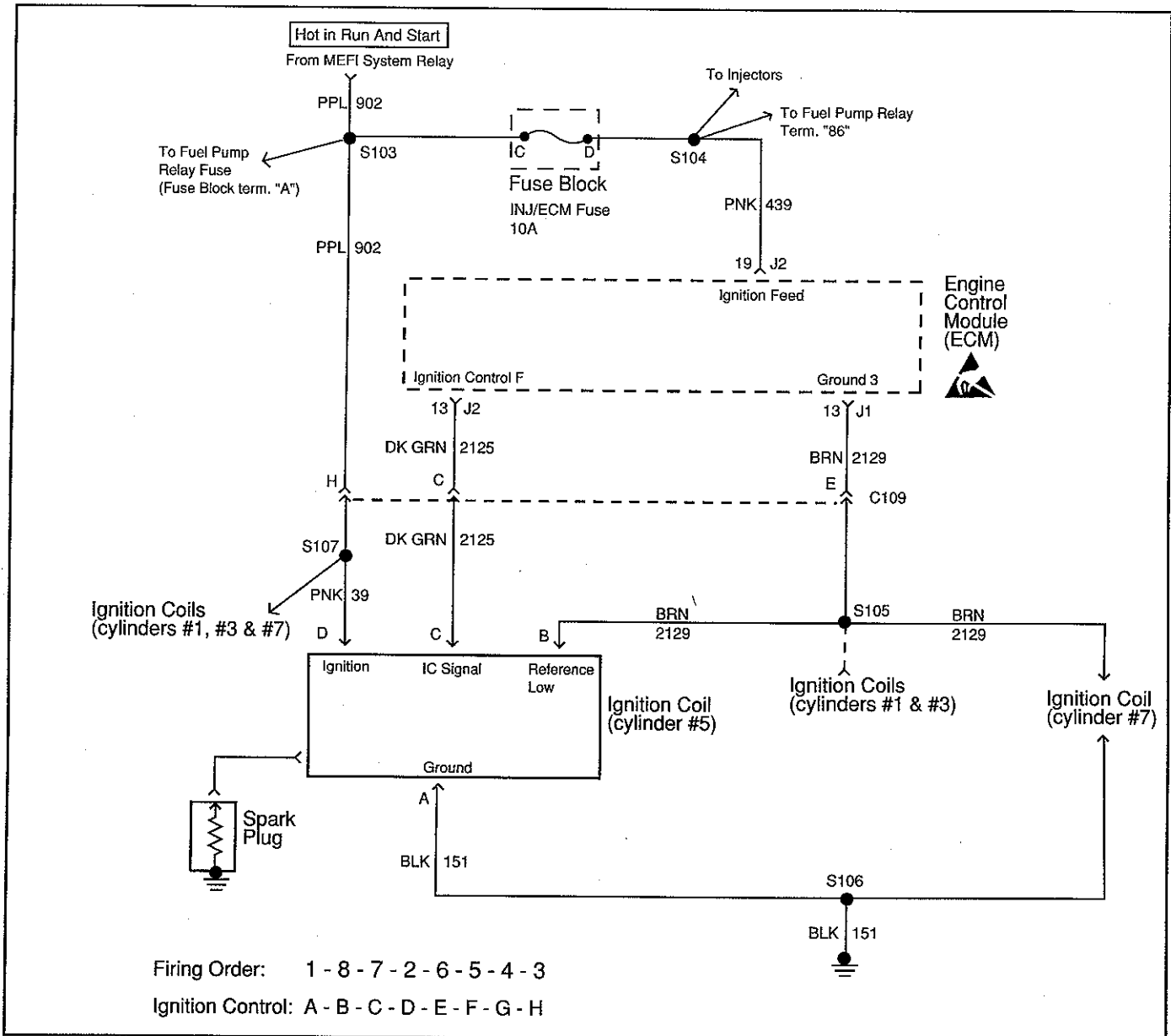
2. This step verifies the fault is present.
4. This step tests the integrity of the IC circuit and the ECM output.
5. This step tests for a short to ground on the IC signal circuit.

DTC 41 - Ignition Coil 4 Control Circuit

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits for an open. 1. Install a scan tool. 2. Using a scan tool, clear DTCs. 3. Start and idle the engine for 2 minutes. 4. Check for DTCs. Does the scan tool indicate a DTC 41 for ignition coil 4?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the engine. 2. Disconnect the ignition coil electrical harness. 3. Measure the frequency at the ignition control signal circuit using the DVOM J 39200 on the DC Hertz scale. Is the frequency within the specified range?	3.0-20 Hz	Go to Step 7	Go to Step 4
4	Measure the voltage at the ignition control signal circuit using the DVOM J 39200. Is the voltage greater than the specified value?	1.0 volts	Go to Step 8	Go to Step 5
5	1. Turn OFF the engine. 2. Disconnect the ECM connector J2. 3. Test the continuity from the IC circuit (at the ignition coil harness connector) to the ECM connector using the DVOM J 39200. Does the DVOM indicate continuity?	—	Go to Step 6	Go to Step 9
6	Test the resistance from the IC circuit (at the ignition coil harness connector) to ground using the DVOM J 39200. Does the DVOM indicate OL?	—	Go to Step 10	Go to Step 9
7	Replace the ignition coil. Is the action complete?	—	Go to Step 12	—
8	Repair the Ignition Control circuit for a short to voltage. Is the action complete?	—	Go to Step 12	—
9	Repair the Ignition Control circuit for an open or grounded circuit. Is the action complete?	—	Go to Step 12	—
10	1. Inspect for poor connections at the ECM connector. 2. Replace the terminal if necessary. Did you find and correct the problem?	—	Go to Step 12	Go to Step 11

DTC 41 - Ignition Coil 4 Control Circuit (cont'd)

Step	Action	Value	Yes	No
11	Replace the ECM. Is the action complete?	—	<i>Go to Step 12</i>	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC information option using the scan tool. 2. Idle the engine at the normal operating temperature. Is DTC 41 indicated?	—	<i>Go to Step 2</i>	<i>Go to Step 13</i>
13	Select the Diagnostic Trouble Code (DTC) option. Does the scan tool display any DTCs that you have not diagnosed?	—	<i>Go to the applicable DTC table</i>	System OK



MEFI4317
7-01-00

DTC 41 - Ignition Coil 5 Control Circuit

Circuit Description

The ignition system on this engine uses an individual ignition coil/module for each cylinder. The ECM controls the ignition system operation. The ECM controls each coil using one of eight Ignition Control (IC) circuits. The ECM commands the IC circuit low when a spark event is requested. This causes the IC module to energize the ignition coil to create a spark at the spark plug. Each ignition coil/module has the following circuits:

- A power feed
- A ground circuit
- An Ignition Control (IC) circuit
- A reference low circuit

Sequencing and timing are ECM controlled. This DTC sets

when the IC circuit is out of range.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

Test Description

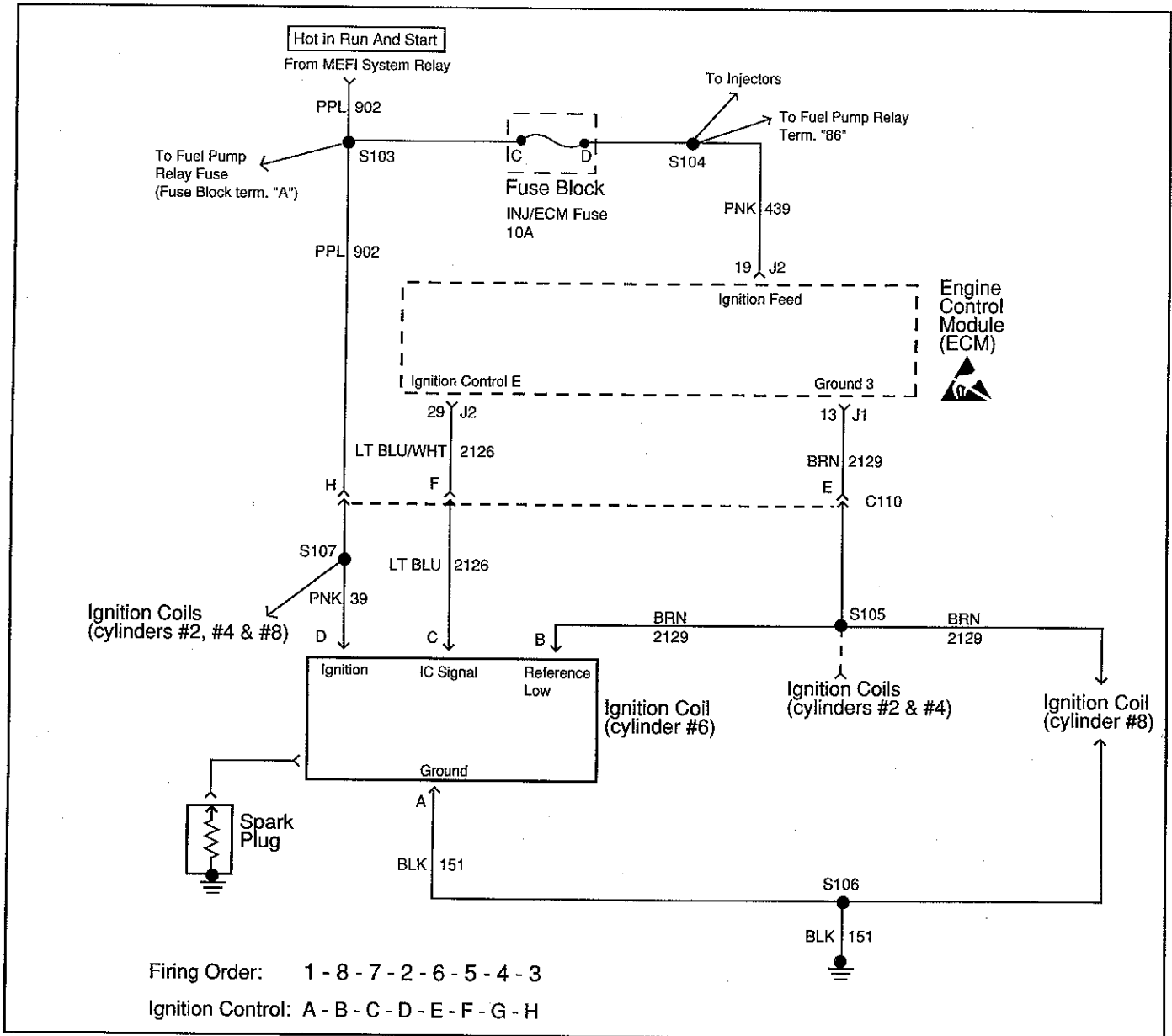
2. This step verifies the fault is present.
4. This step tests the integrity of the IC circuit and the ECM output.
5. This step tests for a short to ground on the IC signal circuit.

DTC 41 - Ignition Coil 5 Control Circuit

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits for an open. 1. Install a scan tool. 2. Using a scan tool, clear DTCs. 3. Start and idle the engine for 2 minutes. 4. Check for DTCs. Does the scan tool indicate a DTC 41 for ignition coil 5?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the engine. 2. Disconnect the ignition coil electrical harness. 3. Measure the frequency at the ignition control signal circuit using the DVOM J 39200 on the DC Hertz scale. Is the frequency within the specified range?	3.0-20 Hz	Go to Step 7	Go to Step 4
4	Measure the voltage at the ignition control signal circuit using the DVOM J 39200. Is the voltage greater than the specified value?	1.0 volts	Go to Step 8	Go to Step 5
5	1. Turn OFF the engine. 2. Disconnect the ECM connector J2. 3. Test the continuity from the IC circuit (at the ignition coil harness connector) to the ECM connector using the DVOM J 39200. Does the DVOM indicate continuity?	—	Go to Step 6	Go to Step 9
6	Test the resistance from the IC circuit (at the ignition coil harness connector) to ground using the DVOM J 39200. Does the DVOM indicate OL?	—	Go to Step 10	Go to Step 9
7	Replace the ignition coil. Is the action complete?	—	Go to Step 12	—
8	Repair the Ignition Control circuit for a short to voltage. Is the action complete?	—	Go to Step 12	—
9	Repair the Ignition Control circuit for an open or grounded circuit. Is the action complete?	—	Go to Step 12	—
10	1. Inspect for poor connections at the ECM connector. 2. Replace the terminal if necessary. Did you find and correct the problem?	—	Go to Step 12	Go to Step 11

DTC 41 - Ignition Coil 5 Control Circuit (cont'd)

Step	Action	Value	Yes	No
11	Replace the ECM. Is the action complete?	—	<i>Go to Step 12</i>	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC information option using the scan tool. 2. Idle the engine at the normal operating temperature. Is DTC 41 indicated?	—	<i>Go to Step 2</i>	<i>Go to Step 13</i>
13	Select the Diagnostic Trouble Code (DTC) option. Does the scan tool display any DTCs that you have not diagnosed?	—	<i>Go to the applicable DTC table</i>	System OK



MEFI4318
7-01-00

DTC 41 - Ignition Coil 6 Control Circuit

Circuit Description

The ignition system on this engine uses an individual ignition coil/module for each cylinder. The ECM controls the ignition system operation. The ECM controls each coil using one of eight Ignition Control (IC) circuits. The ECM commands the IC circuit low when a spark event is requested. This causes the IC module to energize the ignition coil to create a spark at the spark plug. Each ignition coil/module has the following circuits:

- A power feed
- A ground circuit
- An Ignition Control (IC) circuit
- A reference low circuit

Sequencing and timing are ECM controlled. This DTC sets

when the IC circuit is out of range.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

Test Description

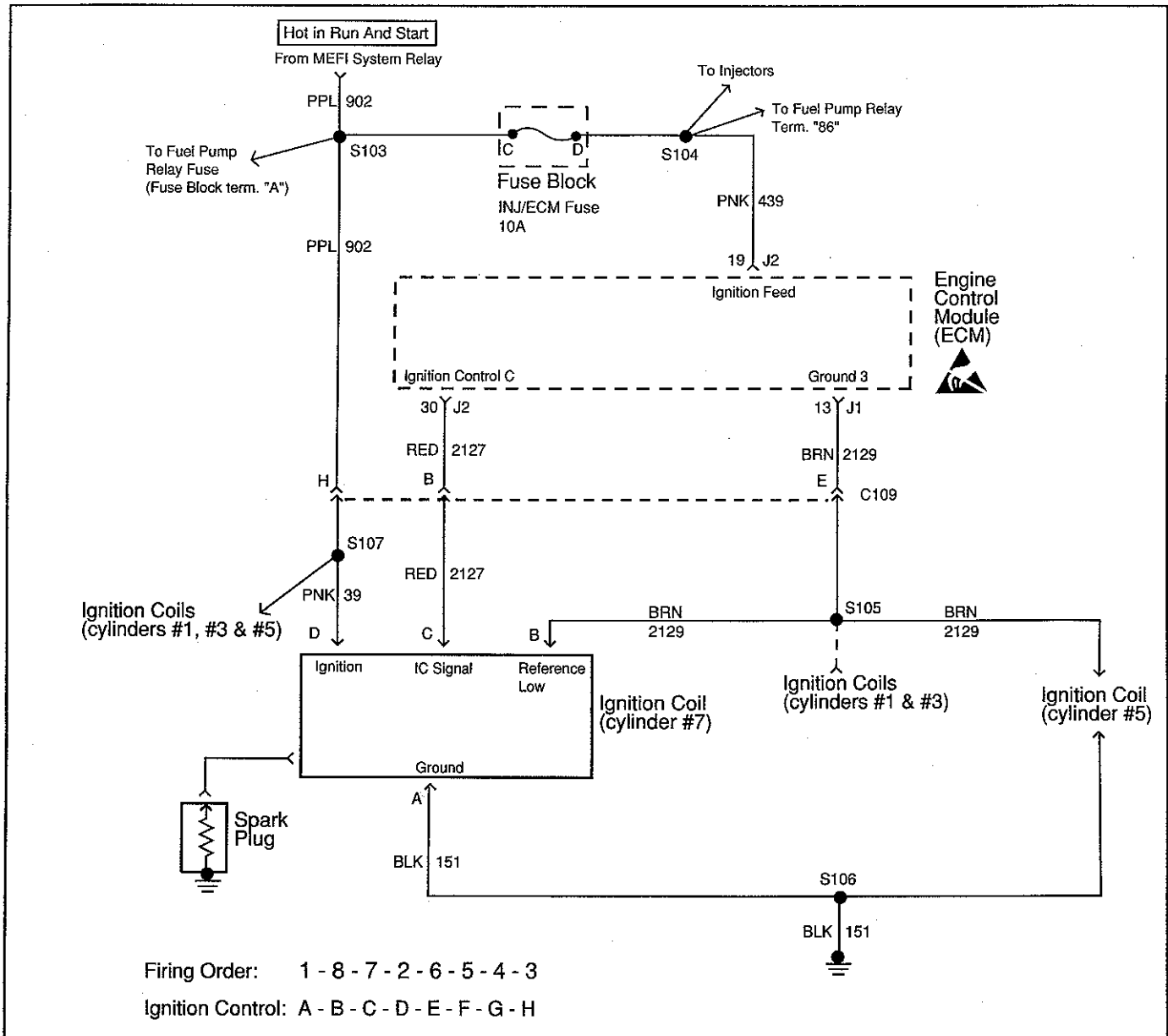
2. This step verifies the fault is present.
4. This step tests the integrity of the IC circuit and the ECM output.
5. This step tests for a short to ground on the IC signal circuit.

DTC 41 - Ignition Coil 6 Control Circuit

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits for an open. 1. Install a scan tool. 2. Using a scan tool, clear DTCs. 3. Start and idle the engine for 2 minutes. 4. Check for DTCs. Does the scan tool indicate a DTC 41 for ignition coil 6?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the engine. 2. Disconnect the ignition coil electrical harness. 3. Measure the frequency at the ignition control signal circuit using the DVOM J 39200 on the DC Hertz scale. Is the frequency within the specified range?	3.0-20 Hz	Go to Step 7	Go to Step 4
4	Measure the voltage at the ignition control signal circuit using the DVOM J 39200. Is the voltage greater than the specified value?	1.0 volts	Go to Step 8	Go to Step 5
5	1. Turn OFF the engine. 2. Disconnect the ECM connector J2. 3. Test the continuity from the IC circuit (at the ignition coil harness connector) to the ECM connector using the DVOM J 39200. Does the DVOM indicate continuity?	—	Go to Step 6	Go to Step 9
6	Test the resistance from the IC circuit (at the ignition coil harness connector) to ground using the DVOM J 39200. Does the DVOM indicate OL?	—	Go to Step 10	Go to Step 9
7	Replace the ignition coil. Is the action complete?	—	Go to Step 12	—
8	Repair the Ignition Control circuit for a short to voltage. Is the action complete?	—	Go to Step 12	—
9	Repair the Ignition Control circuit for an open or grounded circuit. Is the action complete?	—	Go to Step 12	—
10	1. Inspect for poor connections at the ECM connector. 2. Replace the terminal if necessary. Did you find and correct the problem?	—	Go to Step 12	Go to Step 11

DTC 41 - Ignition Coil 6 Control Circuit (cont'd)

Step	Action	Value	Yes	No
11	Replace the ECM. Is the action complete?	—	Go to Step 12	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC information option using the scan tool. 2. Idle the engine at the normal operating temperature. Is DTC 41 indicated?	—	Go to Step 2	Go to Step 13
13	Select the Diagnostic Trouble Code (DTC) option. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK



MEFI4319
4-26-00

DTC 41 - Ignition Coil 7 Control Circuit

Circuit Description

The ignition system on this engine uses an individual ignition coil/module for each cylinder. The ECM controls the ignition system operation. The ECM controls each coil using one of eight Ignition Control (IC) circuits. The ECM commands the IC circuit low when a spark event is requested. This causes the IC module to energize the ignition coil to create a spark at the spark plug. Each ignition coil/module has the following circuits:

- A power feed
- A ground circuit
- An Ignition Control (IC) circuit
- A reference low circuit

Sequencing and timing are ECM controlled. This DTC sets

when the IC circuit is out of range.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

Test Description

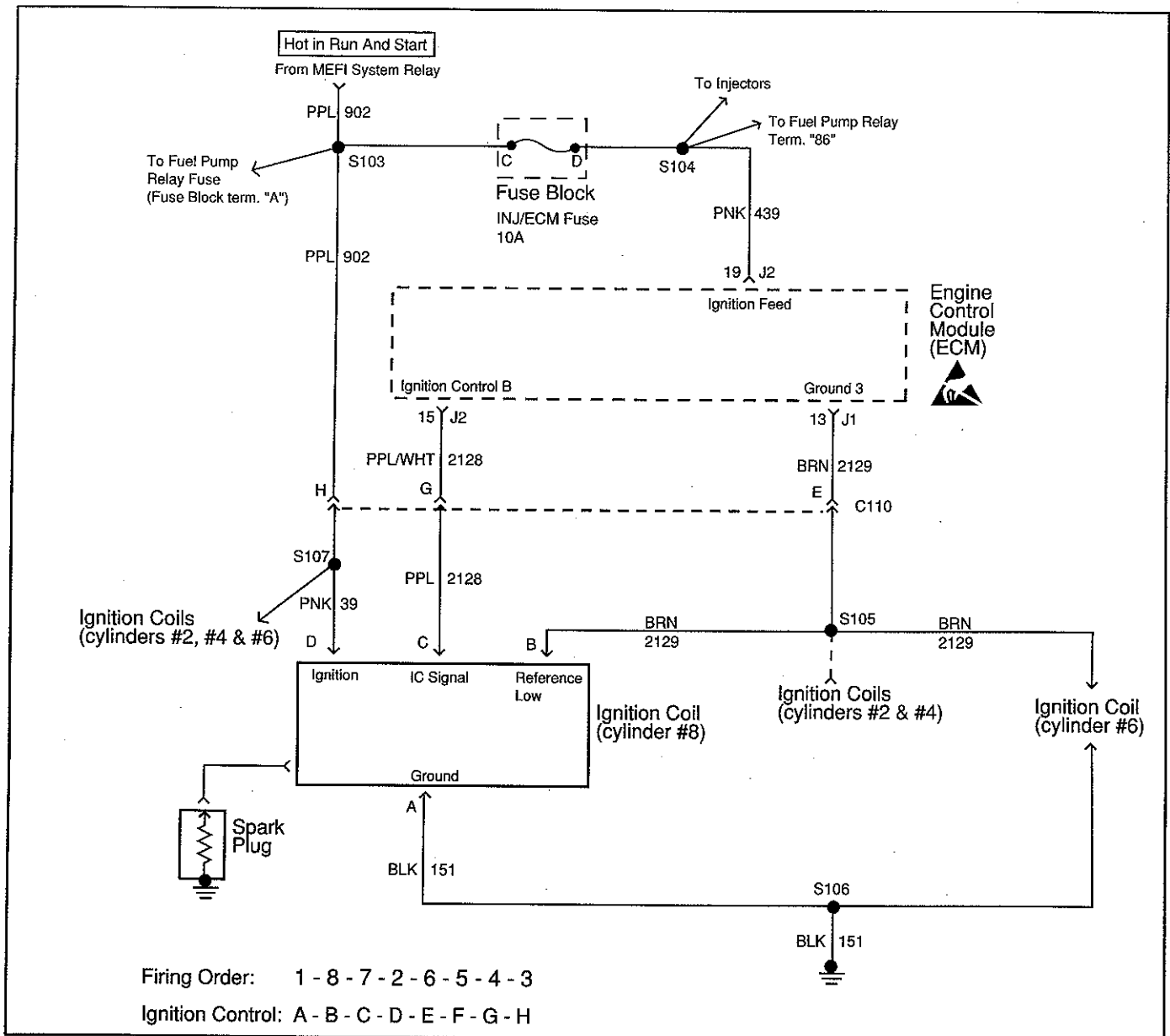
2. This step verifies the fault is present.
4. This step tests the integrity of the IC circuit and the ECM output.
5. This step tests for a short to ground on the IC signal circuit.

DTC 41 - Ignition Coil 7 Control Circuit

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits for an open. 1. Install a scan tool. 2. Using a scan tool, clear DTCs. 3. Start and idle the engine for 2 minutes. 4. Check for DTCs. Does the scan tool indicate a DTC 41 for ignition coil 7?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the engine. 2. Disconnect the ignition coil electrical harness. 3. Measure the frequency at the ignition control signal circuit using the DVOM J 39200 on the DC Hertz scale. Is the frequency within the specified range?	3.0-20 Hz	Go to Step 7	Go to Step 4
4	Measure the voltage at the ignition control signal circuit using the DVOM J 39200. Is the voltage greater than the specified value?	1.0 volts	Go to Step 8	Go to Step 5
5	1. Turn OFF the engine. 2. Disconnect the ECM connector J2. 3. Test the continuity from the IC circuit (at the ignition coil harness connector) to the ECM connector using the DVOM J 39200. Does the DVOM indicate continuity?	—	Go to Step 6	Go to Step 9
6	Test the resistance from the IC circuit (at the ignition coil harness connector) to ground using the DVOM J 39200. Does the DVOM indicate OL?	—	Go to Step 10	Go to Step 9
7	Replace the ignition coil. Is the action complete?	—	Go to Step 12	—
8	Repair the Ignition Control circuit for a short to voltage. Is the action complete?	—	Go to Step 12	—
9	Repair the Ignition Control circuit for an open or grounded circuit. Is the action complete?	—	Go to Step 12	—
10	1. Inspect for poor connections at the ECM connector. 2. Replace the terminal if necessary. Did you find and correct the problem?	—	Go to Step 12	Go to Step 11

DTC 41 - Ignition Coil 7 Control Circuit (cont'd)

Step	Action	Value	Yes	No
11	Replace the ECM. Is the action complete?	—	Go to Step 12	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC information option using the scan tool. 2. Idle the engine at the normal operating temperature. Is DTC 41 indicated?	—	Go to Step 2	Go to Step 13
13	Select the Diagnostic Trouble Code (DTC) option. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK



MEFI4320
7-01-00

DTC 41 - Ignition Coil 8 Control Circuit

Circuit Description

The ignition system on this engine uses an individual ignition coil/module for each cylinder. The ECM controls the ignition system operation. The ECM controls each coil using one of eight Ignition Control (IC) circuits. The ECM commands the IC circuit low when a spark event is requested. This causes the IC module to energize the ignition coil to create a spark at the spark plug. Each ignition coil/module has the following circuits:

- A power feed
- A ground circuit
- An Ignition Control (IC) circuit
- A reference low circuit

Sequencing and timing are ECM controlled. This DTC sets

when the IC circuit is out of range.

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

Test Description

2. This step verifies the fault is present.
4. This step tests the integrity of the IC circuit and the ECM output.

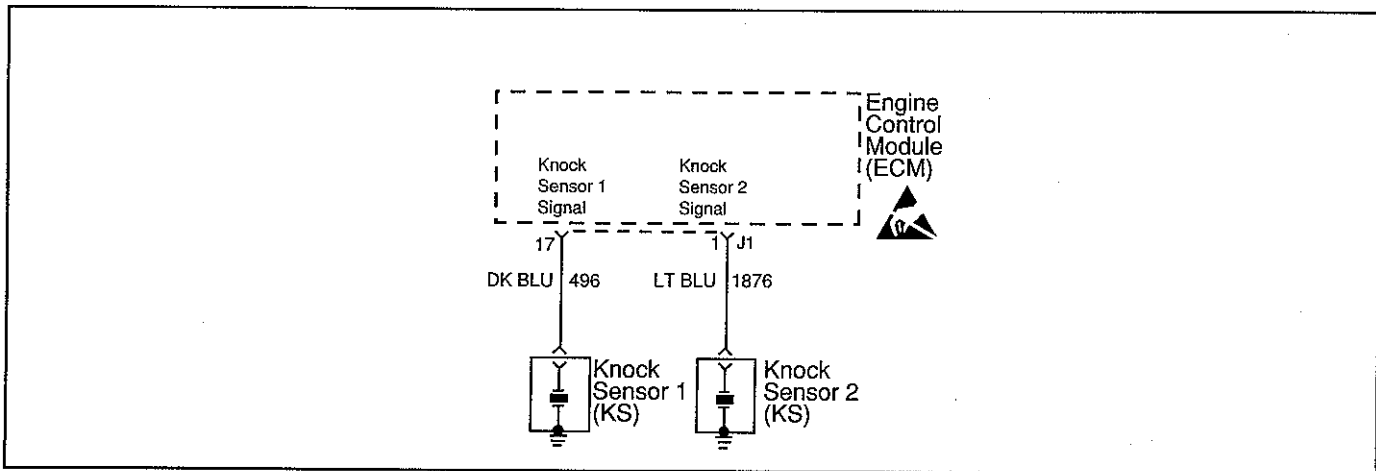
5. This step tests for a short to ground on the IC signal circuit.

DTC 41 - Ignition Coil 8 Control Circuit

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits for an open. 1. Install a scan tool. 2. Using a scan tool, clear DTCs. 3. Start and idle the engine for 2 minutes. 4. Check for DTCs. Does the scan tool indicate a DTC 41 for ignition coil 8?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the engine. 2. Disconnect the ignition coil electrical harness. 3. Measure the frequency at the ignition control signal circuit using the DVOM J 39200 on the DC Hertz scale. Is the frequency within the specified range?	3.0-20 Hz	Go to Step 7	Go to Step 4
4	Measure the voltage at the ignition control signal circuit using the DVOM J 39200. Is the voltage greater than the specified value?	1.0 volts	Go to Step 8	Go to Step 5
5	1. Turn OFF the engine. 2. Disconnect the ECM connector J2. 3. Test the continuity from the IC circuit (at the ignition coil harness connector) to the ECM connector using the DVOM J 39200. Does the DVOM indicate continuity?	—	Go to Step 6	Go to Step 9
6	Test the resistance from the IC circuit (at the ignition coil harness connector) to ground using the DVOM J 39200. Does the DVOM indicate OL?	—	Go to Step 10	Go to Step 9
7	Replace the ignition coil. Is the action complete?	—	Go to Step 12	—
8	Repair the Ignition Control circuit for a short to voltage. Is the action complete?	—	Go to Step 12	—
9	Repair the Ignition Control circuit for an open or grounded circuit. Is the action complete?	—	Go to Step 12	—
10	1. Inspect for poor connections at the ECM connector. 2. Replace the terminal if necessary. Did you find and correct the problem?	—	Go to Step 12	Go to Step 11

DTC 41 - Ignition Coil 8 Control Circuit (cont'd)

Step	Action	Value	Yes	No
11	Replace the ECM. Is the action complete?	—	<i>Go to Step 12</i>	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC information option using the scan tool. 2. Idle the engine at the normal operating temperature. Is DTC 41 indicated?	—	<i>Go to Step 2</i>	<i>Go to Step 13</i>
13	Select the Diagnostic Trouble Code (DTC) option. Does the scan tool display any DTCs that you have not diagnosed?	—	<i>Go to the applicable DTC table</i>	System OK



MEFI4310
6-28-00

DTC 44 - Knock Sensor (KS) 1 Circuit (Scan Diagnostics)

Circuit Description

The ECM uses the Knock Sensor(s) in order to detect engine detonation. This detection allows the ECM to retard spark timing based on the KS signal coming into the ECM. DTC 44 will set only if the ECM does not see any activity on the KS signal circuit(s).

Diagnostic Aids

Check for the following conditions:

- **Poor connection at ECM.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- **Damaged harness.** Inspect the wiring harness for damage.
- Loose Knock Sensor(s) in engine block.
- Poor connection at the Knock Sensor(s).

After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

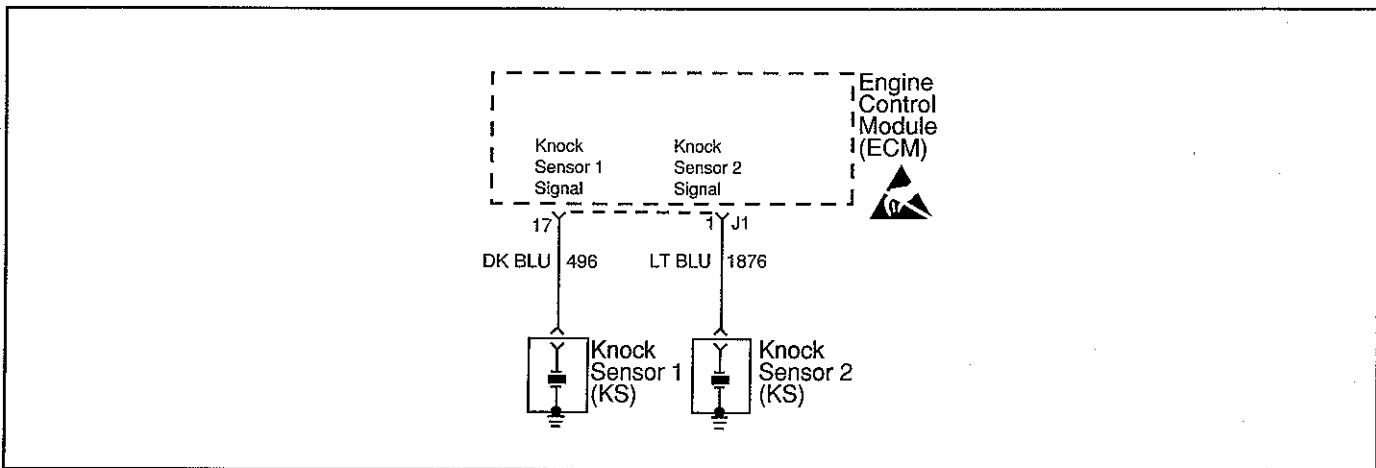
If CKT 496 or CKT 1876 are routed too close to secondary ignition wires, the ECM may see the interference as a knock signal, resulting in false timing retard.

Test Description

4. This step ensures the knock sensor is secured properly in the engine block.
5. Checks to see that the knock sensor circuit is within specifications.

DTC 44 - Knock Sensor (KS) 1 Circuit (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If you can hear the engine knock, repair the engine mechanical problem before proceeding with this diagnostic table. Check the KS signal circuit for incorrect routing near the secondary wires. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 3
3	Check the KS signal circuit for any terminals not being fully seated or for incorrect installation. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 4
4	Check knock sensor for being loose in the engine block. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 5
5	1. Install scan tool. 2. Select the option to view the data list. 3. Select to view the knock signal 1 parameter. 4. Disconnect "J1" harness connector. 5. Connect a DMM from "J1-17" (CKT 496 - Knock Signal 1) to a known good ground near the knock sensor. Is resistance between the specified value?	93-107K ohms	Go to Step 8	Go to Step 6
6	Locate and repair open or short to ground in the circuit that were out of range. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 7
7	Inspect knock sensor terminal contacts. If OK, replace faulty knock sensor. Is action complete?	—	Verify Repair	—
8	Replace faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—



MEFI4310
6-28-00

DTC 44 - Knock Sensor (KS) 2 Circuit (Scan Diagnostics)

Circuit Description

The ECM uses the Knock Sensor(s) in order to detect engine detonation. This detection allows the ECM to retard spark timing based on the KS signal coming into the ECM. DTC 44 will set only if the ECM does not see any activity on the KS signal circuit(s).

Diagnostic Aids

Check for the following conditions:

- Poor connection at ECM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Damaged harness. Inspect the wiring harness for damage.
- Loose Knock Sensor(s) in engine block.
- Poor connection at the Knock Sensor(s).

After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

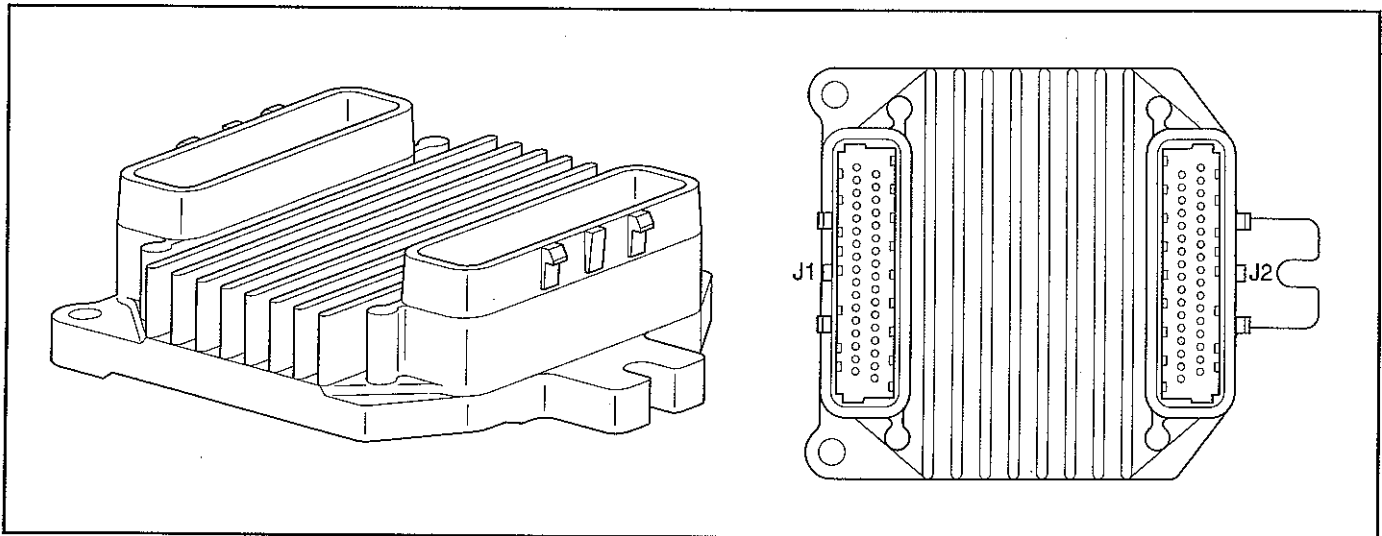
If CKT 496 or CKT 1876 are routed too close to secondary ignition wires, the ECM may see the interference as a knock signal, resulting in false timing retard.

Test Description

4. This step ensures the knock sensor is secured properly in the engine block.
5. Checks to see that the knock sensor circuit is within specifications.

DTC 44 - Knock Sensor (KS) 2 Circuit (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	Important: If you can hear the engine knock, repair the engine mechanical problem before proceeding with this diagnostic table. Check the KS signal circuit for incorrect routing near the secondary wires. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 3
3	Check the KS signal circuit for any terminals not being fully seated or for incorrect installation. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 4
4	Check knock sensor for being loose in the engine block. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 5
5	1. Install scan tool. 2. Select the option to view the data list. 3. Select to view the knock signal 2 parameter. 4. Disconnect "J1" harness connector. 5. Connect a DMM from "J1-1" (CKT 1876 - Knock Signal 2) to a known good ground near knock sensor. Is resistance between the specified value?	93-107K ohms	Go to Step 8	Go to Step 6
6	Locate and repair open or short to ground in the circuit that were out of range. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 7
7	Inspect knock sensor terminal contacts. If OK, replace faulty knock sensor. Is action complete?	—	Verify Repair	—
8	Replace faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—



MEFI3004

DTC 51 - Calibration Checksum Failure (Scan Diagnostics)

Circuit Description

This test allows the ECM to check for a calibration failure by comparing the calibration value to a known value stored in the EEPROM.

This test is also used as a security measure to prevent improper use of calibration or changes to these calibrations that may alter the designed function of MEFI.

Diagnostic Aids

If DTC 51 failed more than once, but is intermittent, replace the ECM.

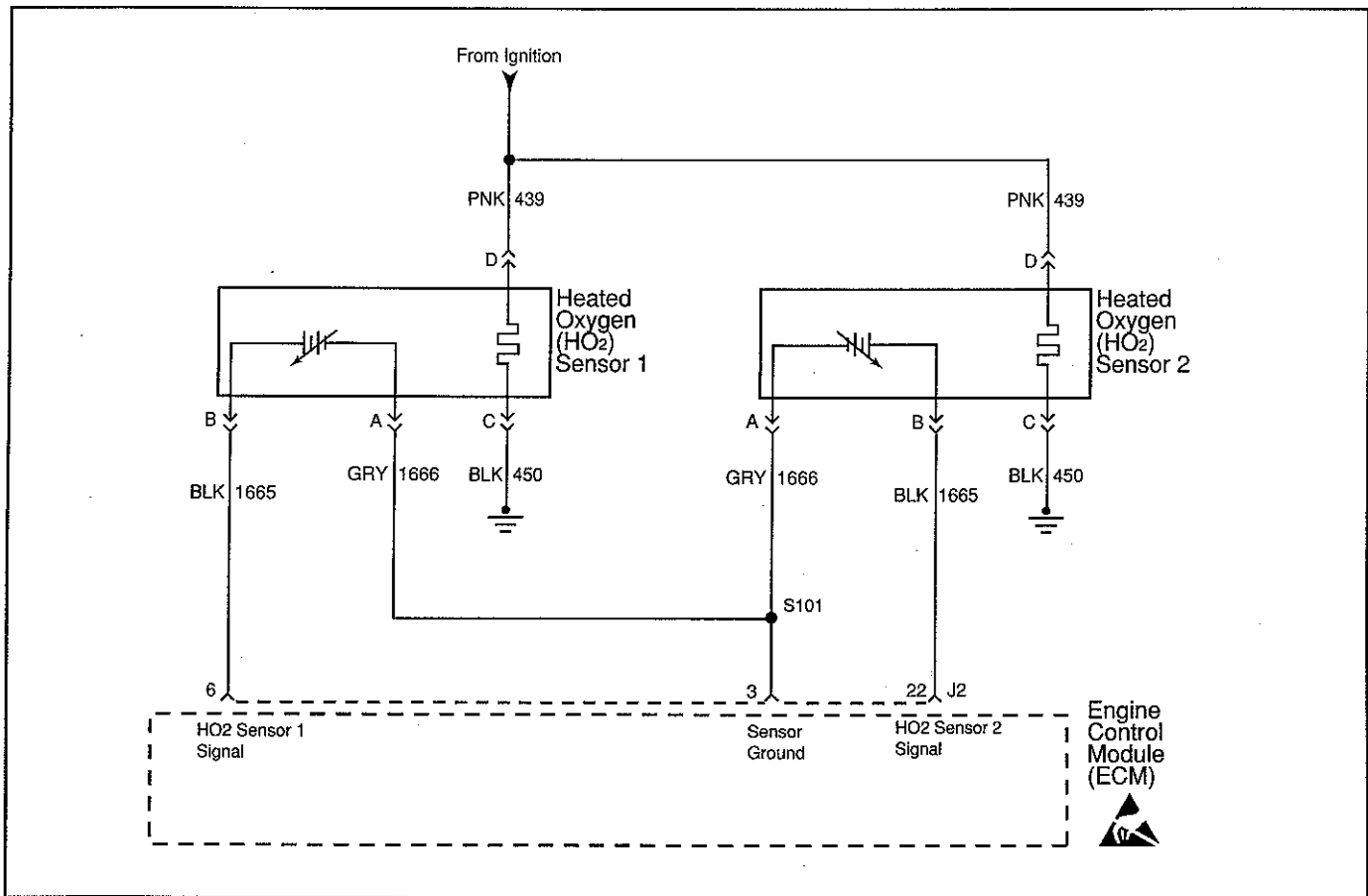
Test Description

2. This step checks to see if the fault is present during diagnosis. If present, the ECM is not functioning properly and must be replaced or reprogrammed.

DTC 51 - Calibration Checksum Failure (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install Diagnostic Trouble Code (DTC) tool. 2. Using "Clear DTC Procedure," clear DTC 51. 3. Turn the ignition ON, leaving the engine OFF. 4. Switch DTC tool to "service mode," or "ON." Does DTC 51 reset?	—	Go to Step 3	Refer to Diagnostic Aids
3	Replace or reprogram faulty ECM and verify DTC does not reset. Is action complete?	—	Verify Repair	—

**This Page Was
Intentionally Left
Blank**



MEFI4313
4-26-00

DTC 54 - Heated Oxygen (HO2) Sensor 1 Circuit Low Voltage - Lean Exhaust Indicated (Scan Diagnostics)

Circuit Description

The Heated Oxygen (HO₂) Sensor varies voltage within a range from about 1.0 volt if the exhaust is rich, down to about 0.1 volt if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 360° C (600° F). An open oxygen sensor circuit or cold oxygen sensor causes an Open Loop operation.

Diagnostic Aids

Check for the following conditions:

- **Poor connection in harness.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- An intermittent short to ground in the HO₂ sensor signal circuit.
- Fuel contamination: Water, even in small amounts delivered to the injectors can cause a lean condition.
- Fuel Pressure: If the fuel pressure is too low, the system will be lean. In order to confirm, monitor a fuel pressure gauge while driving the vehicle at various speeds and

loads.

- Exhaust Leaks: If there is an exhaust leak, the engine may pull the outside air into the exhaust and past the sensor.
- Vacuum leaks can cause a lean condition or high idle.

Never solder the HO₂ wires. For proper wire and connection repairs, refer to "Wiring Repair."

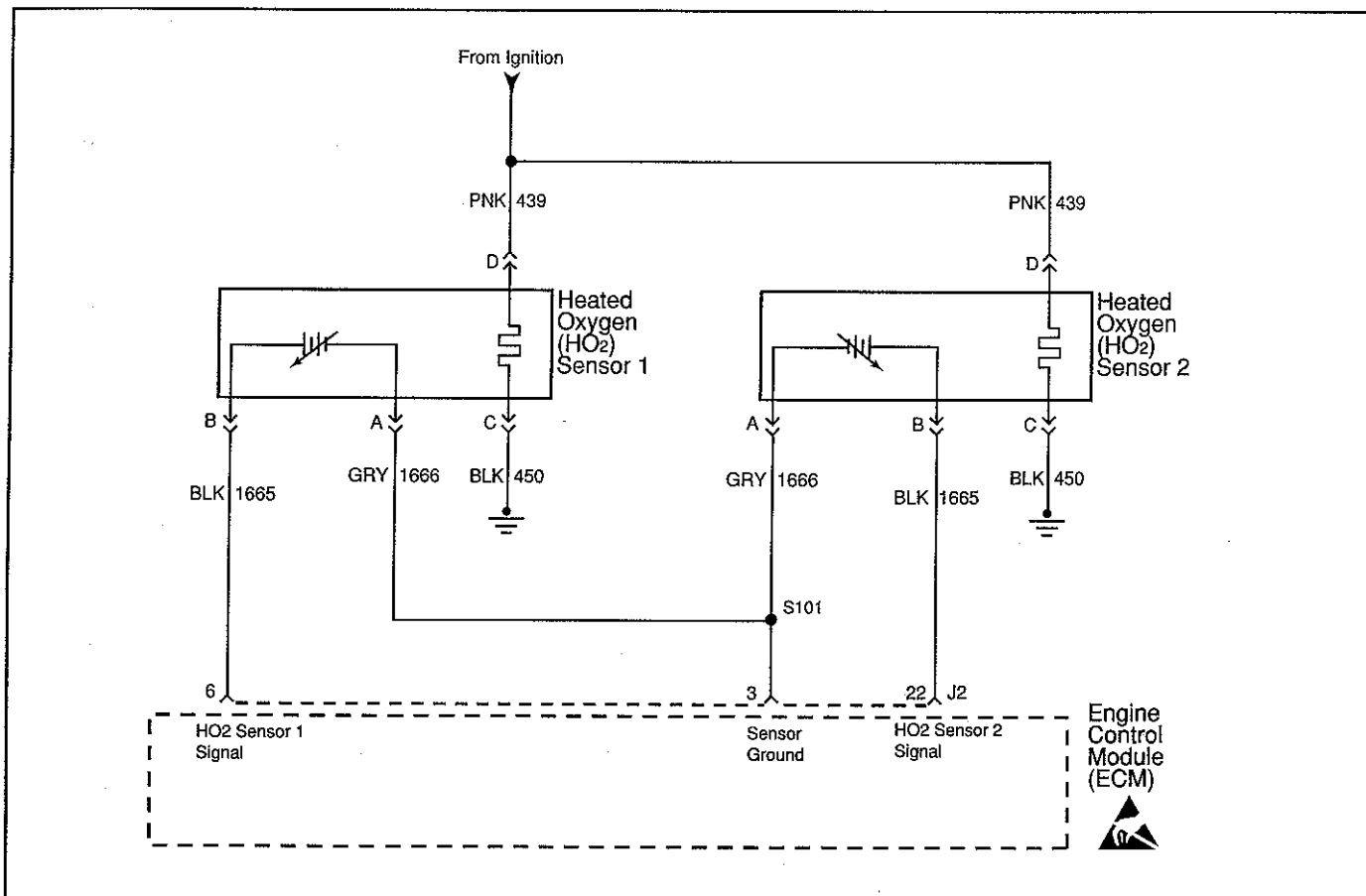
After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. Running the engine at 1200 RPM keeps the HO₂ sensor hot in order to ensure the oxygen sensor remains active and can indicate the exhaust oxygen content accurately.
3. Opening the heated oxygen sensor circuit should result in a displayed voltage between 0.423 volt and 0.487 volt. If the display is fixed below 0.100 volt, the fault is a short to ground in HO₂ sensor signal circuit or a faulty ECM.

**DTC 54 - Heated Oxygen (HO₂) Sensor 1 Circuit Low Voltage - Lean Exhaust Indicated
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	<i>Go to Step 2</i>	<i>Go to OBD System Check</i>
2	1. Connect a scan tool. 2. Run the engine at the normal operating temperature. 3. Place the vehicle in park or neutral. 4. Increase the engine speed to the specified value. Is the HO ₂ sensor 1 voltage displayed fixed less than the specified value?	1200 RPM 0.100 volt	<i>Go to Step 3</i>	<i>Go to Step 4</i>
3	1. Disconnect the HO ₂ sensor 1 electrical connector. 2. Using a jumper wire, connect the HO ₂ sensor 1 Low circuit to a known good ground. 3. Turn the ignition ON, leaving the engine OFF. Does the scan tool HO ₂ Sensor 1 Voltage display indicate a voltage within the specified value?	0.423 - 0.487 volt	Refer to Diagnostic Aids	<i>Go to Step 5</i>
4	DTC 54 is intermittent. If no additional DTC's are stored, refer to the Diagnostic Aids. If any additional DTC's are stored, refer to those table(s) first.	—	Go to Applicable DTC Table	—
5	Locate and repair short to ground in the HO ₂ sensor 1 signal circuit. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	<i>Go to Step 6</i>
6	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—



MEFI4313
4-26-00

DTC 54 - Heated Oxygen (HO₂) Sensor 2 Circuit Low Voltage - Lean Exhaust Indicated (Scan Diagnostics)

Circuit Description

The Heated Oxygen (HO₂) Sensor varies voltage within a range from about 1.0 volt if the exhaust is rich, down to about 0.1 volt if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 360° C (600° F). An open oxygen sensor circuit or cold oxygen sensor causes an Open Loop operation.

Diagnostic Aids

Check for the following conditions:

- Poor connection in harness. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- An intermittent short to ground in the HO₂ sensor signal circuit.
- Fuel contamination: Water, even in small amounts delivered to the injectors can cause a lean condition.
- Fuel Pressure: If the fuel pressure is too low, the system will be lean. In order to confirm, monitor a fuel pressure gauge while driving the vehicle at various speeds and loads.
- Exhaust Leaks: If there is an exhaust leak, the engine may pull the outside air into the exhaust and past the sensor.
- Vacuum leaks can cause a lean condition or high idle.

Never solder the HO₂ wires. For proper wire and connection repairs, refer to "Wiring Repair."

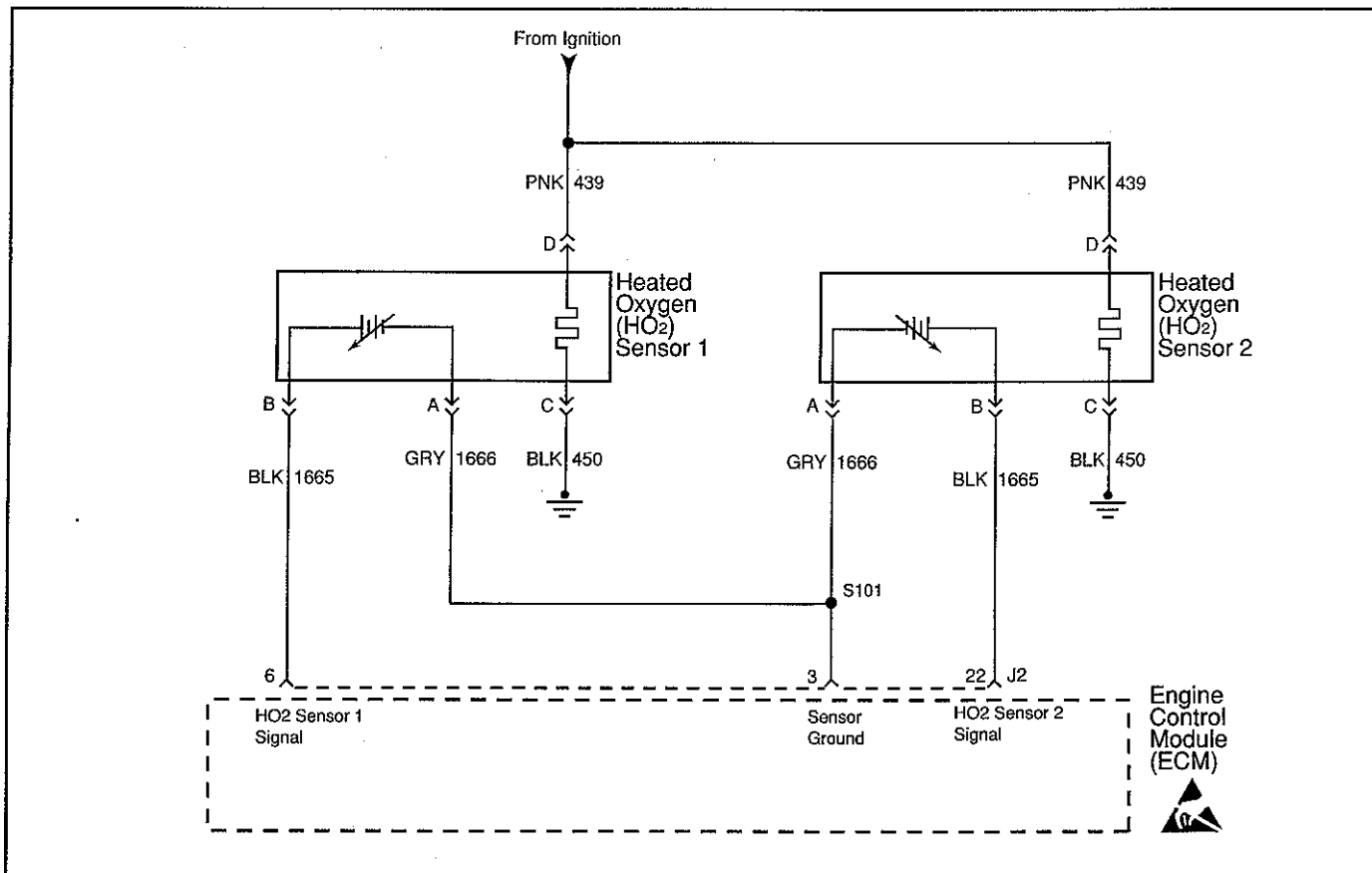
After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. Running the engine at 1200 RPM keeps the HO₂ sensor hot in order to ensure the oxygen sensor remains active and can indicate the exhaust oxygen content accurately.
3. Opening the heated oxygen sensor circuit should result in a displayed voltage between 0.423 volt and 0.487 volt. If the display is fixed below 0.100 volt, the fault is a short to ground in HO₂ sensor signal circuit or a faulty ECM.

**DTC 54 - Heated Oxygen (HO₂) Sensor 2 Circuit Low Voltage - Lean Exhaust Indicated
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Connect scan tool. 2. Run the engine at the normal operating temperature. 3. Place the vehicle in park or neutral. 4. Increase the engine speed to the specified value. Is the HO ₂ sensor 2 voltage displayed fixed less than the specified value?	1200 RPM 0.100 volt	Go to Step 3	Go to Step 4
3	1. Disconnect the HO ₂ sensor 2 electrical connector. 2. Using a jumper wire, connect the HO ₂ sensor 2 Low circuit to a known good ground. 3. Turn the ignition ON, leaving the engine OFF. Does the scan tool HO ₂ Sensor 2 Voltage display indicate a voltage within the specified value?	0.423 - 0.487 volt	Refer to Diagnostic Aids	Go to Step 5
4	DTC 54 is intermittent. If no additional DTC's are stored, refer to the Diagnostic Aids. If any additional DTC's are stored, refer to those table(s) first.	—	Go to Applicable DTC Table	—
5	Locate and repair short to ground in the HO ₂ sensor 2 signal circuit. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 6
6	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—



MEFI4313
4-26-00

DTC 55 - Heated Oxygen (HO₂) Sensor 1 Circuit High Voltage - Rich Exhaust Indicated (Scan Diagnostics)

Circuit Description

The Heated Oxygen (HO₂) Sensor varies voltage within a range from about 1.0 volt if the exhaust is rich, down to about 0.1 volt if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 360° C (600° F). An open oxygen sensor circuit or cold oxygen sensor causes an Open Loop operation.

Diagnostic Aids

Check for the following conditions:

- **Poor connection in harness.** Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- A leaking injector.
- Fuel contaminated oil.
- Fuel Pressure: If the fuel pressure is too high, the system will be rich. In order to confirm, monitor a fuel pressure gauge while driving the vehicle at various speeds and loads.
- Leaking fuel pressure regulator. Check for fuel in the vacuum line to regulator.

- The TP sensor: An intermittent TP sensor output can cause the system to run rich due to a false indication of the throttle moving.
- False rich indication due to silicon contamination of the HO₂ sensor. A DTC 55 accompanied by lean drivability conditions and a powdery white deposit on the sensor indicates a false rich condition.
- Faulty HO₂ sensor: The HO₂ sensor is internally shorted, the HO₂ Sensor Voltage displayed on the scan tool will be over 1.0 volt. Try disconnecting the HO₂ electrical connector, if the displayed voltage goes from over 1.0 volt down to about 0.5 volt, replace the HO₂ sensor.

Never solder the HO₂ wires. For proper wire and connection repairs, refer to "Wiring Repair."

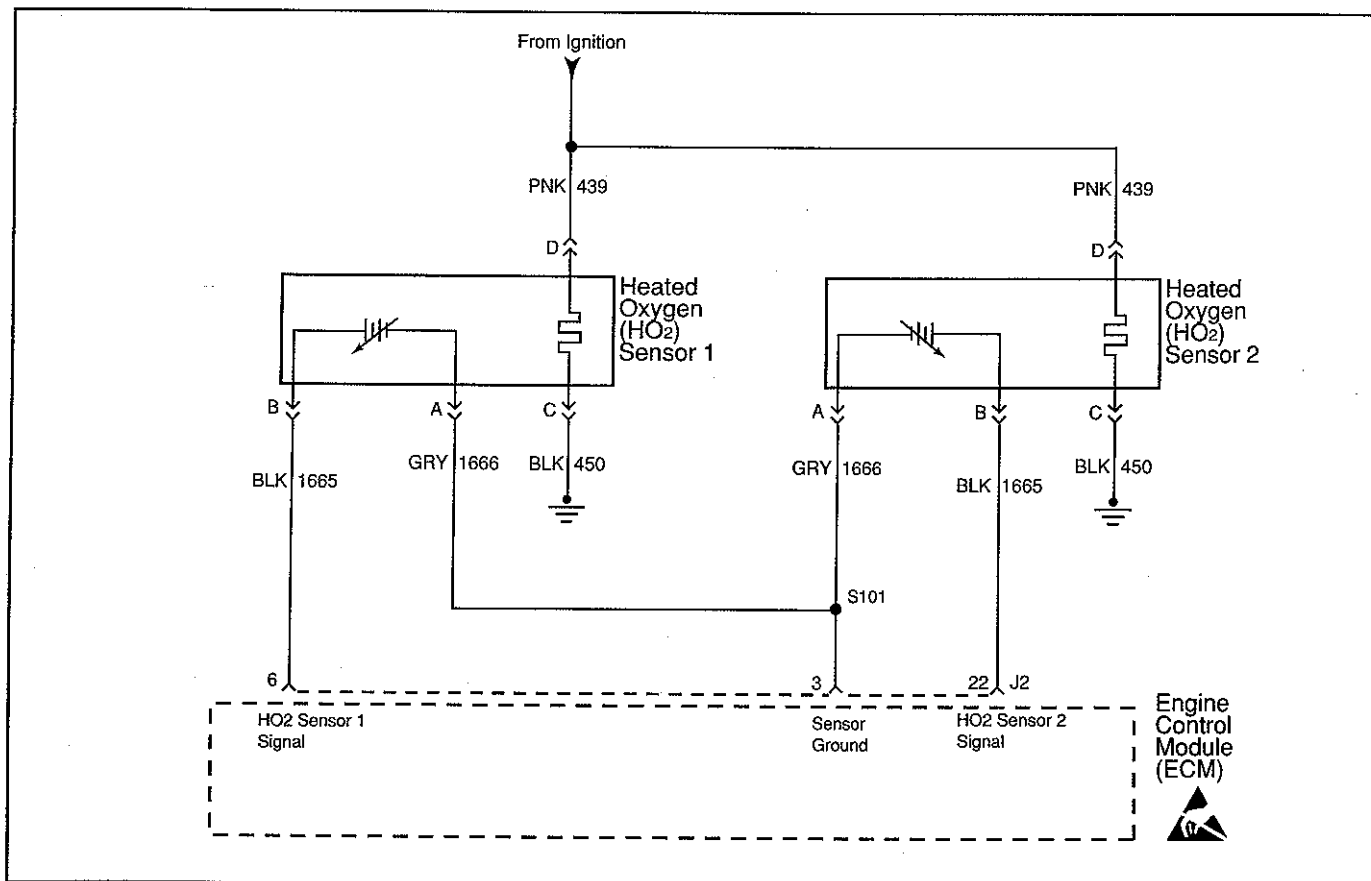
After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. This test determines if the conditions exist in order to set DTC 55.

**DTC 55 - Heated Oxygen (HO₂) Sensor 1 Circuit High Voltage - Rich Exhaust Indicated
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Connect scan tool. 2. Run the engine at the normal operating temperature. 3. Place the vehicle in park or neutral. 4. Increase the engine speed to the specified value. Is the HO ₂ sensor 1 voltage displayed fixed above the specified value?	1200 RPM 0.900 volt	Go to Step 3	Go to Step 5
3	Turn the ignition ON, leaving the engine OFF. Does the scan tool HO ₂ Sensor 1 Voltage display indicate a voltage fixed above the specified value?	0.900 volt	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the HO ₂ sensor 1 electrical connector. 2. Turn the ignition ON, leaving the engine OFF. Does the scan tool HO ₂ Sensor 1 Voltage display indicate a voltage fixed above the specified value?	0.900 volt	Go to Step 7	Go to Step 6
5	DTC 55 is intermittent. If no additional DTC's are stored, refer to the Diagnostic Aids. If any additional DTC's are stored, refer to those table(s) first.	—	Go to Applicable DTC Table	—
6	Replace HO ₂ sensor 1. Is action complete?	—	Verify Repair	—
7	Locate and repair short to voltage on the HO ₂ sensor 1 signal circuit. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 8
8	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—



MEFI4313
4-26-00

DTC 55 - Heated Oxygen (HO₂) Sensor 2 Circuit High Voltage - Rich Exhaust Indicated (Scan Diagnostics)

Circuit Description

The Heated Oxygen (HO₂) Sensor varies voltage within a range from about 1.0 volt if the exhaust is rich, down to about 0.1 volt if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 360° C (600° F). An open oxygen sensor circuit or cold oxygen sensor causes an Open Loop operation.

Diagnostic Aids

Check for the following conditions:

- Poor connection in harness. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- A leaking injector.
- Fuel contaminated oil.
- Fuel Pressure: If the fuel pressure is too high, the system will be rich. In order to confirm, monitor a fuel pressure gauge while driving the vehicle at various speeds and loads.
- Leaking fuel pressure regulator. Check for fuel in the vacuum line to regulator.

- The TP sensor: An intermittent TP sensor output can cause the system to run rich due to a false indication of the throttle moving.
- False rich indication due to silicon contamination of the HO₂ sensor. A DTC 55 accompanied by lean drivability conditions and a powdery white deposit on the sensor indicates a false rich condition.
- Faulty HO₂ sensor: The HO₂ sensor is internally shorted, the HO₂ Sensor Voltage displayed on the scan tool will be over 1.0 volt. Try disconnecting the HO₂ electrical connector, if the displayed voltage goes from over 1.0 volt down to about 0.5 volt, replace the HO₂ sensor.

Never solder the HO₂ wires. For proper wire and connection repairs, refer to "Wiring Repair."

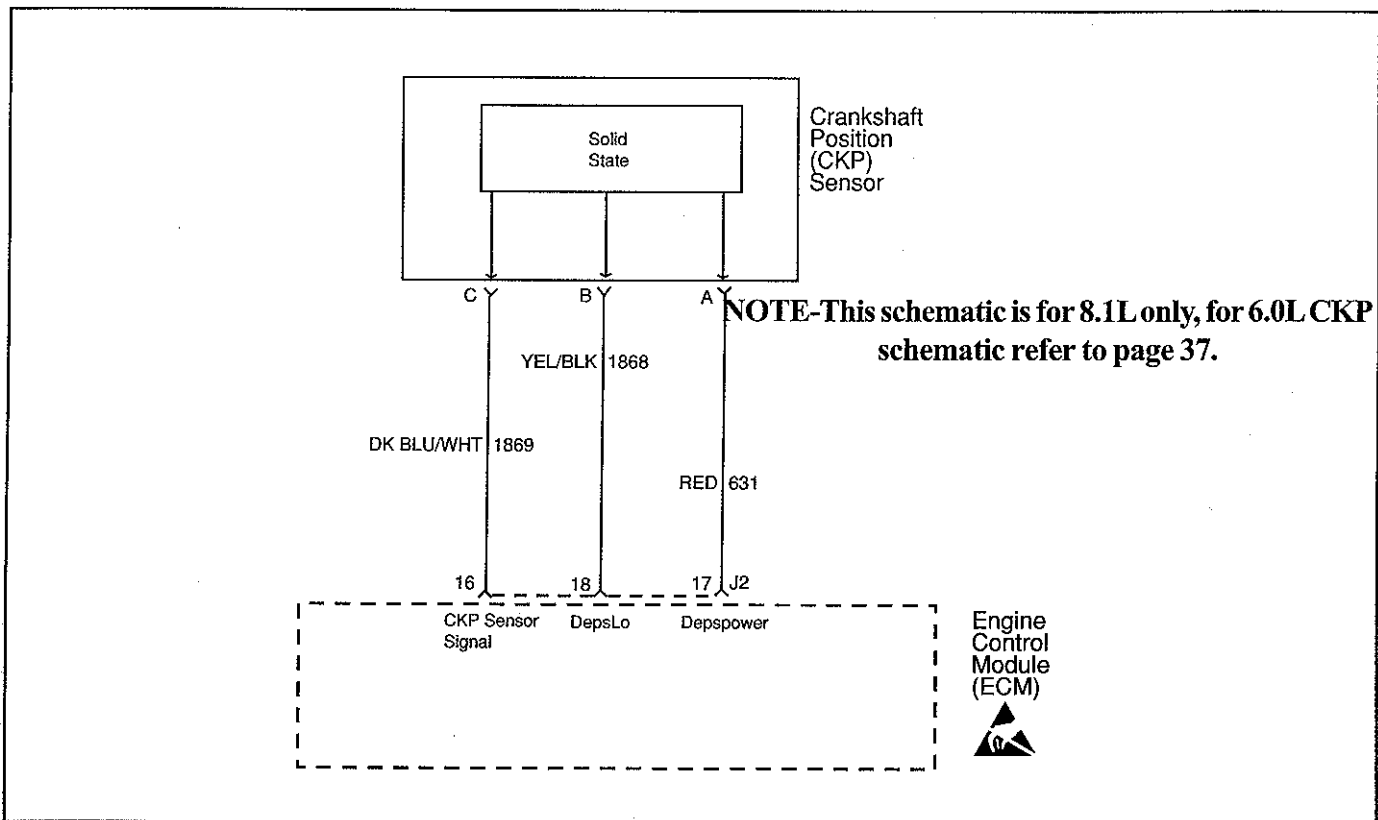
After repairs, clear DTC's following "Clear DTC's Procedure." Failure to do so may result in DTC's not properly being cleared.

Test Description

2. This test determines if the conditions exist in order to set DTC 55.

**DTC 55 - Heated Oxygen (HO₂) Sensor 2 Circuit High Voltage - Rich Exhaust Indicated
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Connect scan tool. 2. Run the engine at the normal operating temperature. 3. Place the vehicle in park or neutral. 4. Increase the engine speed to the specified value. Is the HO ₂ sensor 2 voltage displayed fixed above the specified value?	1200 RPM 0.900 volt	Go to Step 3	Go to Step 5
3	Turn the ignition ON, leaving the engine OFF. Does the scan tool HO ₂ Sensor 2 Voltage display indicate a voltage fixed above the specified value?	0.900 volt	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the HO ₂ sensor 2 electrical connector. 2. Turn the ignition ON, leaving the engine OFF. Does the scan tool HO ₂ Sensor 2 Voltage display indicate a voltage fixed above the specified value?	0.900 volt	Go to Step 7	Go to Step 6
5	DTC 55 is intermittent. If no additional DTC's are stored, refer to the Diagnostic Aids. If any additional DTC's are stored, refer to those table(s) first.	—	Go to Applicable DTC Table	—
6	Replace HO ₂ sensor 2. Is action complete?	—	Verify Repair	—
7	Locate and repair short to voltage on the HO ₂ sensor 2 signal circuit. If a problem is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to Step 8
8	Repair faulty ECM connections or replace faulty ECM. Is action complete?	—	Verify Repair	—



MEFI4325
6-15-00

DTC 81 - Crankshaft Position (CKP) Sensor Circuit Fault (Scan Diagnostics)

Circuit Description

The CKP sensor works in conjunction with a 24X reluctor wheel. The CKP sensor has a B+ power supply, a ground and a signal circuit.

As the crankshaft rotates, the reluctor wheel teeth interrupt a magnetic field produced by a magnet within the sensor. The sensor's internal circuitry detects this and produces a signal which the ECM reads. The ECM uses this signal to accurately measure crankshaft velocity which is a variable used in order to detect misfire, and control spark and fueling.

Diagnostic Aids

Check for the following conditions:

- Poor connection in harness. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal to wire connection.
- Crankshaft reluctor wheel damage or improper installation
- Excessive air gap between the CKP sensor and the reluctor wheel

Excess crankshaft end play causes the CKP sensor reluctor wheel to move out of alignment with the CKP sensor. This

could result in any one of the following:

- A no start
- A start and stall
- Erratic performance

Test Description

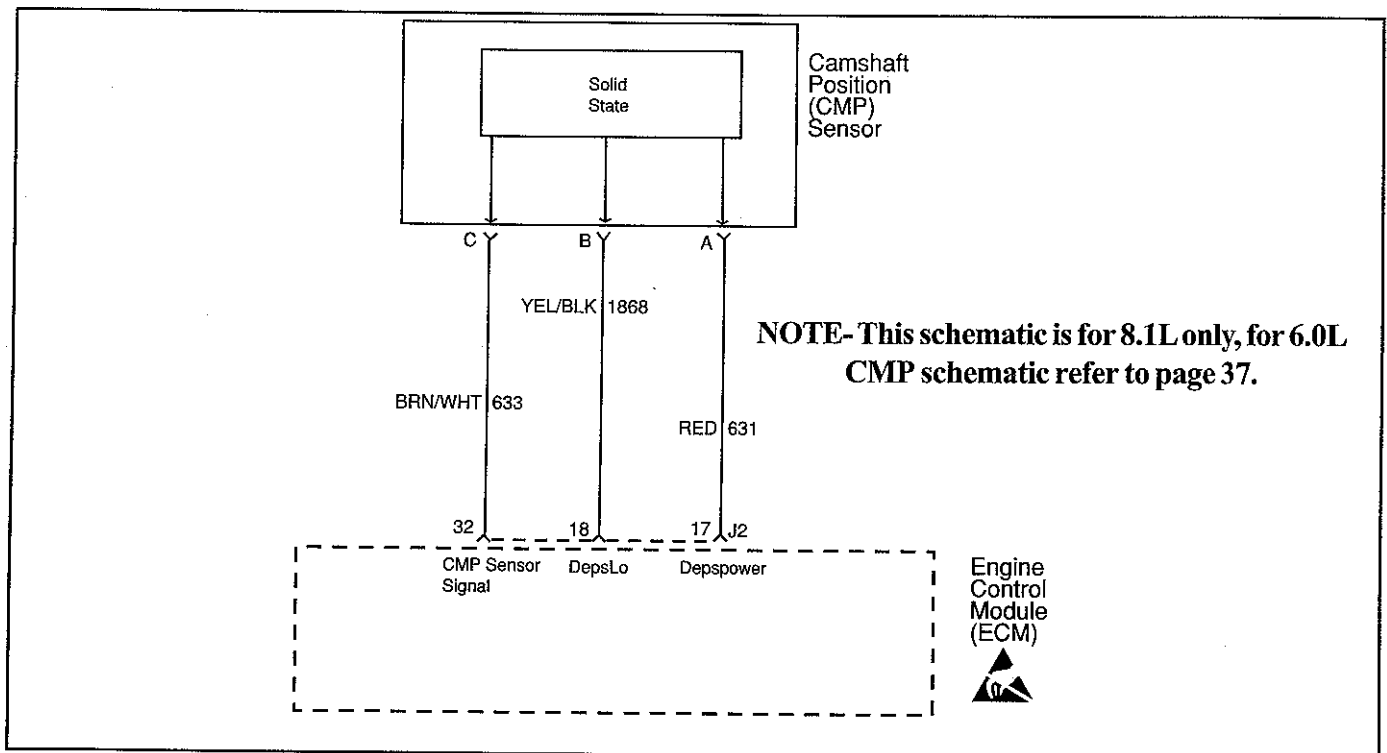
2. This test checks for the 12 volt supply voltage to the crankshaft position sensor.
3. This test verifies the ground circuit to the crankshaft position sensor.

**DTC 81 - Crankshaft Position (CKP) Sensor Circuit Fault
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	<p>Caution: Before proceeding, remove the fuses for the ignition coil and fuel injector feed circuits in order to prevent personal injury from engine rotation, sparks and excessive engine fueling.</p> <p>1. Turn ON the ignition leaving the engine OFF. 2. Disconnect the Crankshaft Position (CKP) sensor harness connector. 3. Using a DMM connected to a known good ground, measure the voltage at terminal "A" (Depspower) at the CKP sensor harness.</p> <p>Does the DMM display the specified value?</p>	B+	Go to Step 3	Go to Step 7
3	Using a DMM, measure the voltage between the CKP sensor harness connector terminals "A" (Depspower) and "B" (Depslo). Does the DMM display the specified value?	B+	Go to Step 4	Go to Step 8
4	<p>1. Turn ignition OFF. 2. Disconnect the ECM "J2" connector. 3. Using a DMM, measure resistance between terminal "C" of the CKP sensor and ECM harness connector "J2-16."</p> <p>Does the DMM display the specified value?</p>	0 ohms	Go to Step 5	Go to Step 9
5	Check for CKP sensor signal circuit shorted to ground or voltage. Is CKP sensor signal circuit shorted to ground or voltage?	—	Go to Step 9	Go to Step 6
6	<p>1. Jumper terminal "A" of the CKP sensor harness connector to terminal "A" of the CKP sensor using a fused jumper wire. 2. Jumper terminal "B" of the CKP sensor harness connector to terminal "B" of the CKP sensor. 3. Using a DMM connected to a known good ground, probe terminal "C" (sensor signal) of the CKP sensor. 4. Hand crank the engine.</p> <p>Does the voltage transition between 0 and more than 7 volts?</p>	—	Go to Step 13	Go to Step 10
7	Locate and repair an open in the CKP sensor "Depspower" circuit. Was a problem found?	—	Verify repair	Go to Step 13

DTC 81 - Crankshaft Position (CKP) Sensor Circuit Fault (cont'd)
(Scan Diagnostics)

Step	Action	Value	Yes	No
8	Locate and repair an open or poor connection in the CKP sensor "Depslo" circuit. Was a problem found?	—	Verify repair	Go to Step 13
9	Locate and repair an open, short to ground or short to voltage in the CKP sensor signal circuit. Was a problem found?	—	Verify Repair	Go to Step 10
10	1. Remove the CKP sensor. 2. Visually inspect the CKP sensor for physical damage, loose or improper installation or wiring routed too closely to secondary ignition components. 3. Repair the circuit as necessary. Was a problem found?	—	Verify Repair	Go to Step 11
11	Inspect for poor connections at the CKP sensor. Was a problem found?	—	Verify Repair	Go to Step 12
12	Replace the faulty CKP sensor. Is the action complete?	—	Verify Repair	—
13	Replace the ECM. Is the action complete?	—	Verify Repair	—



MEFI4326
6-15-00

DTC 81 - Camshaft Position (CMP) Sensor Circuit Fault (Scan Diagnostics)

Circuit Description

The CMP sensor works in conjunction with a 1X reluctor wheel on the camshaft. The Engine Control Module (ECM) provides a 12 volt reference to the CMP sensor as well as a low reference and a signal circuit.

The CMP sensor determines whether a cylinder is on a firing stroke or on an exhaust stroke. As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor. The sensor's internal circuitry detects this and produces a signal which the ECM reads. The ECM uses this 1X signal in combination with the crankshaft position (CKP) sensor 24X signal in order to determine crankshaft position and stroke.

Observe that as long as the ECM receives the CKP sensor 24X signal, the engine will start. The ECM can determine top dead center for all cylinders by using the CKP sensor 24X signal alone. The CMP sensor 1X signal is used by the ECM to determine if the cylinder at top dead center is on the firing stroke or the exhaust stroke. The system attempts synchronization and looks for an increase in engine speed indicating the engine started. If the ECM does not detect an increase in engine speed, the ECM assumes it incorrectly synchronized to the exhaust stroke and re-syncs to the opposite cam position. A slightly longer cranking time may be a symptom of this condition.

Diagnostic Aids

Check for the following conditions:

- Camshaft reluctor wheel damage
- The sensor coming in contact with the reluctor wheel
- A cracked or damaged sensor
- Foreign material passing between the sensor and reluctor wheel

If you find damage to the reluctor wheel or camshaft, refer to *Camshaft Replacement* in Engine Mechanical.

If the condition is suspected to be intermittent, refer to *Intermittent Conditions*.

Test Description

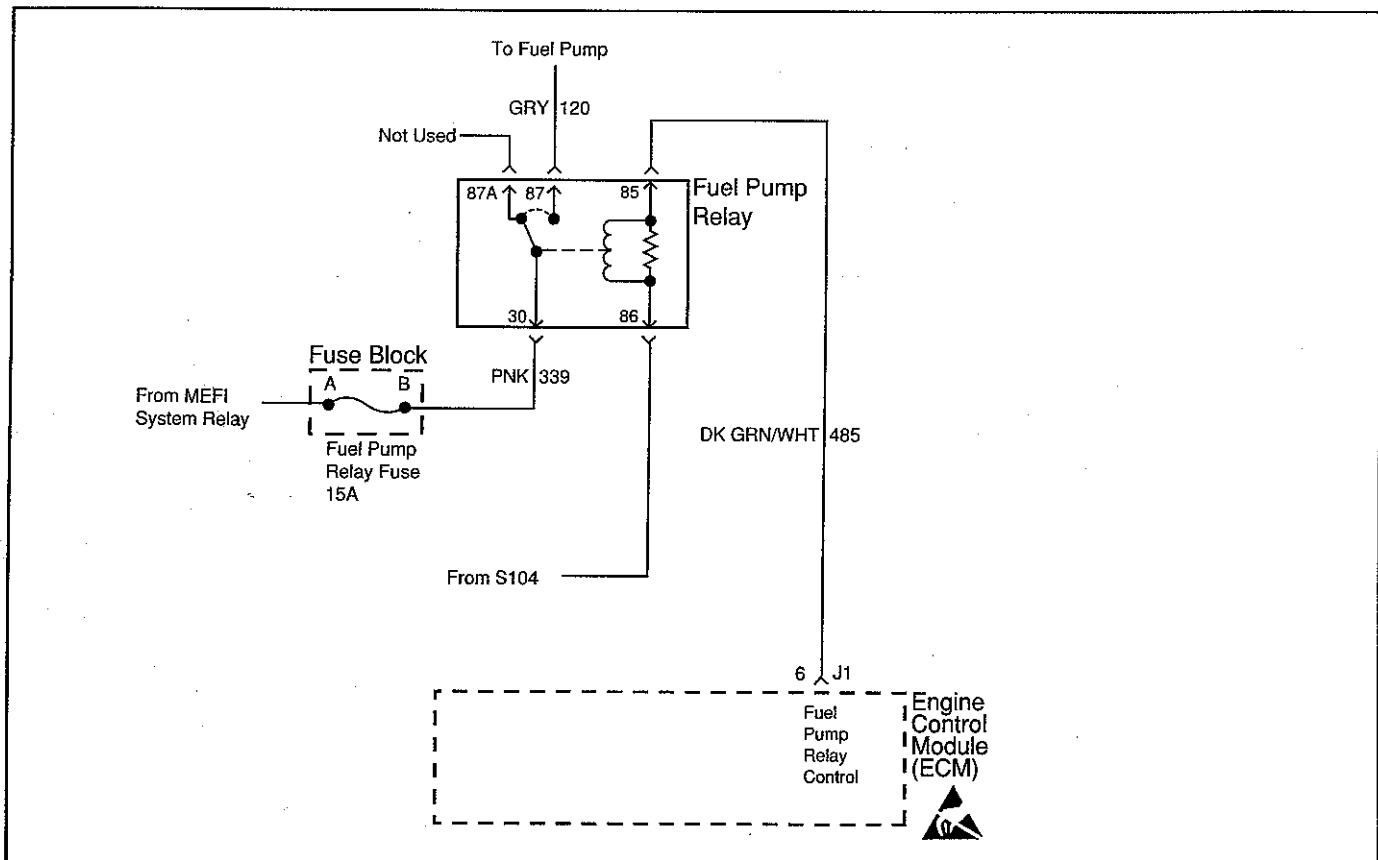
2. This test determines if the conditions exist in order to set DTC 55.

**DTC 81 - Camshaft Position (CMP) Sensor Circuit Fault
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Disconnect the Camshaft Position (CMP) sensor harness connector. 2. Turn ON the ignition, with the engine OFF. 3. Using a DMM connected to a known good ground, measure the voltage at terminal "A" (Depspower) at the CMP sensor harness. Does the DMM display the specified value?	B+	Go to Step 3	Go to Step 5
3	Using a DMM, measure the voltage between the CKP sensor harness connector terminal "A" (Depspower) and terminal "B" (Depslo). Does the DMM display the specified value?	B+	Go to Step 4	Go to Step 7
4	1. Start the engine. 2. Monitor the CAM signal input - high to low and low to high transition using the scan tool. 3. Using a test lamp connected to harness connector terminal "A" (Depspower), momentarily touch the other end to terminal "C" (CMP sensor signal). Does the CAM signal input - High to Low and Low to High transition counters increment when the test lamp contacts the signal circuit?	—	Go to Step 14	Go to Step 9
5	1. Turn OFF the engine. 2. Disconnect ECM connector J2. 3. Using a DMM, measure the resistance of the CMP sensor depspower circuit between the ECM and the CMP sensor. Does the resistance measure with the specified range?	0-5 ohms	Go to Step 6	Go to Step 11
6	Locate and repair a short to ground or poor connection in the CMP sensor "Depspower" circuit. Was a problem found?	—	Verify repair	Go to Step 15
7	1. Turn OFF the ignition. 2. Disconnect ECM connector J2. 3. Using a DMM, measure the resistance of the CMP sensor depslo circuit between the ECM and the CMP sensor. Does the resistance measure with the specified range?	0-5 ohms	Go to Step 15	Go to Step 8
8	Locate and repair an open or poor connection in the CMP sensor "Depslo" circuit. Is action complete?	—	Verify repair	—

DTC 81 - Camshaft Position (CMP) Sensor Circuit Fault (cont'd)
(Scan Diagnostics)

Step	Action	Value	Yes	No
9	1. Turn OFF the ignition. 2. Disconnect ECM connector J2. 3. Using a DMM, measure the resistance of the CMP sensor signal circuit between the ECM and the CMP sensor. Does the resistance measure with the specified range?	0-5 ohms	Go to Step 10	Go to Step 13
10	1. Turn ON the ignition, with the engine OFF. 2. Locate and repair a short to ground or a short to voltage on the CMP sensor signal circuit. Was a problem found?	—	Verify Repair	Go to Step 15
11	Locate and repair an open in the CMP sensor depower circuit. Was a problem found?	—	Verify Repair	Go to Step 15
12	Locate and repair an open in the CMP sensor depresso circuit. Is the action complete?	—	Verify Repair	—
13	Locate and repair an open in the CMP sensor signal circuit. Is action complete?	—	Verify Repair	—
14	Locate and repair a poor connection at the CMP sensor harness connector. Was a problem found?	—	Verify Repair	Go to Step 16
15	Locate and repair a poor connection at the ECM harness connector. Was a problem found?	—	Verify Repair	Go to Step 17
16	Replace the faulty CMP sensor. Is action complete?	—	Verify Repair	—
17	Replace the ECM. Is the action complete?	—	Verify Repair	—



MEFI4327
6-21-00

DTC 81 - Fuel Pump Relay Driver Circuit High, Low or Open (Scan Diagnostics)

Circuit Description

The Engine Control Module (ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the controlled component. This driver has a fault line which the ECM monitors. When the ECM commands the relay ON, the voltage of the control circuit should be low, near 0 volts. When the ECM commands the relay OFF, the voltage should be high, near battery voltage. If the fault detection circuit senses a voltage other than what the ECM expects, the fault line status changes causing the DTC to set.

The relay controls the high current flow to the fuel pump. This allows the ECM driver to only have to control the relatively low current used by the relay.

Diagnostic Aids

If the condition is suspected to be intermittent, refer to *Intermittent Conditions*.

Test Description

2. Listen for an audible click when the relay operates. Command both the ON and OFF states. Repeat the commands if necessary.

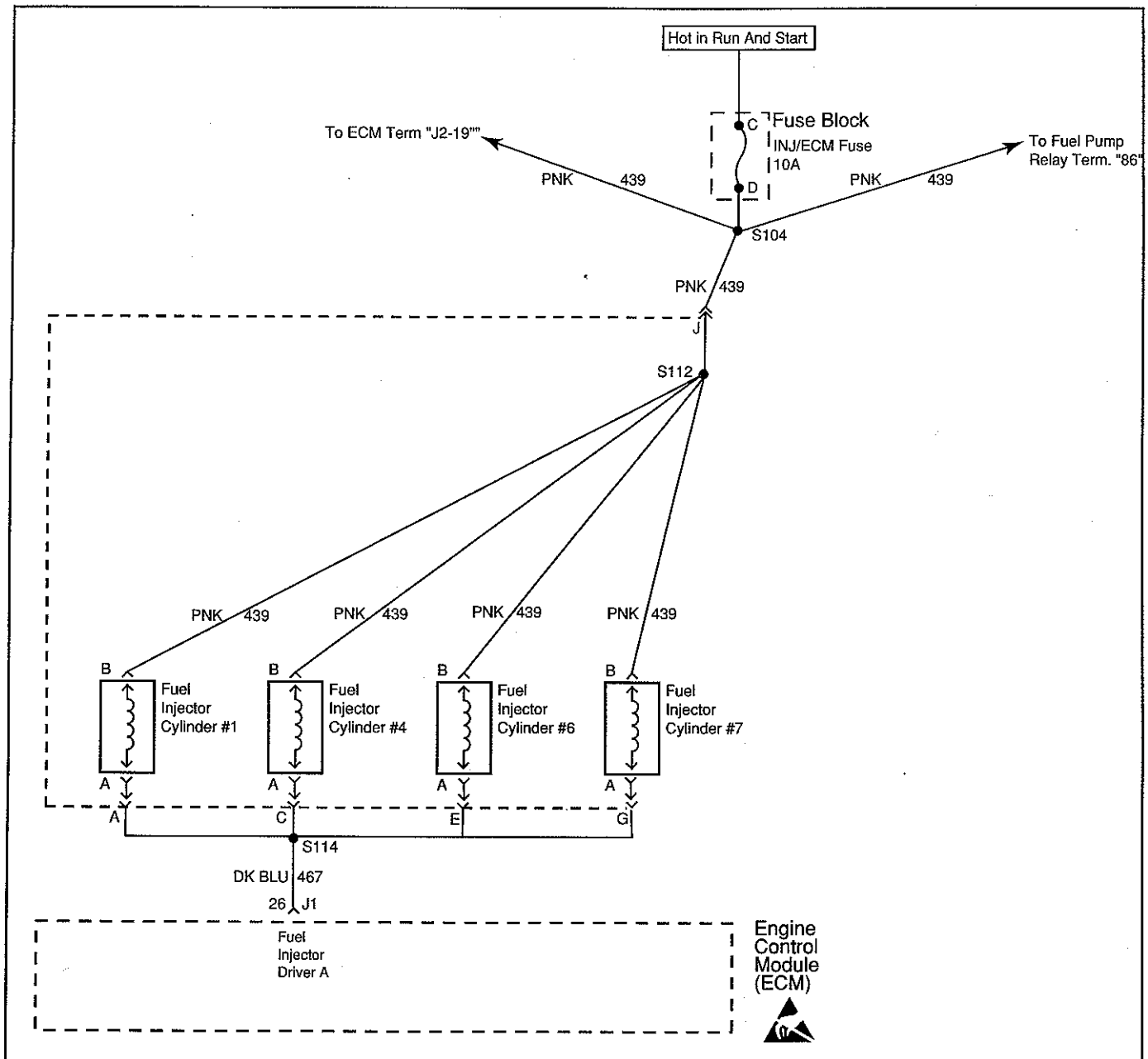
3. This test can detect a partially shorted coil which would cause an excessive current flow. Leaving the circuit energized for 2 minutes allows the coil to warm up. When warm, the coil may open, and the current drops to 0, or the coil may short, and the current goes above 0.75 amp.
5. Identify and test the relay coil terminals in order to avoid improper diagnosis.
12. If no trouble is found in the control circuit or the connection at the ECM, the ECM may be faulty. However, this is an extremely unlikely failure.

**DTC 81 - Fuel Pump Relay Driver Circuit High, Low or Open
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Turn ON the ignition, with the engine OFF. 2. Command the relay ON and OFF using a scan tool. Does the relay turn ON and OFF when commanded?	—	Go to Step 3	Go to Step 5
3	1. Turn OFF the ignition. 2. Disconnect the ECM connector J1. 3. Install a 5 amp fused jumper wire from a known good ground to the control circuit at the ECM harness connector (J1-6). 4. Turn ON the ignition, with the engine OFF. Important: Replace the relay if the DMM goes to 0 during the current draw test. 5. Using a DMM on 40 amp scale, measure the current from the relay control circuit in the ECM harness connector to ground for 2 minutes. Does the current draw measure less than the specified value?	0.75 A	Go to Diagnostic Aids	Go to Step 4
4	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay connector. 3. Using a DMM, measure the resistance from the relay control circuit in the ECM harness connector to ground. Does the DMM display infinite resistance or OL?	—	Go to Step 12	Go to Step 10
5	1. Turn OFF the engine. 2. Disconnect the fuel pump relay connector. 3. Connect a test lamp between the fuel pump relay control circuit and the fuel pump relay ignition feed circuit, on the coil side of the relay, at the fuel pump relay harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Using a scan tool, command the relay ON and OFF. Does the test lamp turn ON and OFF when commanded?	—	Go to Step 8	Go to Step 6
6	Using a test lamp connected to ground, probe the ignition feed circuit, on the coil side of the fuel pump relay harness connector. Is the test lamp illuminated?	—	Go to Step 7	Go to Step 11

DTC 81 - Fuel Pump Relay Driver Circuit High, Low or Open (cont'd)
(Scan Diagnostics)

Step	Action	Value	Yes	No
7	1. Turn OFF the ignition. 2. Reconnect the relay. 3. Disconnect the ECM connector J2. 4. Turn ON the ignition, with the engine OFF. 5. Using a fused jumper wire connected to ground, momentarily probe the relay control circuit in the ECM harness connector. Does the relay turn ON when the circuit is grounded and OFF when the circuit is opened?	—	<i>Go to Step 9</i>	<i>Go to Step 10</i>
8	Locate and repair faulty connections at the relay. Was a problem found?	—	Verify Repair	<i>Go to Step 12</i>
9	Locate and repair faulty connections at the ECM. Was a problem found?	—	Verify Repair	<i>Go to Step 13</i>
10	Repair the faulty relay control circuit. Is action complete?	—	Verify Repair	—
11	Repair the faulty relay ignition feed circuit. Is action complete?	—	Verify Repair	—
12	Replace the faulty relay. Is action complete?	—	Verify Repair	—
13	Replace the ECM Is action complete?	—	Verify Repair	—



MEFI4328
6-21-00

DTC 81 - Fuel Injector Driver A Circuit High, Low or Open (Scan Diagnostics)

Circuit Description

The Engine Control Module (ECM) enables the fuel injector drivers. An ignition voltage is supplied to the fuel injectors. The ECM controls each fuel injector driver by grounding the control circuit via a solid state device called a driver. The ECM monitors the status of each driver. If the ECM detects an incorrect voltage for the commanded state of the driver, a fuel injector control DTC sets.

Diagnostic Aids

Performing the Fuel Injector Coil test may help isolate an intermittent condition. Refer to *Fuel Injector Coil Test* -

Engine Coolant Temperature (ECT) Between 10-35 Degrees C (50-95 Degrees F) or Fuel Injector Coil Test - Engine Coolant Temperature (ECT) Outside 10-35 Degrees C (50-95 Degrees F).

If the condition is suspected to be intermittent, refer to *Intermittent Conditions*.

Test Description

- This step tests for voltage at the fuel injector harness connector. The ECM/INJ fuse supplies power to the coil side of the fuel injector harness connector. If the fuse is open, a short to ground on the fuel injector B+ supply

circuit is indicated. The ECM/INJ fuse also supplies voltage to the ignition coils. If the fuse is open, inspect the circuits to the ignition coils for a short to ground.

5. This test verifies that the ECM is able to control the fuel

injector. If the test lamp blinks, then the ECM and wiring are OK.

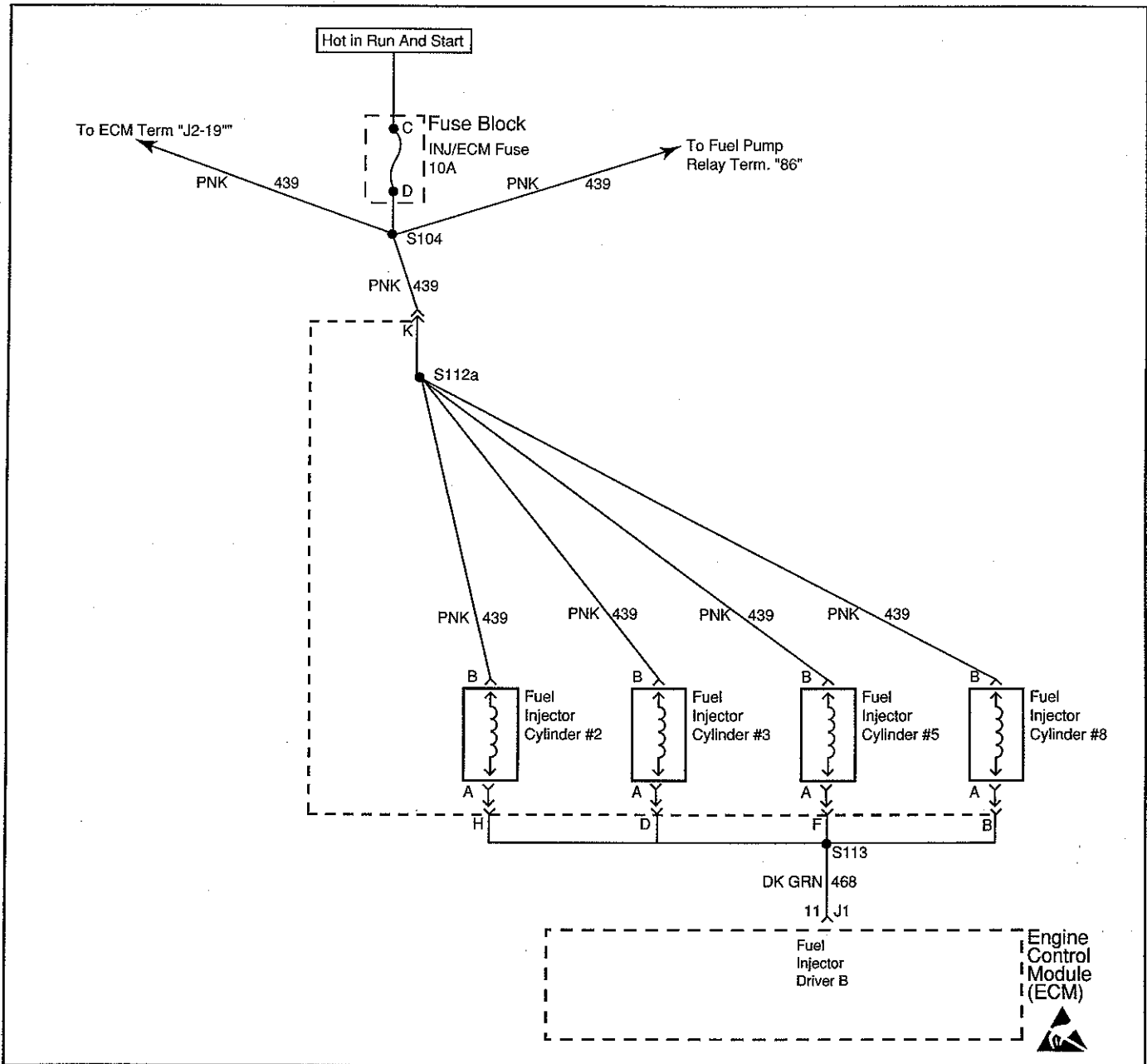
6. This step tests if a ground is constantly being applied to the fuel injector.

DTC 81 - Fuel Injector Driver A Circuit High, Low or Open (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Disconnect the appropriate harness connectors of the four fuel injectors. 2. Turn ON the ignition, with the engine OFF. 3. Using a test lamp connected to a known good ground, probe the ignition voltage circuits of each fuel injector on the harness connector. Does the test lamp illuminate on all four circuits?	—	Go to Step 3	Go to Step 8
3	1. Connect the fuel injector test lamp J 34730-2C between the control circuit and the ignition voltage circuit of the fuel injector harness connector. Repeat for all four fuel injectors. 2. Start the engine. Does the test lamp blink on all four fuel injector harness connectors?	—	Go to Step 7	Go to Step 4
4	Does the test lamp remain illuminated at all times on any of the four fuel injector harness connectors?	—	Go to Step 6	Go to Step 5
5	Locate and repair an open or short to voltage in the fuel injector control circuit. Was a problem found?	—	Verify Repair	Go to Step 8
6	Locate and repair a short to ground in the fuel injector control circuit. Was a problem found?	—	Verify Repair	Go to Step 11
7	Locate and repair poor connections at the harness connector of the fuel injector. Was a problem found?	—	Verify Repair	Go to Step 10
8	Locate and repair poor connections at the harness connector of the ECM. Was a problem found?	—	Verify Repair	Go to Step 11
9	Important: The ECM/INJ fuse also supplies voltage to the ignition coils. If the fuse is open, inspect all related circuits for a short to ground. Repair an open or short to ground in the fuel injector ignition voltage circuit. Was a problem found?	—	Verify Repair	—

DTC 81 - Fuel Injector Driver A Circuit High, Low or Open (cont'd)
(Scan Diagnostics)

Step	Action	Value	Yes	No
10	Replace the fuel injector. Is action complete?	—	Verify Repair	—
11	Replace the ECM. Is action complete?	—	Verify Repair	—



MEFI4329
6-21-00

DTC 81 - Fuel Injector Driver B Circuit High, Low or Open (Scan Diagnostics)

Circuit Description

The Engine Control Module (ECM) enables the fuel injector drivers. An ignition voltage is supplied to the fuel injectors. The ECM controls each fuel injector driver by grounding the control circuit via a solid state device called a driver. The ECM monitors the status of each driver. If the ECM detects an incorrect voltage for the commanded state of the driver, a fuel injector control DTC sets.

Diagnostic Aids

Performing the Fuel Injector Coil test may help isolate an intermittent condition. Refer to *Fuel Injector Coil Test* -

Engine Coolant Temperature (ECT) Between 10-35 Degrees C (50-95 Degrees F) or Fuel Injector Coil Test - Engine Coolant Temperature (ECT) Outside 10-35 Degrees C (50-95 Degrees F).

If the condition is suspected to be intermittent, refer to *Intermittent Conditions*.

Test Description

- This step tests for voltage at the fuel injector harness connector. The ECM/INJ fuse supplies power to the coil side of the fuel injector harness connector. If the fuse is open, a short to ground on the fuel injector B+ supply

circuit is indicated. The ECM/INJ fuse also supplies voltage to the ignition coils. If the fuse is open, inspect the circuits to the ignition coils for a short to ground.

5. This test verifies that the ECM is able to control the fuel

injector. If the test lamp blinks, then the ECM and wiring are OK.

6. This step tests if a ground is constantly being applied to the fuel injector.

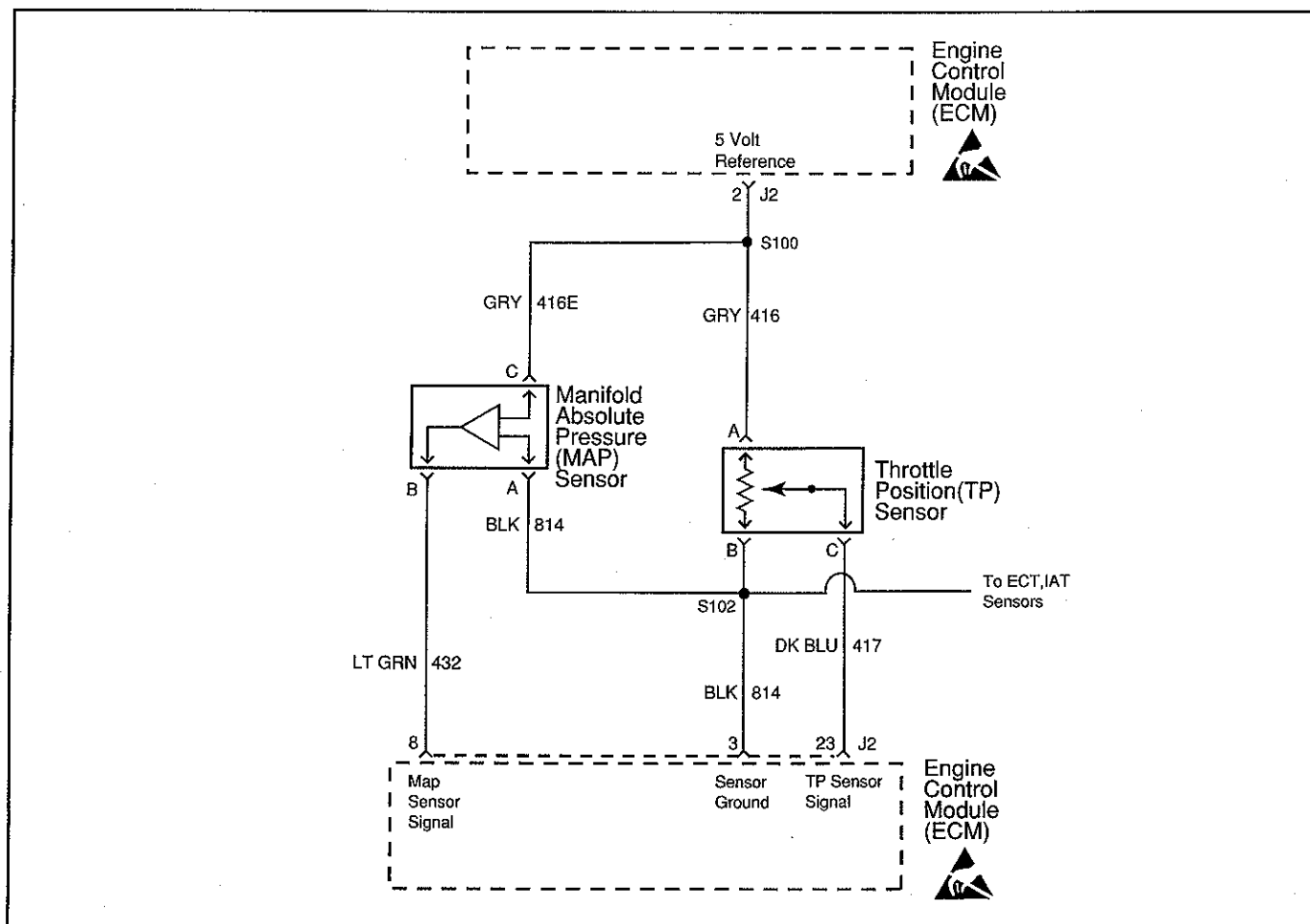
DTC 81 - Fuel Injector Driver B Circuit High, Low or Open (Scan Diagnostics)

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Disconnect the appropriate harness connectors of the four fuel injectors. 2. Turn ON the ignition, with the engine OFF. 3. Using a test lamp connected to a known good ground, probe the ignition voltage circuits of each fuel injector on the harness connector. Does the test lamp illuminate on all four circuits?	—	Go to Step 3	Go to Step 8
3	1. Connect the fuel injector test lamp J 34730-2C between the control circuit and the ignition voltage circuit of the fuel injector harness connector. Repeat for all four fuel injectors. 2. Start the engine. Does the test lamp blink on all four fuel injector harness connectors?	—	Go to Step 7	Go to Step 4
4	Does the test lamp remain illuminated at all times on any of the four fuel injector harness connectors?	—	Go to Step 6	Go to Step 5
5	Locate and repair an open or short to voltage in the fuel injector control circuit. Was a problem found?	—	Verify Repair	Go to Step 8
6	Locate and repair a short to ground in the fuel injector control circuit. Was a problem found?	—	Verify Repair	Go to Step 11
7	Locate and repair poor connections at the harness connector of the fuel injector. Was a problem found?	—	Verify Repair	Go to Step 10
8	Locate and repair poor connections at the harness connector of the ECM. Was a problem found?	—	Verify Repair	Go to Step 11
9	Important: The ECM/INJ fuse also supplies voltage to the ignition coils. If the fuse is open, inspect all related circuits for a short to ground. Repair an open or short to ground in the fuel injector ignition voltage circuit. Was a problem found?	—	Verify Repair	—

DTC 81 - Fuel Injector Driver B Circuit High, Low or Open (cont'd)
(Scan Diagnostics)

Step	Action	Value	Yes	No
10	Replace the fuel injector. Is action complete?	—	Verify Repair	—
11	Replace the ECM. Is action complete?	—	Verify Repair	—

**This Page Was
Intentionally Left
Blank**



MEFI4330
6-21-00

DTC 81 - 5 Volt Reference Circuit Out of Range (Scan Diagnostics)

Circuit Description

The Engine Control Module (ECM) uses a common 5 volt reference circuit as a sensor feed. This circuit supplies 5 volts to the Manifold Absolute Pressure (MAP) sensor and the Throttle Position (TP) sensor. The ECM monitors the voltage on the 5 volt reference circuit. This DTC sets if the voltage is out of range.

Diagnostic Aids

If the condition is suspected to be intermittent, refer to *Intermittent Conditions*.

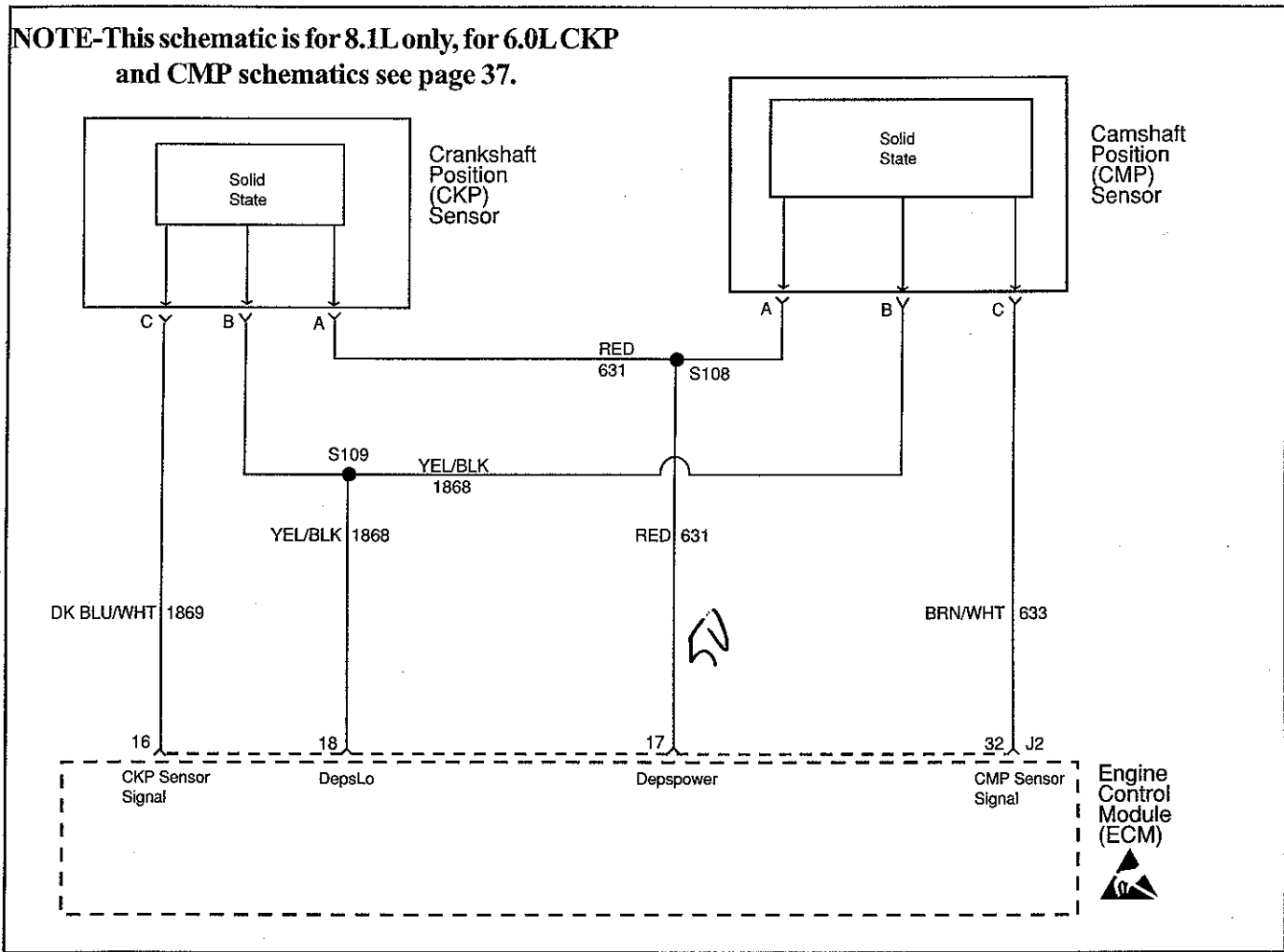
Test Description

3. The 5 volt reference circuit may be shorted to another ECM circuit. The shorted circuit may not be apparent when the ECM harness connector is disconnected.

**DTC 81 - 5 Volt Reference Circuit Out of Range
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Disconnect the ECM harness connector J2. 2. Turn ON the ignition, with the engine OFF. 3. Using a DMM connected to a known good ground, probe the other lead of the DMM to the 5 volt reference circuit (J2-2) at the ECM harness connector. Does the circuit measure more than the specified value?	5.1 V	Go to Step 6	Go to Step 3
3	Before proceeding, remove the following fuses: <ul style="list-style-type: none"> • ECM/BAT • INJ/ECM • MEFI System Relay 1. Disconnect the MAP sensor and the TP sensor harness connectors. 2. Using a DMM, test the continuity from the 5 volt reference circuit to all other ECM circuits at the ECM J2 harness connector. Do any of the circuits indicate a resistance within the specified range?	0-2 ohms	Go to Step 7	Go to Step 9
4	1. Turn OFF the ignition. 2. Disconnect the ECM connector J2. 3. Using a test lamp connected to B+, probe 5 volt reference circuit (J2-2) at the ECM harness connector. Does the test lamp illuminate?	—	Go to Step 8	Go to Step 5
5	Using a DMM, test the continuity from the 5 volt reference circuit to all other ECM circuits at the ECM J2 harness connector. Do any of the circuits indicate a resistance within the specified range?	0-2 ohms	Go to Step 7	Go to Step 9
6	Locate and repair a short to voltage on the 5 volt reference circuit. Is action complete?	—	Verify Repair	—
7	Locate and repair short between the 5 volt reference circuit and the ECM circuit that had continuity. Is action complete?	—	Verify Repair	—
8	Locate and repair short to ground on the 5 volt reference circuit. Is action complete?	—	Verify Repair	—
9	Replace the ECM. Is action complete?	—	Verify Repair	—

NOTE-This schematic is for 8.1L only, for 6.0L CKP and CMP schematics see page 37.



MEFI4331
6-21-00

DTC 81 - Depspower Circuit Out of Range (Scan Diagnostics)

Circuit Description

The Engine Control Module (ECM) uses a dedicated 5 volt reference circuit for the Crankshaft Position (CKP) sensor and the Camshaft Position (CMP) sensor. This circuit supplies 5 volts to only the CKP and the CMP sensor circuits. This circuit is referred to as Depspower. The ECM monitors the voltage on the Depspower circuit. This DTC sets if the voltage is out of range.

Diagnostic Aids

If the condition is suspected to be intermittent, refer to *Intermittent Conditions*.

Test Description

3. The Depspower circuit may be shorted to another ECM circuit. The shorted circuit may not be apparent when the ECM harness connector is disconnected.

**DTC 81 - Depspower Circuit Out of Range
(Scan Diagnostics)**

Step	Action	Value	Yes	No
1	Was the "On-Board Diagnostic" (OBD) system check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Disconnect the ECM harness connector J2. 2. Turn ON the ignition, with the engine OFF. 3. Using a DMM connected to a known good ground, probe the other lead of the DMM to the Depspower circuit (J2-17) at the ECM harness connector. Does the circuit measure more than the specified value?	5.1 V	Go to Step 6	Go to Step 3
3	Before proceeding, remove the following fuses: <ul style="list-style-type: none"> • ECM/BAT • INJ/ECM • MEFI System Relay 1. Disconnect the CKP sensor and the CMP sensor harness connectors. 2. Using a DMM, test the continuity from the Depspower circuit to all other ECM circuits at the ECM J2 harness connector. Do any of the circuits indicate a resistance within the specified range?	0-2 ohms	Go to Step 7	Go to Step 9
4	1. Turn OFF the ignition. 2. Disconnect the ECM connector J2. 3. Using a test lamp connected to B+, probe Depspower circuit (J2-17) at the ECM harness connector. Does the test lamp illuminate?	—	Go to Step 8	Go to Step 5
5	Using a DMM, test the continuity from the Depspower circuit to all other ECM circuits at the ECM J2 harness connector. Do any of the circuits indicate a resistance within the specified range?	0-2 ohms	Go to Step 7	Go to Step 9
6	Locate and repair a short to voltage on the Depspower circuit. Is action complete?	—	Verify Repair	—
7	Locate and repair short between the Depspower circuit and the ECM circuit that had continuity. Is action complete?	—	Verify Repair	—
8	Locate and repair short to ground on the Depspower circuit. Is action complete?	—	Verify Repair	—
9	Replace the ECM. Is action complete?	—	Verify Repair	—

Symptoms - Engine Controls

Important Preliminary Checks Before Starting

Before using this section you should have performed the "On-Board Diagnostic (OBD) System Check" and determined that:

- The ECM and MIL (Malfunction Indicator Lamp) are operating correctly.
- There are no DTC(s) stored.
- Ensure that the engine is not in RPM reduction mode. The ECM turns certain injectors off when the ECM detects certain conditions such as engine over-temp.
- Verify the customer complaint and locate the correct symptom in the table of contents. Check the items indicated under that symptom.

Visual/Physical Check

Several of the symptom procedures call for a careful Visual/Physical Check. The importance of this step cannot be stressed too strongly - it can lead to correcting a problem without further checks and can save valuable time. This check should include:

- ECM grounds and sensor connections for being clean, tight and in their proper location.
- Vacuum hoses for splits, kinks and proper connections. Check thoroughly for any type of leak or restriction.
- Air leaks at throttle body mounting area and intake manifold sealing surfaces.
- Ignition wires for cracking, hardness, proper routing and carbon tracking.
- Wiring for proper connections, pinches and cuts.
- Moisture in primary or secondary ignition circuit connections.
- Corrosion on electrical connections and exposed throttle body linkages.

Intermittents

Important: Check for improper installation of electrical components if an intermittent condition exists. Inspect for aftermarket theft deterrent devices, lights, cellular phones, etc. If you cannot locate an intermittent condition, a cellular phone signal communication may cause the condition.

Important: Problem may or may not turn "ON" the Malfunction Indicator Lamp (MIL) or store a DTC. DO NOT use the Diagnostic Trouble Code (DTC) tables for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform careful visual/physical check. Check for the following conditions:

- Poor mating of the connector halves, or a terminal not fully seated in the connector body (backed out or loose).
- Improperly formed or damaged terminals and/or connectors.

- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal to wire connection (crimping). This requires removing the terminal from the connector body to check. Refer to "Wiring Harness Service" in the *General Information* section.

The vehicle may be driven with a J 39200 Digital Multimeter connected to a suspected circuit. An abnormal voltage when malfunction occurs is a good indication that there is a fault in the circuit being monitored.

A scan tool may also be used to help detect intermittent conditions. The Snapshot feature (if applicable) can be triggered to capture and store engine parameters within the scan tool when the malfunction occurs. This stored information then can be reviewed by the service technician to see what caused the malfunction.

To check loss of DTC memory, disconnect TP sensor and idle engine until the MIL comes "ON." DTC 22 should be stored and kept in memory when ignition is turned "OFF." If not the ECM is faulty. When this test is completed, make sure that you clear the DTC 22 from memory using "Clearing DTC Procedure."

An intermittent MIL with no stored DTC may be caused by the following:

- Ignition coil shorted to ground and arcing at ignition wires or plugs.
- MIL wire to ECM shorted to ground.
- Poor ECM grounds.
- Check for an electrical system interference caused by a sharp electrical surge. Normally, the problem will occur when the faulty component is operated.
- Check for improper installation of electrical options such as lights, radios, etc.
- Check that knock sensor wire(s) are routed away from spark plug wires, ignition system components and charging system components.
- Check for secondary ignition components shorted to ground, or an open ignition coil ground (coil mounting brackets).
- Check for components internally shorted to ground such as starters, alternators or relays.

All Ignition Coil wiring should be kept away from the alternator. Check all wires from the ECM to the ignition coils for poor connections.

If problem has not been found go to "ECM Connector Symptom Tables" at the end of *Symptoms* section.

Hard Start Symptom

Checks	Action
Definition: Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins.
Sensor/System	<ul style="list-style-type: none"> • Check the engine coolant temperature (ECT) sensor for being shifted in value. Connect a scan tool. Compare the engine coolant temperature against the intake air temperature (IAT) on a cold engine. The ECT and IAT sensor values should be within 3 C (5 F) of each other. If the ECT sensor is out of range with the IAT sensor, check the resistance of the ECT sensor. Replace the ECT sensor if the resistance is not within specification. If the sensor is within specification, repair the ECT signal circuit for high resistance. • Check the camshaft position (CMP) sensor for proper mounting and/or a bad connection. A long crank time occurs if the ECM does not receive a CMP signal.
Fuel System	<ul style="list-style-type: none"> • Check the fuel pump relay operation. The fuel pump should turn ON for 2 seconds when you turn ON the ignition. • A faulty fuel pump check valve allows the fuel in the lines to drain back to the tank after the engine stops. • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition.
Ignition System	<ul style="list-style-type: none"> • Check for proper ignition voltage output per manufacturer's recommendations. • Remove the spark plugs and check for the following: <ul style="list-style-type: none"> – Correct heat range – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant or oil fouled. • Check for bare or shorted ignition wires. • Check for loose ignition coil grounds.
Engine Mechanical	<ul style="list-style-type: none"> • Excessive oil in combustion chamber - Leaking valve seals. • Low cylinder compression • Combustion chambers for excessive carbon buildup. Clean the chambers using top engine cleaner. Follow the instructions on the can. • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Cylinder Heads – Camshaft – Pistons, etc. <p>Refer to the appropriate procedures in Engine Mechanical.</p>

Surges/Chuggles Symptom

Checks	Action
Definition: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins.
Sensor/System	<ul style="list-style-type: none"> • Check the heated oxygen sensors (HO2s). The HO2s should respond quickly to different throttle positions. If they do not, check the HO2s for silicon or other contaminants from fuel or the use of improper RTV sealant. The sensors may have a white powdery coating and result in a high but false rich exhaust indication. The ECM will then reduce the amount of fuel delivered to the engine causing a severe drivability problem.
Fuel System	<ul style="list-style-type: none"> • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition. • Check that each injector harness is connected to the correct injector or cylinder according to the firing order. • Check the items that cause an engine to run rich long term. • Check the items that cause an engine to run lean long term.
Ignition System	<ul style="list-style-type: none"> • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Check for proper ignition voltage output per manufacturer's recommendations. • Remove the spark plugs and check for the following: <ul style="list-style-type: none"> – Correct heat range – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant or oil fouled. • Check for bare or shorted ignition wires. • Check for loose ignition coil grounds.
Engine Mechanical	<ul style="list-style-type: none"> • Ensure that the engine is not overheating, causing the engine to go into RPM reduction mode.
Additional Checks	<ul style="list-style-type: none"> • Visually (physically) check vacuum hoses for splits, kinks and proper connections and routing.

Lack of Power, Sluggishness or Sponginess Symptom

Checks	Action
Definition: Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins. • Remove the spark arrestor/air filter element and check for dirt or for being restricted.
Sensor/System	<ul style="list-style-type: none"> • Ensure that the engine is not going into RPM reduction mode. • Use a scan tool in order to monitor the knock sensor system for excessive spark retard activity.
Fuel System	<ul style="list-style-type: none"> • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition. • Check the fuel injectors. Refer to <i>Fuel Injector Coil Test - Engine Coolant Temperature (ECT) Between 10-35 degrees C (50-95 Degrees F)</i>. • Check the items that cause an engine to run rich long term. • Check the items that cause an engine to run lean long term.
Ignition System	<ul style="list-style-type: none"> • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Check for proper ignition voltage output per manufacturer's recommendations. • Remove the spark plugs and check for the following: <ul style="list-style-type: none"> – Correct heat range – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant or oil fouled. • Check for bare or shorted ignition wires. • Check for loose ignition coil grounds.
Engine Mechanical	<ul style="list-style-type: none"> • Excessive oil in combustion chamber - Leaking valve seals. • Low cylinder compression • Combustion chambers for excessive carbon buildup. Clean the chambers using top engine cleaner. Follow the instructions on the can. • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Cylinder Heads – Camshaft – Pistons, etc. <p>Refer to the appropriate procedures in Engine Mechanical.</p>
Additional Checks	<ul style="list-style-type: none"> • Inspect the exhaust system for possible restrictions.

Detonation/Spark Knock Symptom

Checks	Action
Definition: A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins. • If the scan tool readings are normal, refer to supporting text of the Engine Controls Diagnostic Check, and there are no engine mechanical faults, fill the fuel tank with a known high quality fuel that meets the vehicle's minimum octane requirements. Refer to <i>Fuel System Specifications</i>. Road test vehicle and re-evaluate the vehicle's performance.
Fuel System	<ul style="list-style-type: none"> • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition. • Check the items that cause an engine to run lean long term.
Ignition System	<ul style="list-style-type: none"> • Check the spark plugs for being the proper heat range.
Engine Cooling System	<ul style="list-style-type: none"> • Check for obvious overheating problems. <ul style="list-style-type: none"> – Low engine coolant – Restricted air flow to the radiator – Insufficient coolant flow through the radiator – Wrong or stuck thermostat – Inoperative cooling fan
Engine Mechanical	<ul style="list-style-type: none"> • Excessive oil in combustion chamber - Leaking valve seals. • Low cylinder compression • Combustion chambers for excessive carbon buildup. Clean the chambers using top engine cleaner. Follow the instructions on the can. • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Cylinder Heads – Camshaft – Pistons, etc. <p>Refer to the appropriate procedures in Engine Mechanical.</p>

Hesitation, Sag or Stumble Symptom

Checks	Action
Definition: Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually more pronounced when first trying to make the vehicle move, as from a stop. May cause the engine to stall if severe enough.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins.
Sensor/System	<ul style="list-style-type: none"> • Check the MAP sensor operation. • Check the TP sensor operation.
Fuel System	<ul style="list-style-type: none"> • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition. • Check the fuel injectors. Refer to <i>Fuel Injector Coil Test - Engine Coolant Temperature (ECT) Between 10-35 degrees C (50-95 Degrees F)</i>. • Check the items that cause an engine to run rich long term. • Check the items that cause an engine to run lean long term.
Ignition System	<ul style="list-style-type: none"> • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Check for proper ignition voltage output per manufacturer's recommendations. • Remove the spark plugs and check for the following: <ul style="list-style-type: none"> – Correct heat range – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant or oil fouled. • Check for bare or shorted ignition wires. • Check for loose ignition coil grounds.
Engine Cooling System	<ul style="list-style-type: none"> • Check the engine thermostat for proper operation and heat range.
Additional Checks	<ul style="list-style-type: none"> • Check the alternator output voltage. Repair the charging system if the alternator output voltage is less than 10 volts or more than 16 volts.

Cuts Out, Misses Symptom

Checks	Action
Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. This condition is not normally felt above 1,500 RPM. The exhaust has a steady spitting sound at idle or low speed.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins. • Remove the flame arrestor/air filter element and check for dirt or for being restricted.
Fuel System	<ul style="list-style-type: none"> • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition. • Check the items that cause an engine to run rich long term. • Check the items that cause an engine to run lean long term.
Sensor System	<ul style="list-style-type: none"> • Use a scan to in order to monitor the knock sensor system for excessive spark retard activity.
Ignition System	<ul style="list-style-type: none"> • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Check for proper ignition voltage output per manufacturer's recommendations. • Remove the spark plugs and check for the following: <ul style="list-style-type: none"> – Correct heat range – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant or oil fouled. • Check for bare or shorted ignition wires. • Check for loose ignition coil grounds. • Visually and physically inspect the secondary ignition for the following: <ul style="list-style-type: none"> – Ignition wires arcing to ground – Ignition wires for proper engagement to spark plug and coil – Ignition coils for cracks or carbon tracking
Engine Mechanical	<ul style="list-style-type: none"> • Check engine mechanical for the following: <ul style="list-style-type: none"> – Low compression – Sticking or leaking valves – Worn camshaft lobes – Valve timing – Bent push rods – Worn rocker arms – Broken Valve Springs – Excessive oil in the combustion chamber - Leaking valve seals.

Cuts Out, Misses Symptom (cont'd)

Checks	Action
Engine Mechanical (cont'd)	<ul style="list-style-type: none"> • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Camshaft – Cylinder heads – Pistons, etc. <p>Refer to the appropriate procedures in Engine Mechanical.</p>
Additional Checks	<ul style="list-style-type: none"> • Inspect the exhaust system for possible restriction. • Electromagnetic interference (EMI) on the reference circuit can cause an engine miss condition. A sudden increase in indicated RPM with little change in actual engine RPM change indicates EMI is present. Check for high voltage components near ignition control circuits if a problem exists. • Check the intake manifold and the exhaust manifold passages for casting flash.

Poor Fuel Economy Symptom

Checks	Action
Definition: Fuel economy, as measured by actual fuel used, is noticeably lower than expected. Also, fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by actual measurement.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins. • Check the owners driving habits. <ul style="list-style-type: none"> – Is there excessively heavy loads being carried? – Is the acceleration rate too much, too often? – Remove the flame arrestor/air filter element and check for dirt or for being restricted.
Fuel System	<ul style="list-style-type: none"> • Check the type, quality and alcohol content of the fuel. Oxygenated fuels have lower energy and may deliver reduced fuel economy. • Check the fuel injectors. Refer to <i>Fuel Injector Coil Test - Engine Coolant Temperature (ECT) Between 10-35 degrees C (50-95 Degrees F)</i>. • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition. • Check that each injector harness is connected to the correct injector and cylinder. • Check for foreign material accumulation in the throttle bore, choking on the throttle valve or on the throttle shaft. Also check for throttle body tampering. • Check the items that cause an engine to run rich long term.
Sensor System	<ul style="list-style-type: none"> • Check the air intake system and crankcase for air leaks. • Check the crankcase ventilation valve for proper operation. Place a finger over the inlet hole in the valve end several times. The valve should snap back. If not, replace valve. • Use a scan tool in order to monitor the knock sensor (KS) system for excessive spark retard activity.

Poor Fuel Economy Symptom (cont'd)

Checks	Action
Ignition System	<ul style="list-style-type: none"> • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Check for proper ignition voltage output per manufacturer's recommendations. • Remove the spark plugs and check for the following: <ul style="list-style-type: none"> – Correct heat range – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant or oil fouled. • Check for bare or shorted ignition wires. • Check for loose ignition coil grounds. • Visually and physically inspect the secondary ignition for the following: <ul style="list-style-type: none"> – Ignition wires arcing to ground – Ignition wires for proper engagement to spark plug and coil – Ignition coils for cracks or carbon tracking
Engine Cooling System	<ul style="list-style-type: none"> • Check engine coolant level for being low. • Check the engine thermostat for proper operation and for the correct heat range.
Engine Mechanical	<ul style="list-style-type: none"> • Check engine mechanical for the following: <ul style="list-style-type: none"> – Low compression – Sticking or leaking valves – Worn camshaft lobes – Valve timing – Bent push rods – Worn rocker arms – Broken Valve Springs – Excessive oil in the combustion chamber - Leaking valve seals. • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Camshaft – Cylinder heads – Pistons, etc. <p>Refer to the appropriate procedures in Engine Mechanical.</p>
Additional Checks	<ul style="list-style-type: none"> • Inspect the exhaust system for possible restriction. • Electromagnetic interference (EMI) on the reference circuit can cause an engine miss condition. A sudden increase in indicated RPM with little change in actual engine RPM change indicates EMI is present. Check for high voltage components near ignition control circuits if a problem exists.

Poor Fuel Economy Symptom (cont'd)

Checks	Action
Additional Checks (cont'd)	<ul style="list-style-type: none"> • Check the intake manifold and the exhaust manifold passages for casting flash. • Check for excessive drag on the vehicle.

Rough, Unstable or Incorrect Idle and Stalling Symptom

Checks	Action
<p>Definition: Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine.</p>	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins. • Remove the flame arrestor/air filter element and check for dirt or for being restricted.
Fuel System	<ul style="list-style-type: none"> • Check the fuel injectors. Refer to <i>Fuel Injector Coil Test - Engine Coolant Temperature (ECT) Between 10-35 degrees C (50-95 Degrees F)</i>. • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition. • Check that each injector harness is connected to the correct injector and cylinder. • Check for foreign material accumulation in the throttle bore, choking on the throttle valve or on the throttle shaft. Also check for throttle body tampering. • Check the items that cause an engine to run rich long term. • Check the items that cause an engine to run lean long term.
Sensor System	<ul style="list-style-type: none"> • Check the air intake system and crankcase for air leaks. • Check the crankcase ventilation valve for proper operation. Place a finger over the inlet hole in the valve end several times. The valve should snap back. If not, replace valve. • Check the idle air control (IAC) valve for proper operation. • Use a scan tool in order to monitor the knock sensor (KS) system for excessive spark retard activity.
Ignition System	<ul style="list-style-type: none"> • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Check for proper ignition voltage output per manufacturer's recommendations. • Remove the spark plugs and check for the following: <ul style="list-style-type: none"> – Correct heat range – Wet plugs – Cracks – Wear – Improper gap

Rough, Unstable or Incorrect Idle and Stalling Symptom (cont'd)

Checks	Action
Ignition System	<ul style="list-style-type: none"> – Burned electrodes – Heavy deposits • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant or oil fouled. • Check for bare or shorted ignition wires. • Check for loose ignition coil grounds. • Visually and physically inspect the secondary ignition for the following: <ul style="list-style-type: none"> – Ignition wires arcing to ground – Ignition wires for proper engagement to spark plug and coil – Ignition coils for cracks or carbon tracking
Engine Mechanical	<ul style="list-style-type: none"> • Check engine mechanical for the following: <ul style="list-style-type: none"> – Low compression – Sticking or leaking valves – Worn camshaft lobes – Valve timing – Bent push rods – Worn rocker arms – Broken Valve Springs – Excessive oil in the combustion chamber - Leaking valve seals. • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Camshaft – Cylinder heads – Pistons, etc. <p>Refer to the appropriate procedures in Engine Mechanical.</p>
Additional Checks	<ul style="list-style-type: none"> • Inspect the exhaust system for possible restriction. • Electromagnetic interference (EMI) on the reference circuit can cause an engine miss condition. A sudden increase in indicated RPM with little change in actual engine RPM change indicates EMI is present. Check for high voltage components near ignition control circuits if a problem exists. • Check for faulty motor mounts. • Check the intake manifold and the exhaust manifold passages for casting flash. • Check for an exhaust gas recirculation (EGR) valve stuck open or EGR pintle not seating properly. Inspect EGR valve gasket for leaks.

Dieseling, Run-On Symptom

Checks	Action
Definition: Engine continues to run after key is turned OFF, but runs very rough. If the engine runs smooth, check the ignition switch and the ignition switch adjustment.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins.
Fuel System	<ul style="list-style-type: none"> • Inspect the injectors for a leaking condition.

Backfire Symptom

Checks	Action
Definition: Fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.	
Preliminary	<ul style="list-style-type: none"> • Refer to Important Preliminary Checks Before Starting in <i>Symptoms - Engine Controls</i>. • Check the ECM grounds for being clean, tight and in the proper locations. • Search for bulletins.
Fuel System	<ul style="list-style-type: none"> • Check for incorrect fuel pressure. • Check for a restricted fuel filter. • Check for a contaminated fuel condition. • Check the fuel injectors. Refer to <i>Fuel Injector Coil Test - Engine Coolant Temperature (ECT) Between 10-35 degrees C (50-95 Degrees F)</i>. • Check that each injector harness is connected to the correct injector and cylinder.
Sensor System	<ul style="list-style-type: none"> • Check the air intake system and crankcase for air leaks. • Check the crankcase ventilation valve for proper operation. Place a finger over the inlet hole in the valve end several times. The valve should snap back. If not, replace the valve. • Use a scan to in order to monitor the knock sensor system for excessive spark retard activity.
Ignition System	<ul style="list-style-type: none"> • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Check for proper ignition voltage output per manufacturer's recommendations. • Remove the spark plugs and check for the following: <ul style="list-style-type: none"> – Correct heat range – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant or oil fouled. • Check for bare or shorted ignition wires. • Check for loose ignition coil grounds. • Visually and physically inspect the secondary ignition for the following: <ul style="list-style-type: none"> – Ignition wires arcing to ground – Ignition wires for proper routing – Ignition coils for cracks or carbon tracking
Engine Cooling System	<ul style="list-style-type: none"> • Check the engine coolant level for being low. • Check the engine thermostat for proper operation and for the correct heat range.

Backfire Symptom (cont'd)

Checks	Action
Engine Mechanical	<ul style="list-style-type: none"> • Check engine mechanical for the following: <ul style="list-style-type: none"> – Low compression – Sticking or leaking valves – Worn camshaft lobes – Valve timing – Bent push rods – Worn rocker arms – Broken Valve Springs – Excessive oil in the combustion chamber - Leaking valve seals. • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Camshaft – Cylinder heads – Pistons, etc. <p>Refer to the appropriate procedures in Engine Mechanical.</p>
Additional Checks	<ul style="list-style-type: none"> • Inspect the exhaust system for possible restriction. • Electromagnetic interference (EMI) on the reference circuit can cause an engine miss condition. A sudden increase in indicated RPM with little change in actual engine RPM change indicates EMI is present. Check for high voltage components near ignition control circuits if a problem exists. • Check for faulty motor mounts. • Check the intake manifold and the exhaust manifold passages for casting flash. • Visually and physically check the vacuum hoses for splits, kinks and proper connections and routing.