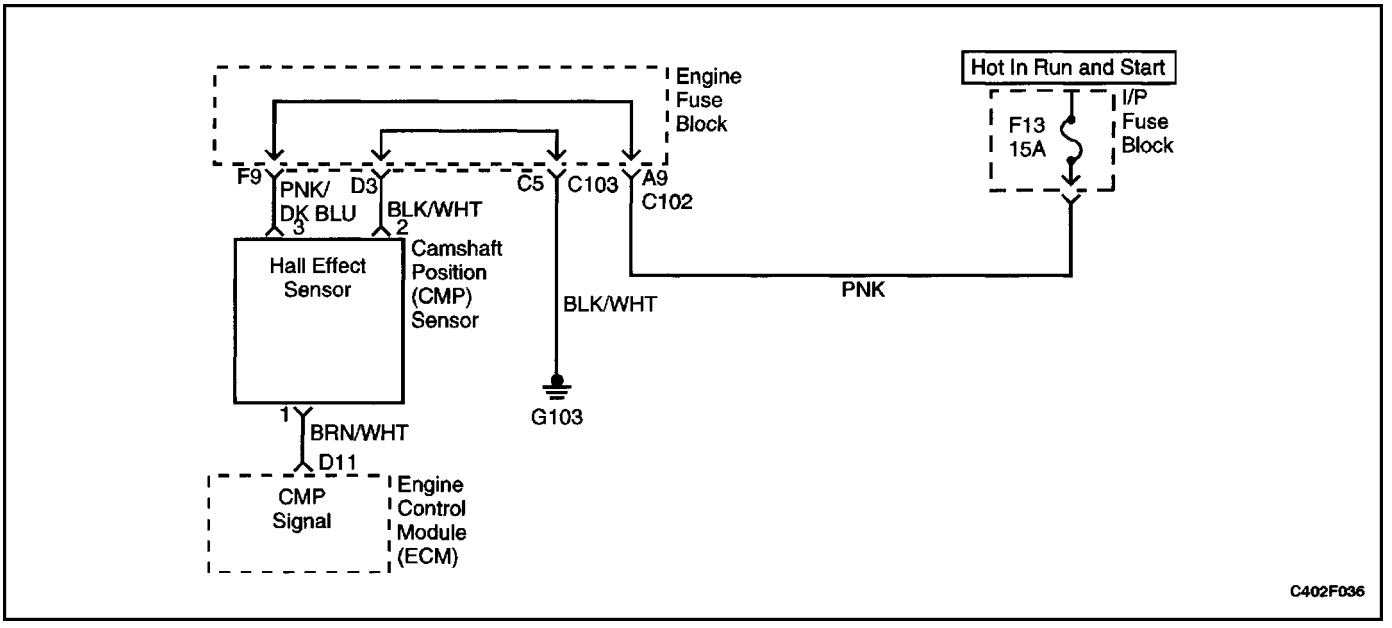


DIAGNOSTIC TROUBLE CODE (DTC) P0341

CAM RATIONALITY

System Description

The Camshaft Position (CMP) Sensor is used to correlate crankshaft to camshaft position so that the engine control module (ECM) can determine which cylinder is ready to be fueled by the injector. The CMP is also used to determine which cylinder is misfiring when misfire is present. If the ECM receives an intermittent signal from the CMP, then the CMP Resync Counter will increment. When the ECM cannot use the information from the CMP sensor, a Diagnostic Trouble Code (DTC) is set, and the ECM will fuel the engine using the Alternating Synchronous Double Fire (ASDF) method.

Conditions for Setting the DTC

- Engine is running.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm–up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed–through wire insulation, or a wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions:

- Backed–out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal–to–wire connection
- Physical damage to the wiring harness

If the ECM sees less than 15 resyncs in 256 seconds, the counter is reset to 0. Anytime a poor connection is present, the CMP Reference Activity counter will stop incrementing, and the CMP Resync Counter will increment.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

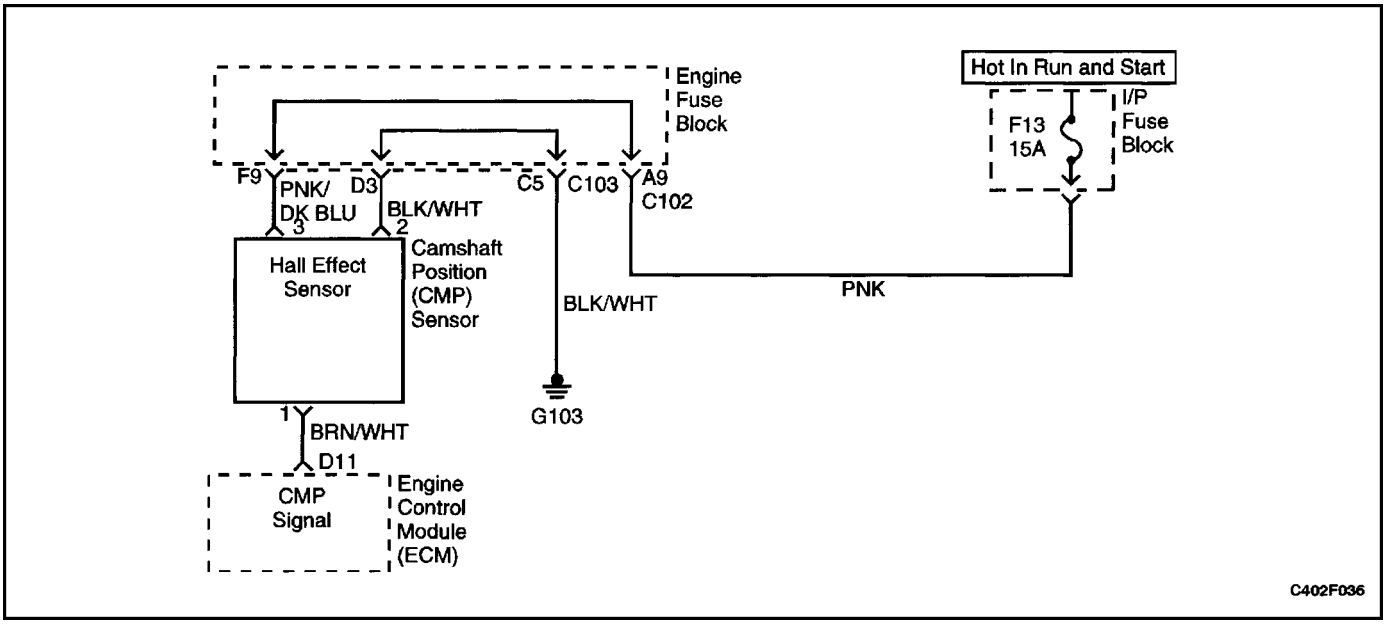
1. The On–Board Diagnostic (OBD II) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0341 is the result of a hard failure or an intermittent condition.

3. The counter should stop incrementing with the sensor electrical connector disconnected and set a DTC P0342 with the sensor disconnected. If it still increments, the ECM is malfunctioning.
4. By moving the CMP electrical connector, the connections at the sensor are checked. Make sure the electrical connector remains securely fastened.
5. A poor connection in any of the circuits at the CMP will cause the CMP Resync Counter to increment. Anytime a poor connection is present, the CMP Reference Activity counter will stop incrementing and the CMP Resync Counter will increment.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0341 Cam Rationality

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to ”On–Board Diagnostic System Check”
2	1. Idle the engine. 2. Install a scan tool. Is the Camshaft Position (CMP) Resync Counter incrementing?		Go to *Step 3*	Go to *Step 4*
3	Disconnect the CMP electrical connector. Does the CMP Resync Counter stop incrementing?		Go to *Step 5*	Go to *Step 6*
4	With the engine still running, wiggle the CMP sensor electrical connector by hand. Does the CMP Resync Counter start to increment?		Go to *Step 5*	Go to *Step 9*
5	Check for poor connections at the CMP electrical connector and repair as necessary. Is a repair necessary?		Go to *Step 10*	Go to *Step 7*
6	Replace the engine control module (ECM). Is the action complete?		Go to *Step 10*	
7	1. Turn the ignition OFF. 2. Disconnect the ECM electrical connector 2 and check the CMP terminal D11 for a poor connection and repair as necessary. Is a repair necessary?		Go to *Step 10*	Go to *Step 8*
8	Replace the CMP. Is the action complete?		Go to *Step 10*	
9	1. Turn the ignition switch ON with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting this DTC. Is the CMP Resync Counter incrementing?		Go to *Step 3*	Go to *Step 10*

Step	Action	Value(s)	Yes	No
10	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?		Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to ”Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0342

CAM POSITION NO SIGNAL

System Description

The Camshaft Position (CMP) Sensor is used to correlate crankshaft to camshaft position so that the engine control module (ECM) can determine which cylinder is ready to be fueled by the injector. The CMP is also used to determine which cylinder is misfiring when misfire is present. If the ECM receives an intermittent signal from the CMP, then the CMP Resync Counter will increment. When the ECM cannot use the information from the CMP sensor, a Diagnostic Trouble Code (DTC) is set and the ECM will fuel the engine using the Alternating Synchronous Double Fire (ASDF) method.

Conditions for Setting the DTC

- Engine is running.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm–up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed–through wire insulation, or a wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions:

- Backed–out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal–to–wire connection
- Physical damage to the wiring harness

Test Description

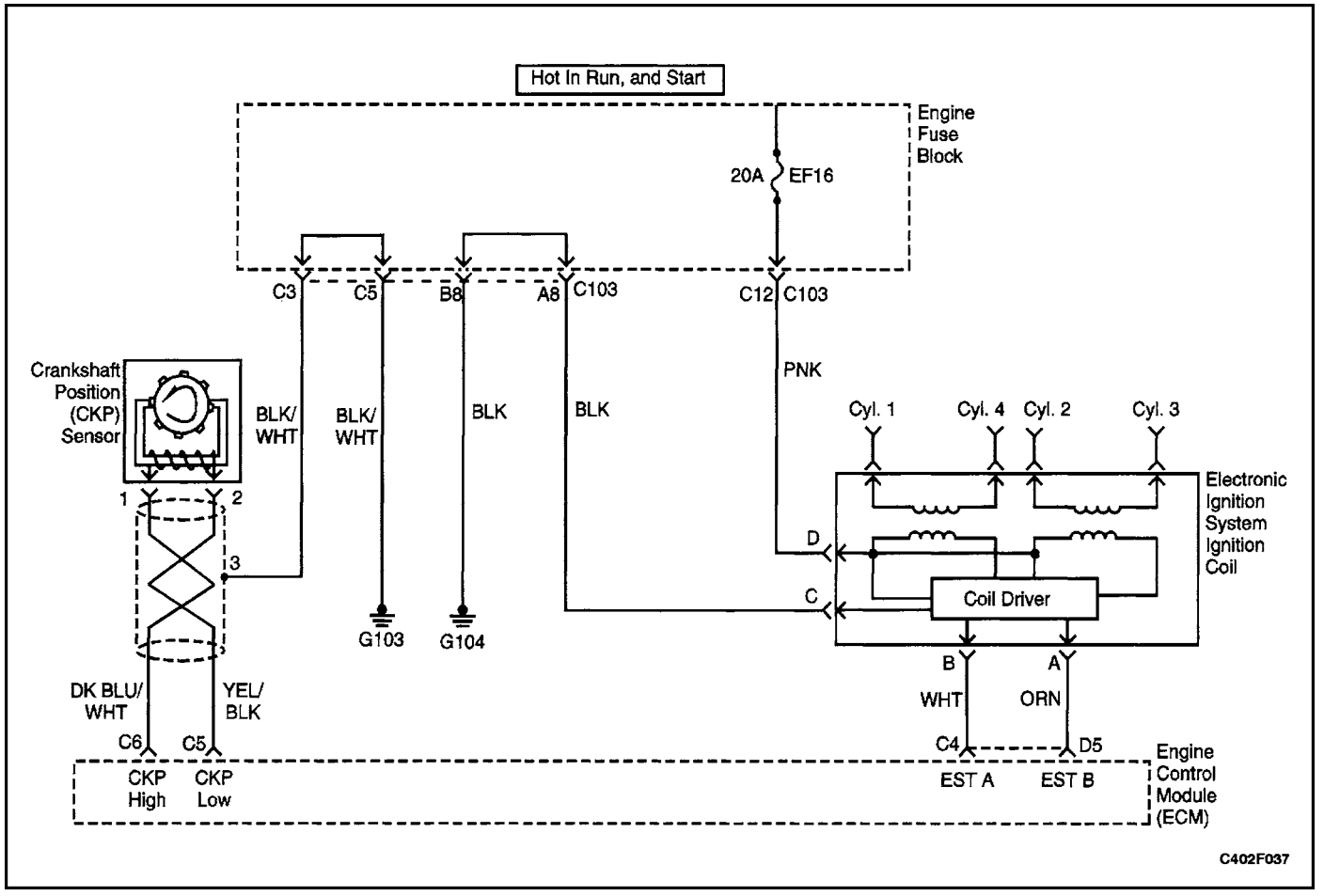
Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The On–Board Diagnostic (OBD II) System Check prompts the technician to complete some basic checks and to store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0342 is the result of a hard failure or an intermittent condition.
4. Determines if voltage is available to the CMP.
7. This step checks for a signal from the CMP. It is necessary to supply B+ to the ignition feed 2 terminal in order for the CMP to have B+ supplied to it. While cranking the engine, the CMP will send a B+ signal and then a ground signal as the reluctor passes the sensor.
15. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0342 Cam Position No Signal

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to ”On–Board Diagnostic System Check”
2	1. Idle the engine. 2. Install a scan tool. Is the Camshaft Position (CMP) Active Counter incrementing?		Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition switch ON with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting this DTC. Is the CMP Active Counter incrementing?		Go to *Step 16*	Go to *Step 4*
4	1. Turn the ignition switch ON with the engine OFF. 2. Disconnect the CMP sensor electrical connector. 3. With a test light connected to ground, probe the CMP positive voltage feed terminal 3. Does the test light illuminate?		Go to *Step 5*	Go to *Step 6*
5	With a test light connected to B+, probe the CMP ground terminal 2. Does the test light illuminate?		Go to *Step 7*	Go to *Step 8*
6	Check for a poor connection or open in the CMP B+ feed circuit and repair as necessary. Is a repair necessary?		Go to *Step 16*	Go to *Step 15*
7	1. Turn the ignition OFF. 2. Disconnect the CMP sensor electrical connectors. 3. Disconnect the engine control module (ECM) connector 2. 4. Install a jumper wire to B+ in the ignition 2 terminal of the ECM connector. 5. With a digital voltmeter (DVM) connected to ground, probe the CMP signal terminal D11 at the ECM connector. 6. Crank the engine. Does the DVM display a voltage varying between the specified values?	0 v–B+	Go to *Step 15*	Go to *Step 9*
8	Check for a poor connection or open in the CMP ground circuit and repair as necessary. Is a repair necessary?		Go to *Step 16*	Go to *Step 15*
9	Does the DVM display a steady voltage of the specified value?	B+	Go to *Step 10*	Go to *Step 11*
10	Check the CMP signal circuit, terminal D11 for a short to B+ and repair as necessary. Is a repair necessary?		Go to *Step 16*	Go to *Step 14*

Step	Action	Value(s)	Yes	No
11	1. Disconnect the CMP electrical connector. 2. With the DVM connected to B+, probe the CMP signal circuit, terminal 1. Does the DVM display a voltage greater than the specified value?	0.5 v	Go to *Step 12*	Go to *Step 13*
12	Repair the short to ground in the CMP signal circuit. Is the action complete?		Go to *Step 16*	
13	Check for a poor connection or an open in the CMP signal circuit and repair as necessary. Is a repair necessary?		Go to *Step 16*	Go to *Step 14*
14	Replace the CMP. Is the repair complete?		Go to *Step 16*	–
15	Replace the ECM. Is the repair complete?		Go to *Step 16*	
16	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?		Go to ”Applicable DTC table”	System OK
14	Replace the CMP. Is the repair complete?		Go to ”Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0351

IGNITION CONTROL A CIRCUIT FAULT

Circuit Description

The engine control module (ECM) provides a ground for the electronic spark timing B circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil which fires the spark plug.

The circuit between the ECM and the electronic ignition system ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the ECM detects a problem in the electronic spark timing A circuit, it will set Diagnostic Trouble Code (DTC) P0351.

Conditions for Setting the DTC

- Ignition ON.
- Time of fault fall occurrence is greater than the time of the estimated fall occurrence.
- Must receive more than 40 failures within 80 test cycles.

Action Taken When the DTC Sets

- The ECM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0351 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0351 can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for:

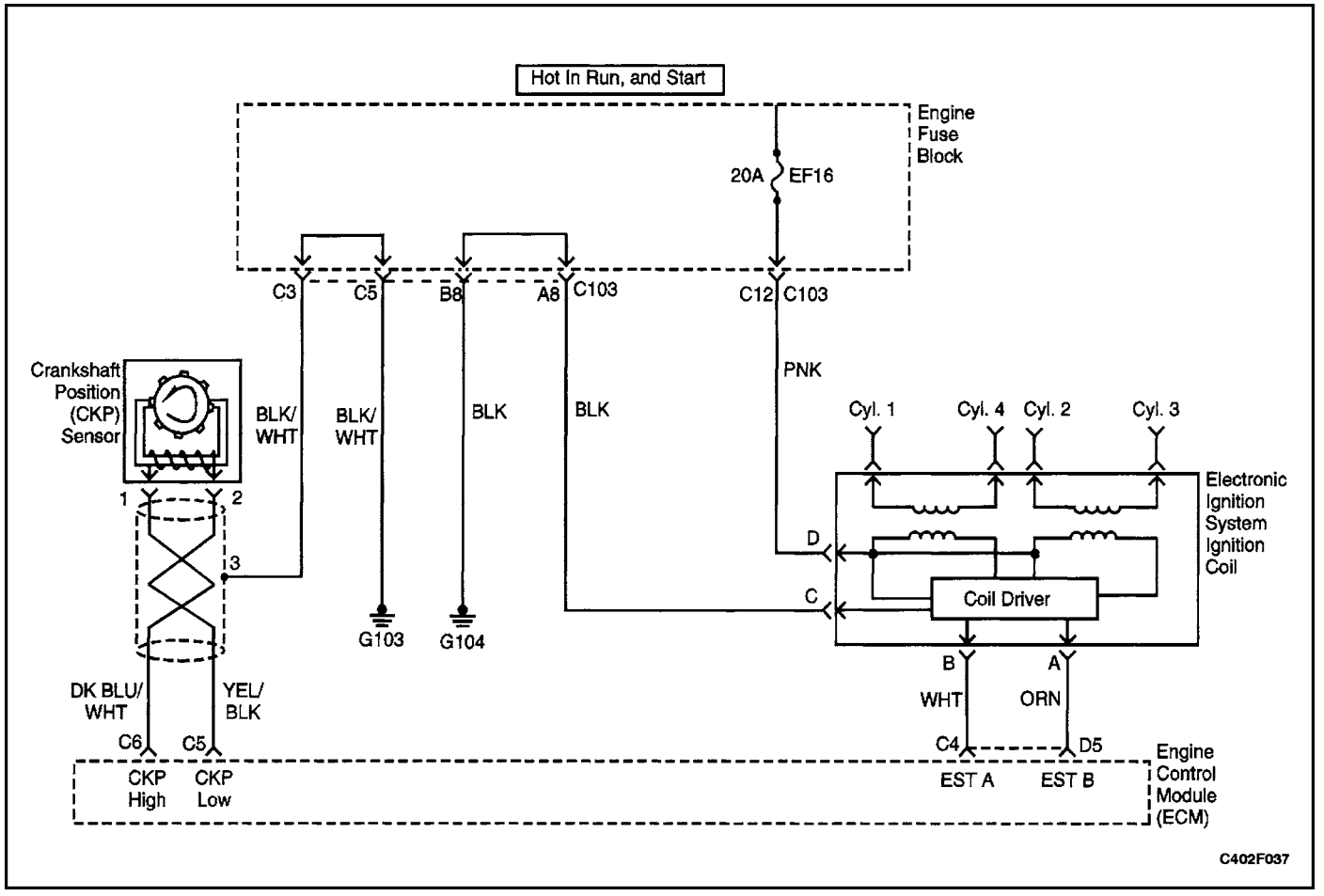
- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–towire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on, and observe a voltmeter connected to the 58X reference circuit at

the ECM harness connector while moving connectors and wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0351 Ignition Control A Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to "On–Board Diagnostic System Check"
2	Check for a faulty connection or a damaged terminal B at the ignition coil. Is a problem found?		Go to *Step 8*	Go to *Step 3*
3	Check for a faulty connection or a damaged terminal C4 at the engine control module (ECM) connector. Is a problem found?		Go to *Step 8*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Check the ignition control circuit for a short to ground. Is a problem found?		Go to *Step 8*	Go to *Step 5*
5	Check the ignition control circuit for a short to voltage. Is a problem found?		Go to *Step 8*	Go to *Step 6*
6	Check for an open in the ignition control circuit. Is a problem found?		Go to *Step 8*	Go to *Step 7*
7	Replace the ECM. Is the action complete?		Go to *Step 8*	
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?		Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to "Applicable DTC table"	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0352

IGNITION CONTROL B CIRCUIT FAULT

Circuit Description

The engine control module (ECM) provides a ground for the electronic spark timing A circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil which fires the spark plug.

The circuit between the ECM and the electronic ignition system ignition coil is monitored for an open circuit, short to voltage, and short to ground. When the ECM detects a problem in the electronic spark timing A circuit, it will set Diagnostic Trouble Code (DTC) P0352.

Conditions for Setting the DTC

- Ignition ON.
- Time of fault fall occurrence is greater than the time of the EST fall occurrence.
- Must receive more than 40 failures within 80 test cycles.

Action Taken When the DTC Sets

- The ECM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is detected.
- The ECM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The ECM will turn the MIL off on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0352 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0352 can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–towire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on, and observe a

voltmeter connected to the 58X reference circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0352 Ignition Control B Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to "On–Board Diagnostic System Check"
2	Check for a faulty connection or a damaged terminal A at the ignition coil. Is a problem found?		Go to *Step 8*	Go to *Step 3*
3	Check for a faulty connection or a damaged terminal D5 at the engine control module (ECM) connector. Is a problem found?		Go to *Step 8*	Go to *Step 4*
4	1. 2. Disconnect the ECM (white) connector. 3. Check the ignition control circuit for a short to ground. Is a problem found?		Go to *Step 8*	Go to *Step 5*
5	Check the ignition control circuit for a short to voltage. Is a problem found?		Go to *Step 8*	Go to *Step 6*
6	Check for an open in the ignition control circuit. Is a problem found?		Go to *Step 8*	Go to *Step 7*
7	Replace the ECM. Is the action complete?		Go to *Step 8*	
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?		Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to "Applicable DTC table"	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0401

EXHAUST GAS RECIRCULATION INSUFFICIENT FLOW

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an engine control module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

This diagnostic will determine if there is a reduction in EGR flow.

Conditions for Setting the DTC

- DTC(s) P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0201, P0202, P0203, P0204, P0351, P0352, P0353, P0402, P0404, P0405, P0406, P0502, P0443, P1404, P1441, and P1627 are not set.
- Engine Coolant Temperature (ECT) is greater than 72˚C (162˚F).
- The change in Idle Air Control (IAC) is less than 5 counts.
- A/C clutch/transmission clutch are unchanged.
- Compensated MAP is between 10—32 kPa (M/T) / 10–50 kPa (A/T).
- The EGR is less than 2%.
- Barometric Pressure (BARO) is greater than 70 kPa.
- Vehicle speed is above 33 mph (M/T) / 18 mph (A/T).
- Voltage is less than 16 volts and greater than 11 volts.
- The rpm is greater than 1000.
- The TP sensor is less than 1.0%.
- The change in the MAP is less than 2.2 kPa.
- The change of the RPM is greater than 100 (M/T) / 125 (A/T).
- EGR opened less than 95% commanded position.
- Engine speed is between 1150–2600 rpm (A/T).
- Engine speed is between 1600–3200 rpm (M/T).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm–up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

The EGR Decel Filter value can be a great aid in determining if a problem exists and to verify repairs. The EGR Decel Filter is an average of the difference in the expected MAP change and the actual MAP change caused by opening the EGR valve during a deceleration, and is used to determine when the MIL is illuminated. By driving the vehicle up to approximately 60 mph (97 km/h) and decelerating to 20 mph (32 km/h), it can be determined if the EGR system is OK, partially restricted, or fully restricted.

A more negative number (less than –3) indicates that the system is working normally, whereas a positive number indicates that the system is being restricted and that the expected amount of EGR flow is was not seen. A number that falls between negative 3 and positive 2 indicates that the system is partially restricted but not restricted enough to cause an emissions impact.

The EGR Decel Filter value should always be a –3 or lower. If the EGR Decel Filter number becomes more positive (towards 0 or more), then the EGR system is becoming restricted. Look for possible damage to the EGR pipe or for a restriction caused by carbon deposits in the EGR passages or on the EGR valve.

Test Description

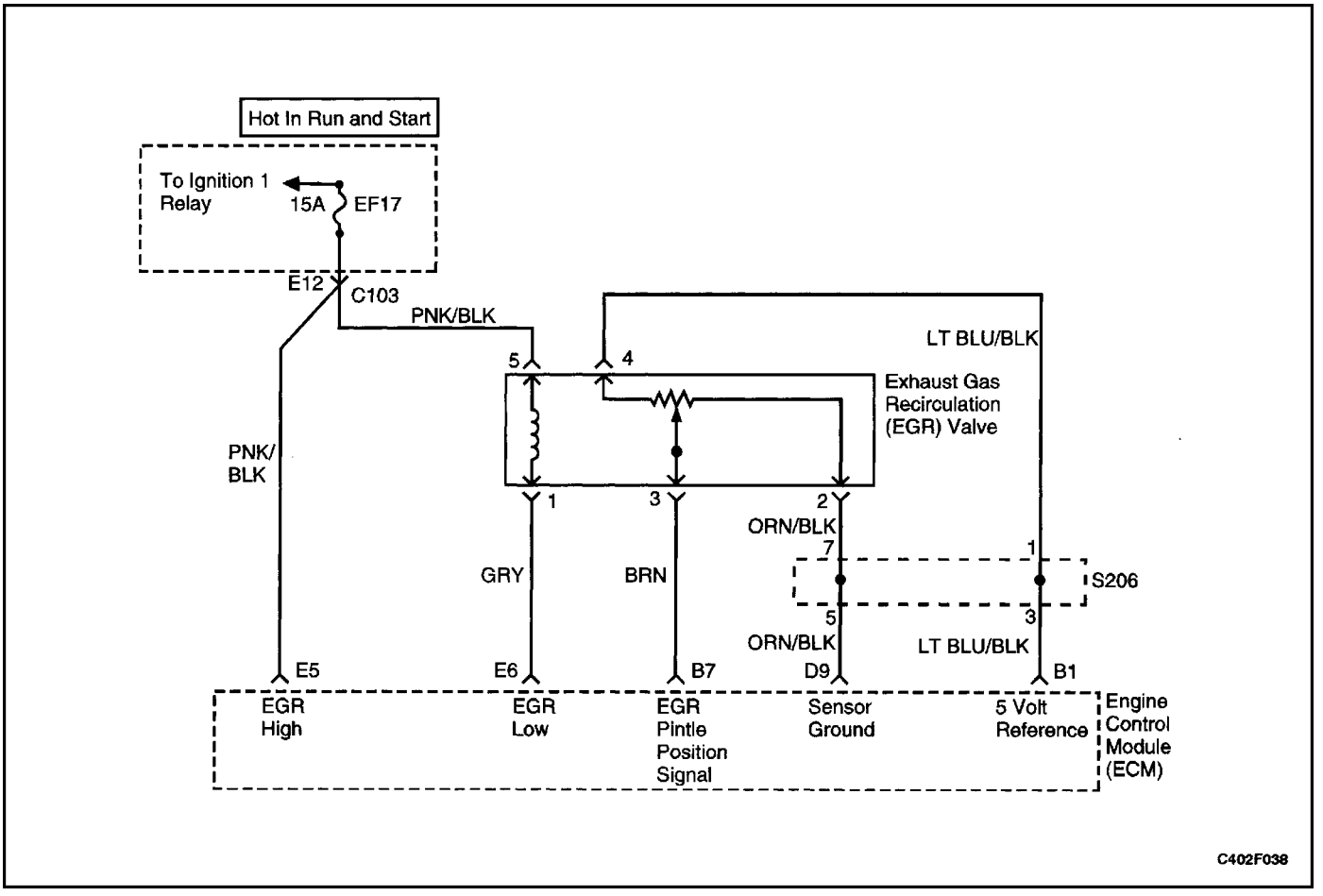
Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The On–Board Diagnostic (OBD II) System Check prompts the technician to complete some basic checks and to store the freeze frame and failure records data on the scan tool if applicable. This

creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. Commanding the EGR valve open determines whether the EGR system is totally restricted or partially restricted.
3. Visually and physically inspect the EGR passages and valve for excessive carbon deposits or damage.
4. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a DTC P0401 to set.
5. This step verifies if the fault is present and if a repair corrected the problem. If the EGR Decel Filter value stays near 0 or a positive number after several tests have been run, then a small restriction may still exist. Be sure to check the EGR pipe for damage or dents and the EGR valve for any excessive carbon build up. Only 1 test per ignition cycle will run unless a DTC P0401 has been cleared or the battery has been disconnected.
6. Clearing DTCs is a very important step for this diagnostic. The clearing function allows the EGR valve to relearn a new pintle position as the old pintle position was inaccurate due to the failure that caused the DTC. The DTC must be cleared with the ignition ON, engine OFF or when the engine is idling. If the ECM sees a EGR command, the new pintle will not be learned.

DTC P0401 Exhaust Gas Recirculation Insufficient Flow

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to ”On–Board Diagnostic System Check”
2	1. Start the engine and allow the engine to idle. 2. Install a scan tool. 3. Command the exhaust gas recirculation (EGR) valve to the specified value. Does the engine stall or attempt to stall.	50%	Go to *Step 5*	Go to *Step 3*
3	1. Turn the engine OFF. 2. Remove the EGR valve assembly. 3. Inspect the EGR valve, passages and pipe for a restriction or damage and repair as necessary. Is a repair necessary?		Go to *Step 5*	Go to *Step 4*
4	Replace the EGR valve. Is the action complete?		Go to *Step 5*	
5	1. Start the engine.. 2. Disconnect the battery for the specified time. 3. Drive the vehicle up to the specified value. 4. Release the throttle and allow the vehicle to decelerate to the specified value. Is the EGR Decel Filter value greater than the specified value?	10 seconds 60 mph (97 km/h) 20 mph (32 km/h) 0	Go to *Step 3*	Go to *Step 6*
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?		Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to ”Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0402

EXHAUST GAS RECIRCULATION EXCESSIVE FLOW

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an engine control module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

This Diagnostic Trouble Code (DTC) will detect an EGR open to a large value during crank. Crank time may be excessive with an open EGR valve.

Conditions for Setting the DTC

- Ignition voltage is between 11 volts and 16 volts.
- Engine cranking (not running) rpm is less than 500.
- EGR position during crank is greater than 200 counts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm–up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

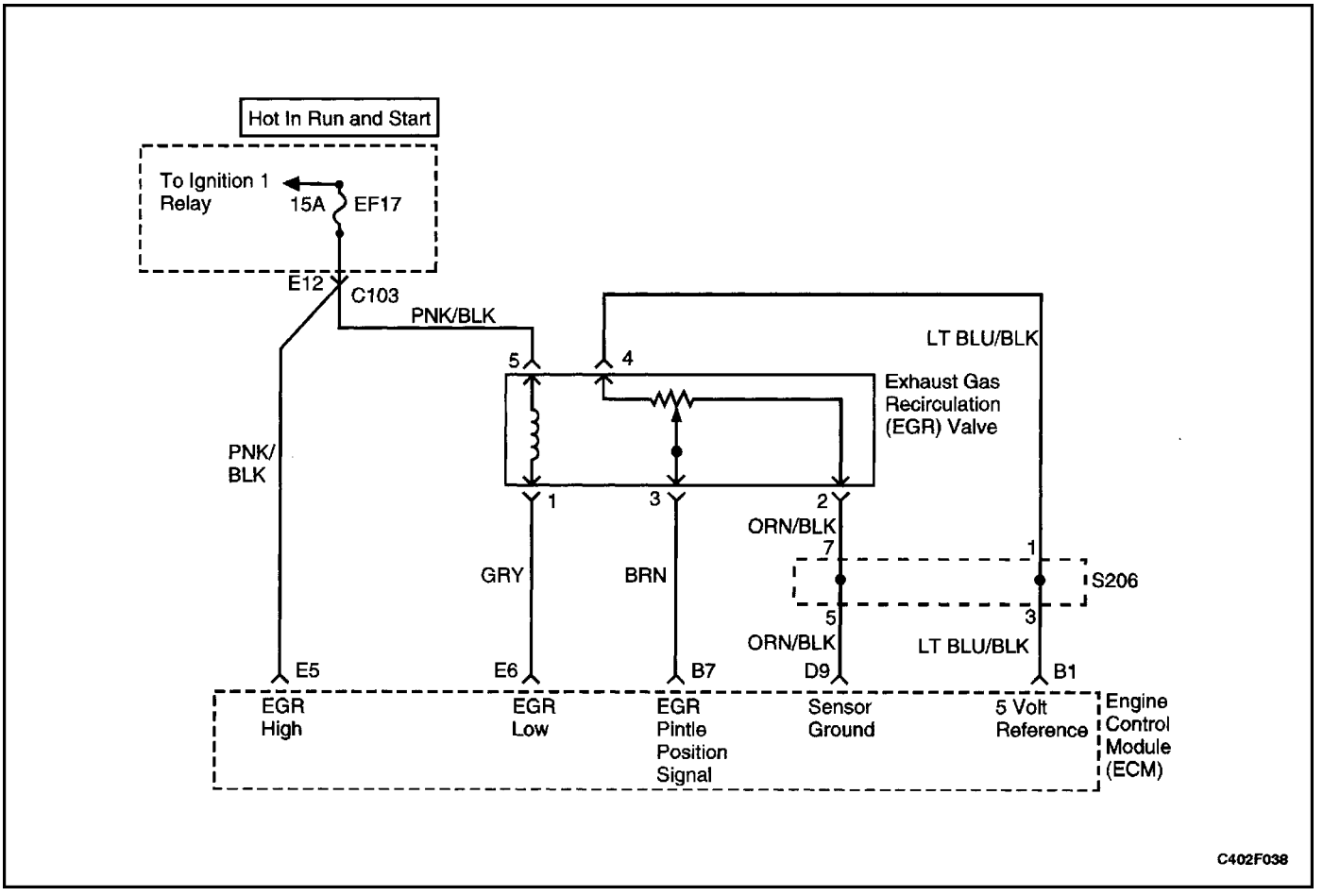
1. The On–Board Diagnostic (OBD II) System Check prompts the technician to complete some basic checks and to store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault is present. The difference between the current and commanded position is greater than 15%.
3. When the EGR valve electrical connector is disconnected, the scan tool should display the Actual EGR Position as 0%. If it does not, the fault lies either in the EGR signal circuit or the ECM.
4. A test light, when connected to ground, will glow dimly when the EGR valve is commanded to 25%, and will brighten as the EGR valve is commanded to 100%. If the light flashes, check the sensor ground for an open.
5. An open or poor connection condition may have caused this DTC to set. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
7. The test light will have glowed brightly in the previous step if the EGR control circuit was shorted to B+ and the Actual EGR Position on the scan tool will display 100%. A test light that did not illuminate, indicates that the circuit may be open or shorted to ground.
9. If the EGR valve 5 volt reference is shorted to voltage, the digital voltmeter (DVM) will read battery voltage, and additional DTCs may be set and the engine performance will be poor.
12. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
13. Although the circuitry acted correctly when checked, a problem may still lie within the terminals which would not show up in probe–type testing. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
17. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and, therefore, must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a DTC P0401 to set.
18. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
19. Clearing DTCs is a very important step for this diagnostic. The clearing function allows the EGR valve to relearn a new pintle position as the old pintle position was inaccurate due to the failure that caused the DTC. The DTC must be cleared with the ignition ON, engine OFF or when the engine is idling. If the ECM sees a EGR command, the new pintle will not be learned.
20. If no malfunctions have been found at this point and no additional DTCs were set, refer to"Diagnostic Aids" in this section for additional checks and information.

DTC P0402 Exhaust Gas Recirculation Excessive Flow

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to "On–Board Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition switch ON with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit at terminal 2 to the EGR valve. Does the test light illuminate?		Go to *Step 4*	Go to *Step 5*
4	1. Connect the test light to ground. 2. Probe the EGR control circuit at terminal 1 to the EGR valve. 3. Command the EGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to *Step 6*	Go to *Step 7*
5	Repair the open or poor connection in the EGR ground circuit. Is the action complete?		Go to *Step 19*	
6	With a test light still connected to ground, probe the signal circuit at terminal 3. Does the test light illuminate?		Go to *Step 8*	Go to *Step 9*
7	With the test light still connected to ground, again probe the control circuit without commanding the EGR valve with the scan tool. Does the test light illuminate?		Go to *Step 10*	Go to *Step 11*
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 12*
9	With a digital voltmeter (DVM) connected to ground, probe the 5 v reference circuit at terminal 4. Is the voltage measured near the specified value?	5 v	Go to *Step 13*	Go to *Step 14*
10	Check the control circuit for a short to voltage and repair as necessary. Is a repair necessary.		Go to *Step 19*	Go to *Step 12*
11	Connect the test light to B+ and again probe the control circuit at terminal 1. Does the test light illuminate?		Go to *Step 15*	Go to *Step 16*
12	Replace the engine control module (ECM). Is the action complete?		Go to *Step 19*	
13	Check the EGR ground circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 17*
14	Check the 5 v reference circuit for a short to voltage and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 12*
15	Check the control circuit at terminal A for a short to ground and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 12*
16	Check the control circuit at terminal A for an open or poor connection at the EGR valve electrical connector and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 18*

Step	Action	Value(s)	Yes	No
17	Replace the EGR valve. Is the action complete?		Go to *Step 19*	
18	Check the ECM electrical connector for a poor connection and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 12*
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?		Go to *Step 7*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to ”Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0404

EXHAUST GAS RECIRCULATION OPEN VALVE POSITION ERROR

Circuit Description

lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gasses, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an engine control module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

This DTC will detect an open valve position.

Conditions for Setting the DTC

- Ignition voltage is between 11 v and 16 v.
- The change of defired EGR position is less than 2%.
- Engine running.
- Coolant temperature is greater than 2˚C.
- EGR commanded ON (Desired EGR Position is greater than 0%).
- Actual EGR Position differs from Desired EGR Position by more than 15% for 18 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

Test Description

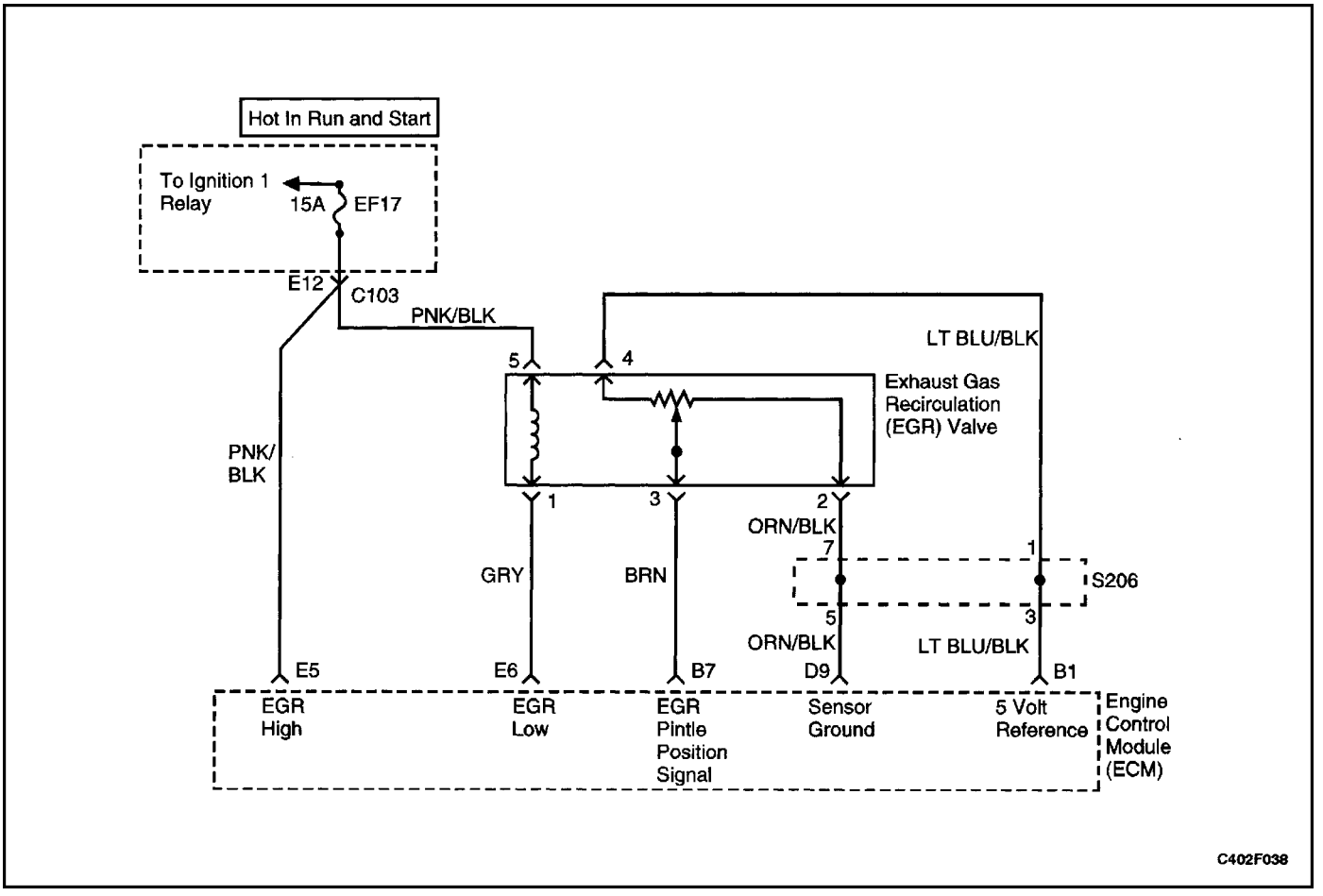
Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The On–Board Diagnostic (OBD II) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault is present. The difference between the current and commanded position is greater than 15%.
3. When the EGR valve electrical connector is disconnected, the scan tool should display the Actual EGR Position as 0%. If it does not, the fault lies either in the EGR signal circuit or the ECM.
4. A test light, when connected to ground, will glow dimly when the EGR valve is commanded to 25%, and brighter as the EGR valve is commanded to 100%. If the light flashes, check the sensor ground for an open.
5. An open or poor connection condition may have caused this DTC to set. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
7. The test light will have glowed brightly in the previous step if the EGR control circuit was shorted to B+ and the Actual EGR Position on the scan tool will display 100%. A test light that did not illuminate, indicates that the circuit may be open or shorted to ground.
9. If the EGR valve 5 volt reference is shorted to voltage, the digital voltmeter (DVM) will read battery voltage and additional DTCs may be set and the engine performance will be poor.
12. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
13. Although the circuitry acted correctly when checked, a problem may still lie within the terminals which would not show up in probe type testing. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
17. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and therefore must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a DTC P0401 to set.
18. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
19. Clearing DTCs is a very important step for this diagnostic. The clearing function allows the EGR valve to relearn a new pintle position as the old pintle position was inaccurate due to the failure that caused the DTC. The DTC must be cleared with the ignition ON, engine OFF or when the engine is idling. If the ECM sees a EGR command, the new pintle will not be learned.
20. If no malfunctions have been found at this point and no additional DTCs were set, refer to ”Diagnostic Aids” in this section for additional checks and information.

DTC P0404 Exhaust Gas Recirculation Open Valve Position Error

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to ”On–Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch ON, with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit at terminal 2 to the EGR valve. Does the test light illuminate?		Go to *Step 4*	Go to *Step 5*
4	1. Connect the test light to ground. 2. Probe the EGR control circuit at terminal 1 to the EGR valve. 3. Command the EGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to *Step 6*	Go to *Step 7*
5	Repair the open or poor connection in the EGR ground circuit. Is the action complete?		Go to *Step 19*	
6	With a test light still connected to ground, probe the signal circuit at terminal 3. Does the test light illuminate?		Go to *Step 8*	Go to *Step 9*
7	With the test light still connected to ground, again probe the control circuit without commanding the EGR valve with the scan tool. Does the test light illuminate?		Go to *Step 10*	Go to *Step 11*
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 12*
9	With a digital voltmeter (DVM) connected to ground, probe the 5 v reference circuit at terminal 4. Is the voltage measured near the specified value?	5 v	Go to *Step 13*	Go to *Step 14*
10	Check the control circuit for a short to voltage and repair as necessary. Is a repair necessary.		Go to *Step 19*	Go to *Step 12*
11	Connect the test light to B+ and again probe the control circuit. Does the test light illuminate?		Go to *Step 15*	Go to *Step 16*
12	Replace the engine control module (ECM). Is the action complete?		Go to *Step 19*	

Step	Action	Value(s)	Yes	No
13	Check the EGR ground circuit at terminal D9 for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 17*
14	Check the 5 v reference circuit for a short to voltage and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 12*
15	Check the control circuit for a short to ground and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 12*
16	Check the control circuit for an open or poor connection at the EGR valve electrical connector and repair as necessary. Is a repair necessary?		Go to *Step 19*	Go to *Step 18*
17	Replace the EGR valve. Is the action complete?		Go to *Step 19*	
18	Check the ECM electrical connector for a poor connection and repair as necessary.		Go to *Step 19*	Go to *Step 12*
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?		Go to *Step 7*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to ”Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0405

EXHAUST GAS RECIRCULATION PINTLE POSITION LOW VOLTAGE

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an engine control module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

This Diagnostic Trouble Code (DTC) will detect an open or short circuit.

Conditions for Setting the DTC

- Ignition voltage is between 11 v and 16 v.
- Engine running.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.

- A history DTC is stored.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm–up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

Test Description

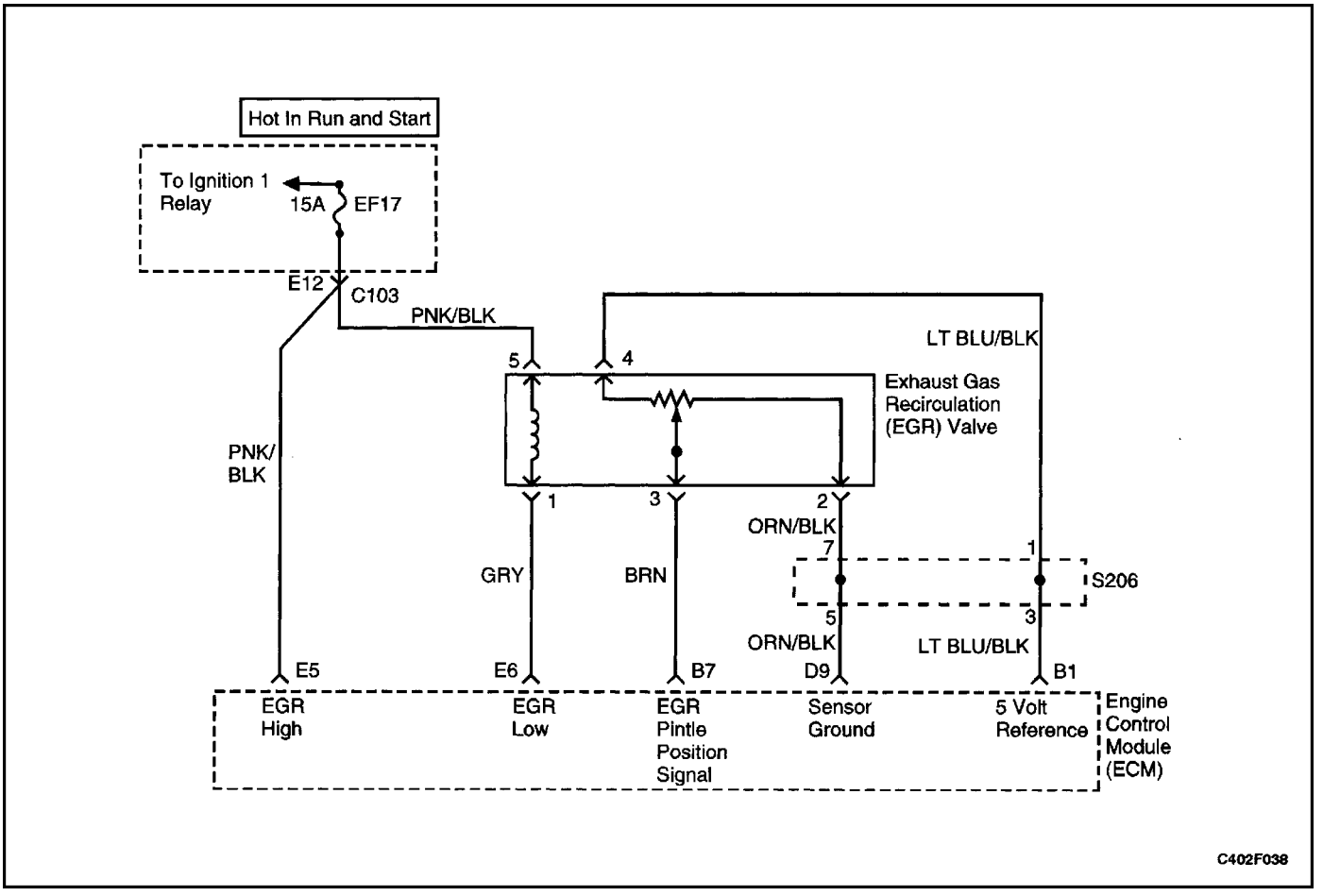
Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The On–Board Diagnostic (OBD II) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault is present.
3. If the EGR valve 5 volt reference is shorted to ground, the digital voltmeter (DVM) will read no voltage and additional DTCs may be set and the engine performance will be poor. When this circuit is open, only a DTC P0405 will be set.
4. Jumping the 5 volt reference circuit to the signal circuit checks the signal circuit and the ECM. The scan tool should display the Actual EGR Position as 100% if the signal circuit and ECM are OK.
6. Although the ECM and circuitry acted correctly in the previous step, a problem may still lie within the terminals which would not show up in probe type testing. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
10. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and therefore must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a DTC P0401 to set.
13. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
14. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
15. Clearing DTCs is a very important step for this diagnostic. The clearing function allows the EGR valve to relearn a new pintle position as the old pintle position was inaccurate due to the failure that caused the DTC. The DTC must be cleared with the ignition ON, engine OFF or when the engine is idling. If the ECM sees an EGR command, the new pintle will not be learned.
16. If no malfunctions have been found at this point and no additional DTCs were set, refer to Diagnostic Aids for additional checks and information.

DTC P0405 Exhaust Gas Recirculation Pintle Position Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to ”On–Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 15*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a digital voltmeter (DVM) connected to ground, probe the 5 volt reference circuit at terminal 4 to the EGR valve. Does the DVM read near the specified value?	5 v	Go to *Step 4*	Go to *Step 5*

Step	Action	Value(s)	Yes	No
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 4 and 3. Does the Actual EGR Position display the specified value?	100%	Go to *Step 6*	Go to *Step 7*
5	1. Connect the test light to B+. 2. Probe the 5 volt reference circuit to the EGR valve. Does the test light illuminate?		Go to *Step 8*	Go to *Step 9*
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 10*
7	1. Connect the test light to B+. 2. Probe the signal circuit at terminal 3 to the EGR valve. Does the test light illuminate?		Go to *Step 11*	Go to *Step 12*
8	Check for a short to ground in the EGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 13*
9	Check for an open in the EGR 5 volt reference circuit and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 14*
10	Replace the EGR valve. Is the action complete?		Go to *Step 15*	
11	Check for a short to ground in the EGR valve signal circuit and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 13*
12	Check for an open in the EGR valve signal circuit and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 14*
13	Replace the engine control module (ECM). Is the action complete?		Go to *Step 15*	
14	Check the affected circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 13*
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?		Go to *Step 7*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to ”Applicable DTC table”	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0406

EXHAUST GAS RECIRCULATION PINTLE POSITION HIGH VOLTAGE

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with an engine control module (ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The ECM then commands the EGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EGR Position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

Conditions for Setting the DTC

- Engine running.
- Ignition voltage is between 11 v and 16 v.
- A malfunction is present for more than 5 seconds.
- EGR position signal is greater than 250 counts (4.9 v).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate after two consecutive ignition cycles in which the diagnostic runs with the fault active.

- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history Diagnostic Trouble Code (DTC) is stored.
- EGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm–up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EGR valve may freeze and stick in cold weather. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the freeze frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The On–Board Diagnostic (OBD II) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault is present.
3. If the EGR valve 5 volt reference is shorted to ground, the digital voltmeter (DVM) will read no voltage and additional DTCs may be set and the engine performance will be poor. When this circuit is open, only a DTC P0405 will be set.
4. Jumpering the 5 volt reference circuit to the signal circuit checks the signal circuit and the ECM. The scan tool should display the Actual EGR Position as 100% if the signal circuit and ECM are OK.
6. Although the ECM and circuitry acted correctly in the previous step, a problem may still lie within the terminals which would not show up in probe type testing. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
10. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and therefore must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a DTC P0401 to set.
13. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
14. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
15. Clearing the DTCs is a very important step for this diagnostic. The clearing function allows the EGR valve to relearn a new pintle position as the old pintle position was inaccurate due to the failure that caused the DTC. The DTC must be cleared with the ignition ON, engine OFF or when the engine is idling. If the ECM sees a EGR command, the new pintle will not be learned.
16. If no malfunctions have been found at this point and no additional DTCs were set, refer to ”Diagnostic Aids” in this section for additional checks and information.

DTC P0406 Exhaust Gas Recirculation Pintle Position High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to ”On–Board Diagnostic System Check”
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition switch ON with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a digital voltmeter (DVM) connected to ground, probe the 5 v reference circuit at terminal 4 to the EGR valve. Does the DVM read near the specified value?	5 v	Go to *Step 4*	Go to *Step 5*
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 4 and 3. Does the Actual EGR Position display the specified value?	100%	Go to *Step 6*	Go to *Step 7*
5	1. Connect the test light to B+. 2. Probe the 5 v reference circuit to the EGR valve. Does the test light illuminate?		Go to *Step 8*	Go to *Step 9*
6	Check the 5 v reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 10*
7	1. Connect the test light to B+. 2. Probe the signal circuit at terminal 3 to the EGR valve. Does the test light illuminate?		Go to *Step 11*	Go to *Step 12*
8	Check for a short to ground in the EGR valve 5 v reference circuit and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 13*
9	Check for an open in the EGR 5 v reference circuit and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 14*
10	Replace the EGR valve. Is the action complete?		Go to *Step 15*	
11	Check for a short to ground in the EGR valve signal circuit and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 13*
12	Check for an open in the EGR valve signal circuit and repair as necessary. ? Is a repair necessary		Go to *Step 15*	Go to *Step 14*
13	Replace the engine control module (ECM). Is the action complete?		Go to *Step 19*	
14	Check the affected circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?		Go to *Step 15*	Go to *Step 13*

Step	Action	Value(s)	Yes	No
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?		Go to *Step 7*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to ”Applicable DTC table”	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0420
CATALYST BANK 1 LOW EFFICIENCY

Circuit Description

In order to control exhaust emissions of Hydrocarbons (HC), Carbon Monoxide (CO) and Oxides of Nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide, and it reduces NOx, converting it into nitrogen. The catalytic converter also has the ability to store oxygen. The engine control module (ECM) has the capability to monitor this process using a Heated Oxygen Sensor (HO2S 2) located in the exhaust stream past the three–way catalytic converter. The HO2S 2 produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust emissions effectively. The ECM monitors the catalyst efficiency by first allowing the catalyst to heat up, waiting for a stabilization period while the engine is idling, and then adding and removing fuel while monitoring the reaction of the HO2S 2. When the catalyst is functioning properly, the HO2S 2 response to the extra fuel is slow compared to the oxygen sensor (O2S 1). When the HO2S 2 response is close to that of the O2S 1, the Oxygen storage capability or efficiency of the catalyst is considered to be bad, and the Malfunction Indicator Lamp (MIL) will illuminate.

Conditions for Setting the DTC

- DTC(s) P0106, P0107, P0108, P0117, P0118, P0121, P0122, P0123, P0125, P0131, P0132, P0133, P0134, P0137, P0138, P0140, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P0440, P0502, P1133, P1134, P1171, P1441, and P1626 not set.
- Closed loop stoichiometry.
- Catalyst temperature is greater than 399˚C (750˚F).
- Engine air load is less than or equal to 80%.
- Airflow is between 6 and 21 g/sec (M/T).
- The change in the engine load is less than or equal to 5%.
- Vehicle speed is greater than or equal to 20 mph and less than or equal to 60 mph.
- Engine speed is less than or equal to 3000 rpm (M/T)/ 2900 rpm (A/T).

Action Taken When the DTC Sets

- The MIL will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm–up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

The catalyst test may abort due to a change in the engine load. Do not change the engine load (i.e. A/C, coolant fan, heater motor) while a catalyst test is in progress.

An intermittent problem may be caused by a poor connection, rubbed–through wire insulation, or a wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the intermittent complaint, should be thoroughly checked for the following conditions:

- Backed–out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal–to–wire connection

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. The On–Board Diagnostic (OBD II) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. If any component DTCs are set, diagnose those DTCs first. A fault in a component can cause the converter to appear degraded or may have caused its failure.
3. This step includes checks for conditions that can cause the three–way catalytic converter to appear degraded. Repair any problems found before proceeding with this table.
5. If the three–way catalytic converter needs to be replaced, make sure that another condition is not present which would cause the converter to become damaged. These conditions may include: misfire; high engine oil or coolant consumption; retarded spark timing or weak spark. To avoid damaging the replacement converter, correct any possible causes of converter damage before replacing the catalytic converter.
6. Clearing DTCs allows the catalyst test to be run up to 6 times this ignition cycle. Once the ignition is cycled, the test will run only once. Driving the ve-

hicle heats the catalyst to a test temperature. The ECM must see a predetermined amount of time at above idle before allowing the catalyst test to run at idle. Once at idle, the ECM will allow the system to stabilize and then test the catalyst in 2 stages.

7. If no faults have been found at this point and no additional DTCs were set, refer to ”Diagnostic Aids” in this section for additional checks and information.

DTC P0420 Catalyst Bank 1 Low Efficiency

Step	Action	Value(s)	Yes	No
1	Perform an On–Board Diagnostic (OBD II) System Check. Is the system check complete?		Go to *Step 2*	Go to ”On–Board Diagnostic System Check”
2	Install a scan tool. Are any component Diagnostic Trouble Codes (DTCs) set?		Go to ”Applicable DTC table”	Go to *Step 3*
3	Visually/physically check the following: • Exhaust system for leaks. • Heated Oxygen Sensor (HO2S). Is a problem found?		Go to *Step 4*	Go to *Step 5*
4	Repair the exhaust system as necessary. Is the action complete?		Go to *Step 6*	
5	Repair the three–way catalytic converter. Is the action complete?		Go to *Step 6*	
6	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?		Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?		Go to ”Applicable DTC table”	System OK