## 2006 ENGINE PERFORMANCE

## Advanced Diagnostics - MDX

# DTC P0036 (163): ADVANCED DIAGNOSTICS

### DTC P0036: REAR SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S) (BANK 1, SENSOR 2) HEATER CIRCUIT MALFUNCTION

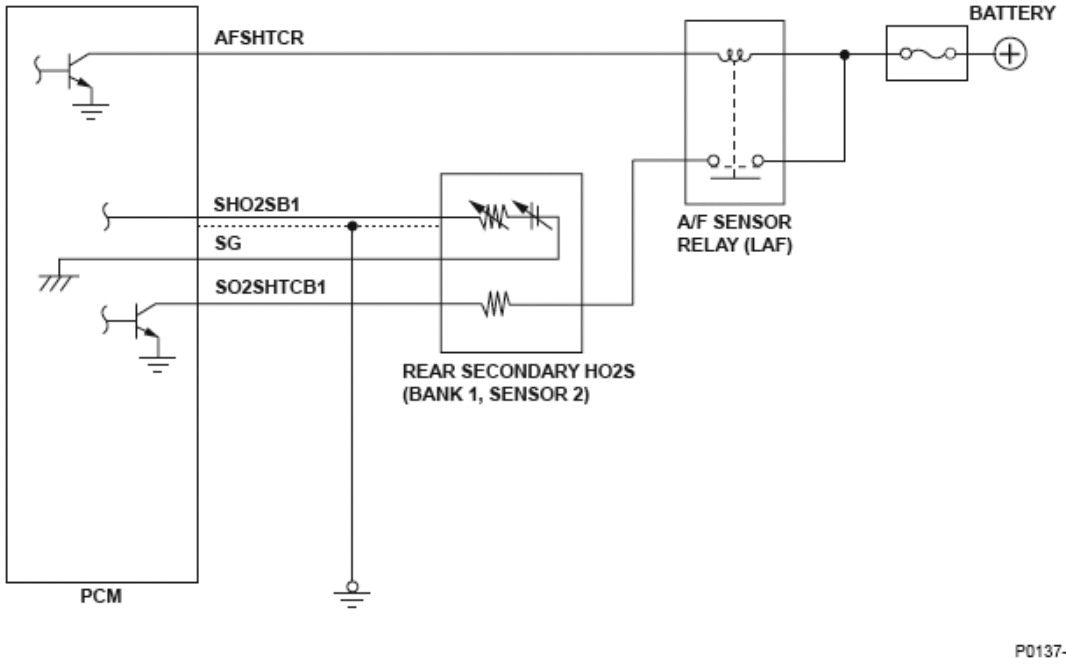



**Fig. 1: Rear Secondary Heated Oxygen Sensor Heater Circuit Diagram (Bank 1, Sensor 2)**

**General Description**

A heater for the zirconia element is embedded in the rear secondary heated oxygen sensor (rear secondary HO2S) (bank 1, sensor 2), and it is controlled by the powertrain control module (PCM). When activated, it heats the sensor to stabilize and speed up the detection of oxygen content when the exhaust gas temperature is cold.

The PCM reads the return signal against the rear secondary HO2S (bank 1, sensor 2) drive signal.

When the drive signal and the return signal do not match, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |

| | |
|---|---|
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0117, P0118 |

**Malfunction Threshold**

When either of the following conditions continues for at least 1 second:

- The return signal is OFF when the PCM outputs the ON signal to the rear secondary HO2S (bank 1, sensor 2)
- The return signal is ON when the PCM outputs the OFF signal to the rear secondary HO2S (bank 1, sensor 2)

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0056 (164): ADVANCED DIAGNOSTICS

### DTC P0056: FRONT SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S) (BANK 2, SENSOR 1) HEATER CIRCUIT MALFUNCTION

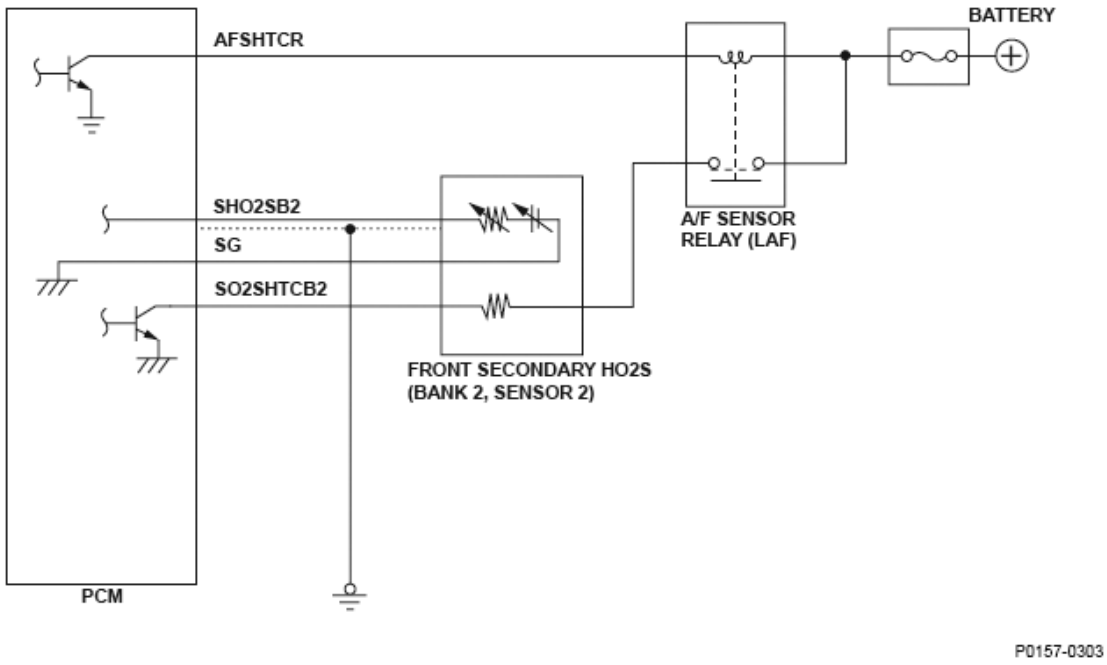



**Fig. 2: Front Secondary Heated Oxygen Sensor Heater Circuit Diagram**

**General Description**

A heater for the zirconia element is embedded in the front secondary heated oxygen sensor (front secondary HO2S) (bank 2, sensor 1), and it is controlled by the powertrain control module (PCM). When activated, it heats the sensor to stabilize and speed up the detection of oxygen content when the exhaust gas temperature is cold.

The PCM reads the return signal against the front secondary HO2S (bank 2, sensor 1) drive signal.

When the drive signal and the return signal do not match, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |

| | |
|---|---|
| No active DTCs | P0117, P0118 |

**Malfunction Threshold**

When either of the following conditions continues for at least 1 second:

- The return signal is OFF when the PCM outputs the ON signal to the front secondary HO2S (bank 2, sensor 1)
- The return signal is ON when the PCM outputs the OFF signal to the front secondary HO2S (bank 2, sensor 1)

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0107 (3): ADVANCED DIAGNOSTICS

## DTC P0107: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW VOLTAGE

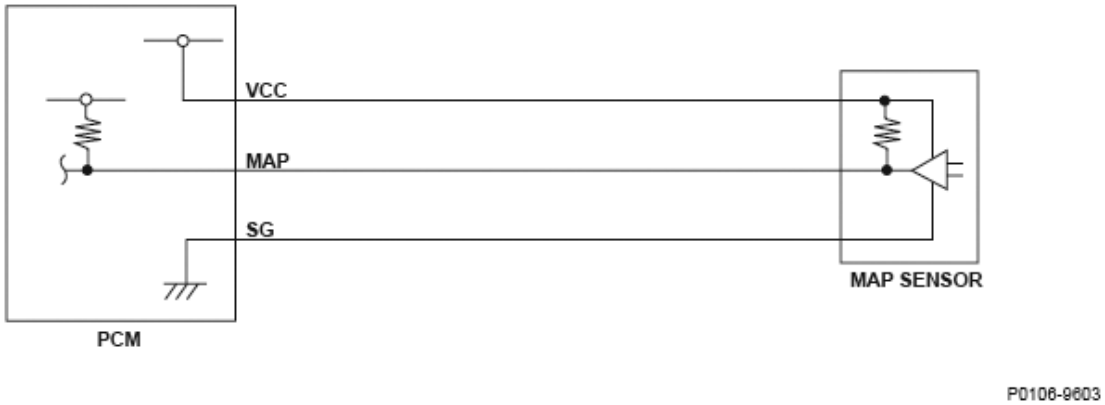



**Fig. 3: Manifold Absolute Pressure (MAP) Sensor Circuit Diagram**

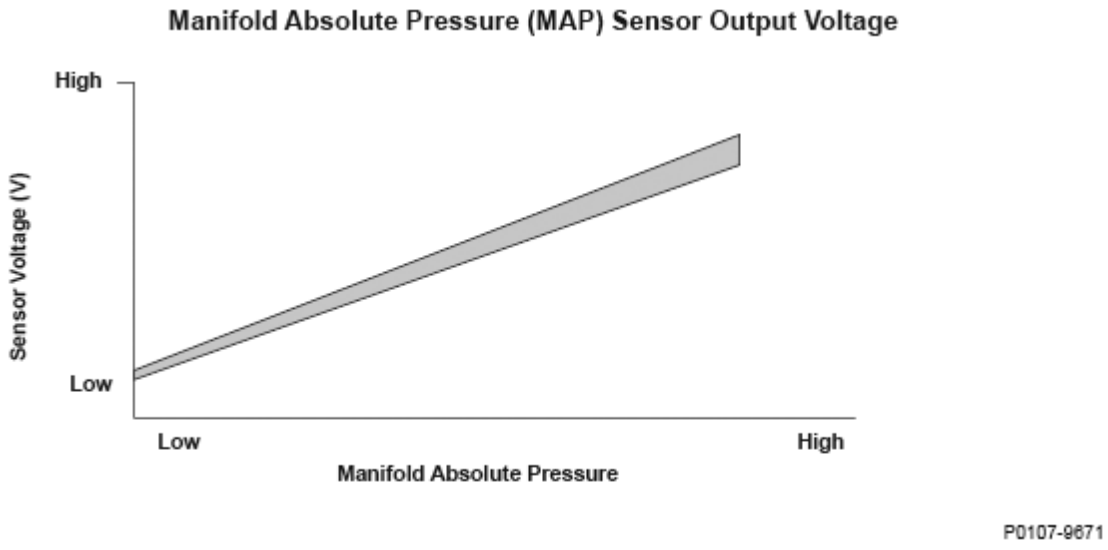



**Fig. 4: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph**

**General Description**

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open).

If a signal voltage from the MAP sensor is a set value or less, the powertrain control module (PCM) detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0108 |

**Malfunction Threshold**

The MAP sensor output voltage is 0.23 V or less for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0108 (3): ADVANCED DIAGNOSTICS

## DTC P0108: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT HIGH VOLTAGE

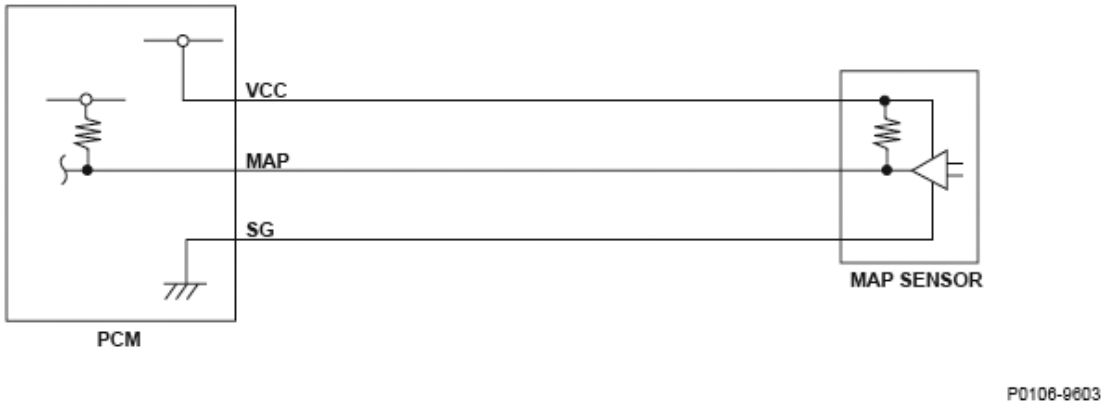



**Fig. 5: Manifold Absolute Pressure (MAP) Sensor Circuit Diagram**

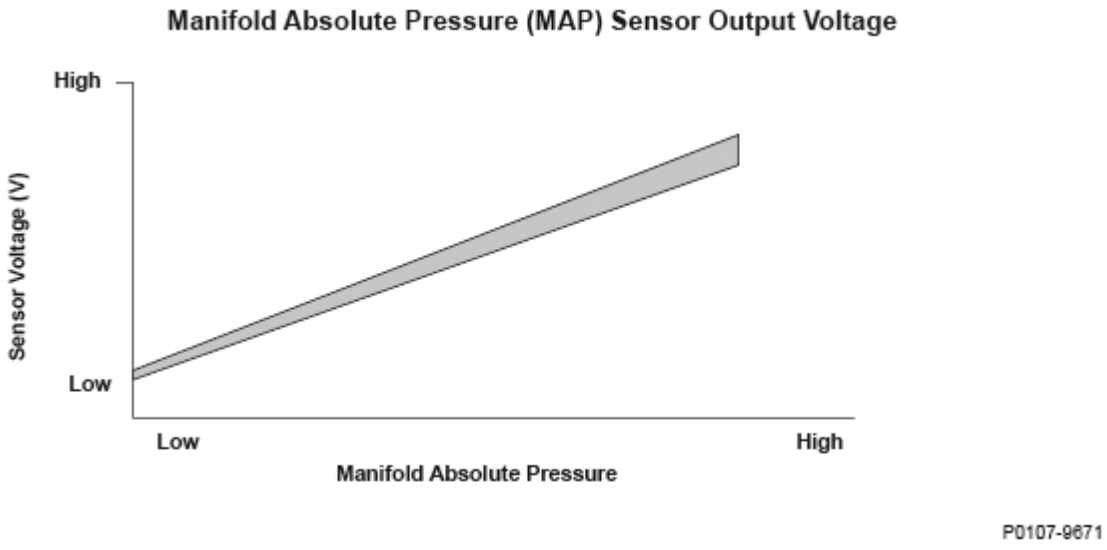



**Fig. 6: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph**

**General Description**

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open). If a signal voltage from the MAP sensor is a set value or more, the powertrain control module (PCM) detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0107 |

**Malfunction Threshold**

The MAP sensor output voltage is 4.49 V or more for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0111 (10): ADVANCED DIAGNOSTICS

## DTC P0111: INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

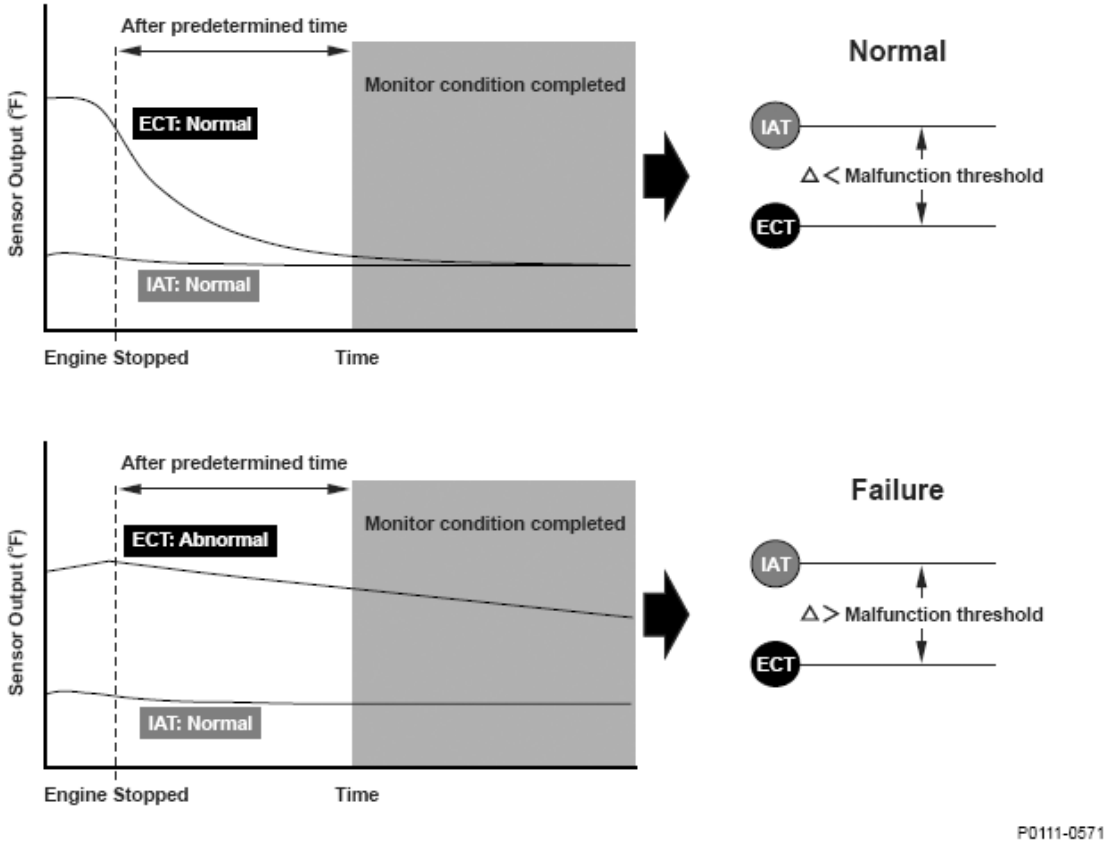



**Fig. 7: Intake Air Temperature Sensor Graph**

**General Description**

Two engine coolant temperature sensors and one intake air temperature sensor are used by the powertrain

control module (PCM).

When the engine is stopped and enough time has passed, the temperature of the engine will equal the ambient temperature.

When an inappropriate temperature is detected after comparing the temperature readings of each sensor, a malfunction in the corresponding sensor is detected and a DTC is stored.

#### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

#### Enable Conditions

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine off time | 6 hours | - |
| No active DTCs | P0112, P0113, P0116, P0117, P0118, P0125, P1116, P2610 | |

#### Malfunction Threshold

A malfunction is detected if the temperature difference (IAT minus ECT) is 52°F (29°C) or more after the engine and the ignition switch have been off for at least 6 hours.

#### Driving Pattern

1. Turn the ignition off, and wait at least 6 hours.
2. Start the engine, and let it idle for at least 10 seconds.

#### Diagnosis Details

##### Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

##### Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0112 (10): ADVANCED DIAGNOSTICS

### DTC P0112: INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT LOW VOLTAGE


**Fig. 8: Intake Air Temperature (IAT) Sensor Circuit Diagram**

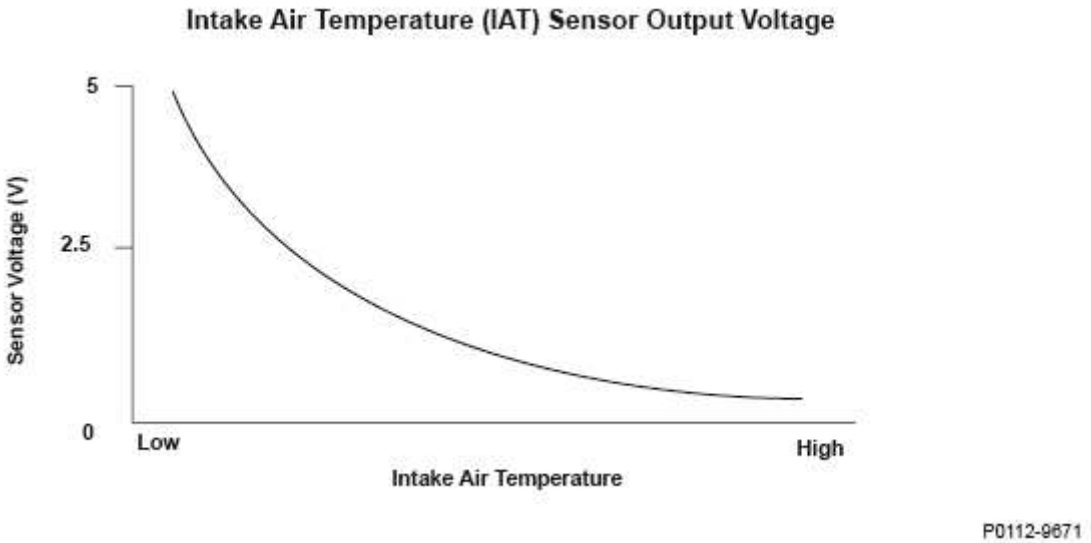



**Fig. 9: Intake Air Temperature (IAT) Sensor Output Voltage - Graph**

#### General Description

The intake air temperature (IAT) sensor is a thermistor that detects intake air temperature, and it is used for A/F feedback control to compensate for the atmospheric density fluctuations that accompany changes in intake air temperature.

The IAT sensor resistance varies depending on temperature. The output voltage and the sensor resistance increase as the intake air temperature decreases. Conversely, the output voltage and the sensor resistance decrease as the intake air temperature increases. If the IAT sensor output voltage is excessively low, the powertrain control module (PCM) detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

### MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

### ENABLE CONDITIONS

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0113 |

**Malfunction Threshold**

The IAT sensor output voltage is 0.08 V or less for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0113 (10): ADVANCED DIAGNOSTICS

### DTC P0113: INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT HIGH VOLTAGE

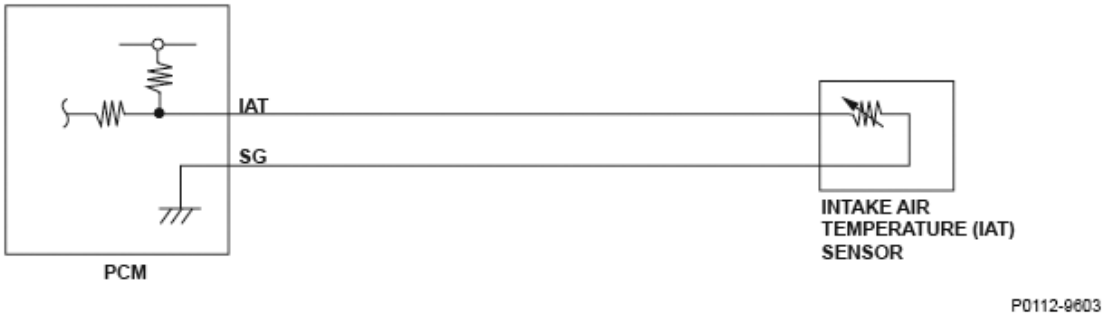



**Fig. 10: Intake Air Temperature (IAT) Sensor Circuit Diagram**

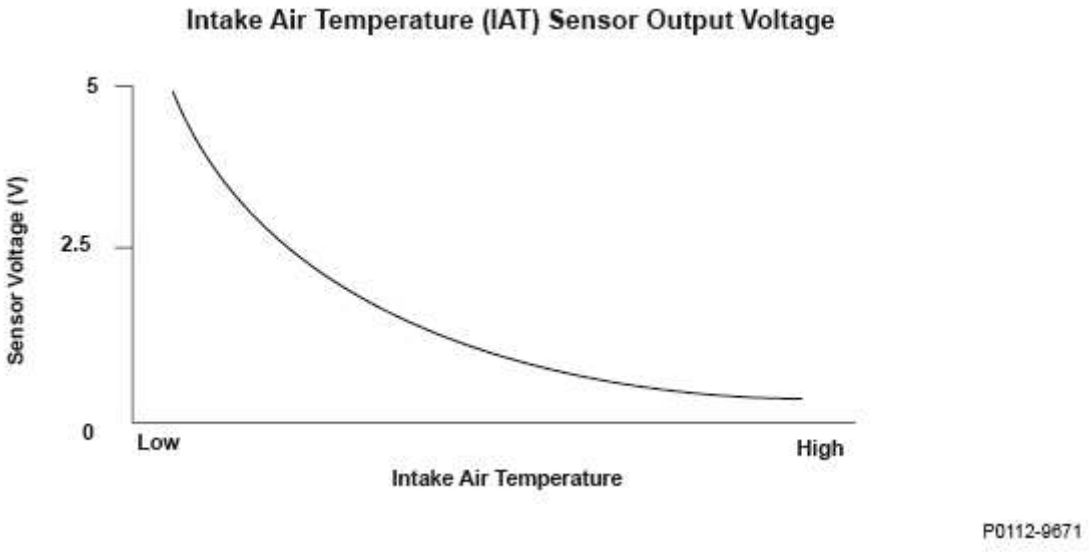



**Fig. 11: Intake Air Temperature (IAT) Sensor Output Voltage - Graph**

**General Description**

The intake air temperature (IAT) sensor is a thermistor that detects intake air temperature, and it is used for A/F feedback control to compensate for the atmospheric density fluctuations that accompany changes in intake air temperature.

The IAT sensor resistance varies depending on temperature. The output voltage and the sensor resistance increase as the intake air temperature decreases. Conversely, the output voltage and the sensor resistance decrease as the intake air temperature increases. If the IAT sensor output voltage is excessively high, the powertrain control module (PCM) detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |

| | |
|---|---|
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0112 |

**Malfunction Threshold**

The IAT sensor output voltage is 4.92 V or more for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0116 (86): ADVANCED DIAGNOSTICS

**DTC P0116: ENGINE COOLANT TEMPERATURE (ECT) SENSOR RANGE/PERFORMANCE PROBLEM**

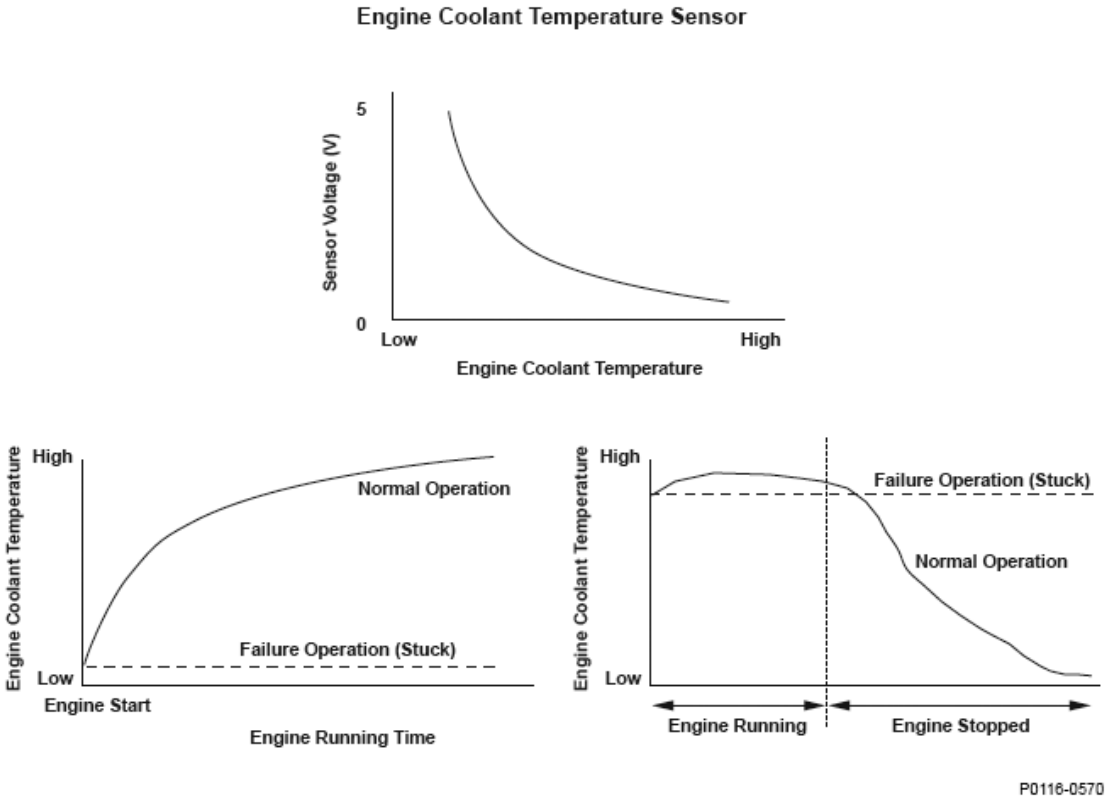



**Fig. 12: Engine Coolant Temperature - Graph**

**General Description**

The powertrain control module (PCM) supplies voltage to the engine coolant temperature (ECT) signal circuit (about 5 V) through a pull-up resistor. As the engine coolant cools, ECT sensor resistance increases, and the PCM detects a high signal voltage. As the engine coolant warms, ECT sensor resistance decreases, and the PCM detects a low signal voltage.

If the ECT output voltage after driving a set time after starting the engine does not reach a set temperature, or when the difference between the ECT output voltage when driving and the output voltage of the ECT after the engine is stopped a set time does not change a certain amount, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 10 minutes or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time after starting the engine | 10 seconds | - |
| Fuel feedback | Other than during fuel cut-off operation | |
| No active DTCs | P0107, P0108, P0117, P0118, P0134, P0135, P0154, P0155, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0506, P0507, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1172, P1174, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2413, P2610, P2627, P2628, P2630, P2631, P2646, P2647, P2648, P2649 | |
| Others | With a completely cooled engine (one that has been off for at least 6 hours): Judgment is made after the engine has been run for at least 10 minutes, turned off for at least 10 seconds, then started and run again for at least 10 seconds. | |
| | With a partially cooled engine (one that has been off for less than 6 hours): Judgment is made after the engine has been run for at least 10 minutes, turned off for at least 150 minutes then started and run again for at least 10 seconds. | |

**Malfunction Threshold**

Malfunction determination 1:

With a completely cooled engine (one that has been off for at least 6 hours):

When the change in coolant temperature after 10 minutes or more of running time is 50°F (10°C) or less, a malfunction is detected.

Malfunction determination 2:

With a partially cooled engine (one that has been off for less than 6 hours):

When the difference between the coolant temperature after 10 minutes or more of running time minus the coolant temperature after the engine has been off for 150 minutes and then run for 10 seconds is 50°F (10°C) or less, a malfunction is detected.

**Driving Pattern**

- With a completely cooled engine (one that has been off for at least 6 hours).

1. Start the engine, and let it idle for at least 10 minutes.
2. Turn off the ignition for 10 seconds, then restart the engine and let it idle for at least 10 seconds.

- With a partially cooled engine (one that has been off for less than 6 hours).

1. Start the engine, and let it idle for at least 10 minutes.
2. Turn off the ignition for 150 minutes, then restart the engine and let it idle for at least 10 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0117 (6): ADVANCED DIAGNOSTICS

## DTC P0117: ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT LOW VOLTAGE


**Fig. 13: Engine Coolant Temperature (ECT) Sensor Circuit Diagram**

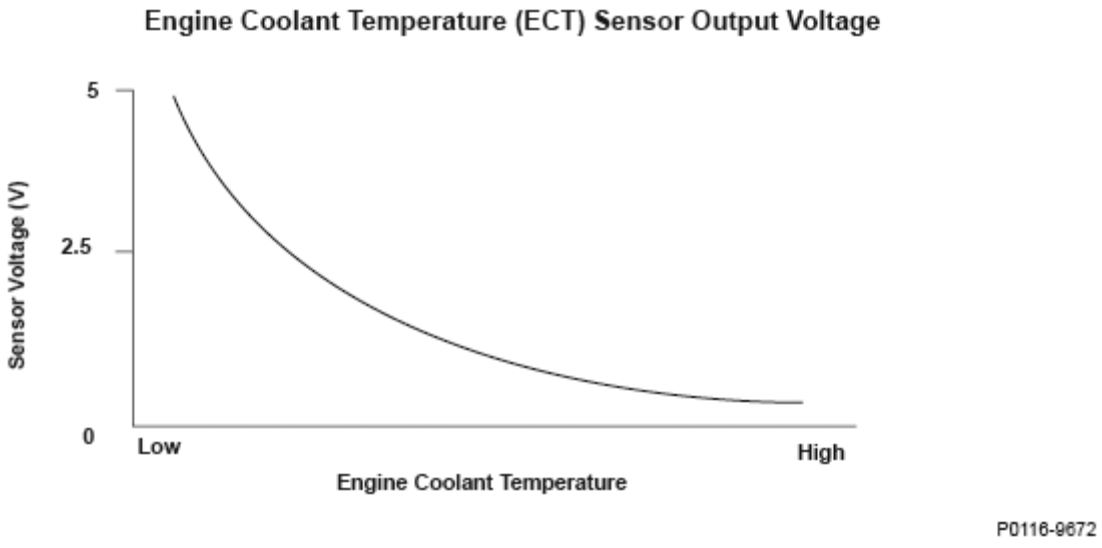



**Fig. 14: Engine Coolant Temperature (ECT) Sensor Output Voltage Graph**

**General Description**

The engine coolant temperature (ECT) sensor is used for air/fuel ratio feedback control, ignition timing control, idle speed control, and other functions. The ECT sensor resistance varies depending on the engine coolant temperature. As the engine coolant cools, the ECT sensor resistance increases, and the powertrain control module (PCM) detects a high signal voltage. As the engine coolant warms, the ECT sensor resistance decreases, and the PCM detects a low signal voltage. If the ECT sensor output voltage is less than a set value when the engine coolant temperature is high, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0118 |

**Malfunction Threshold**

The ECT sensor output voltage is 0.08 V or less for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0118 (6): ADVANCED DIAGNOSTICS

## DTC P0118: ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH VOLTAGE


**Fig. 15: Engine Coolant Temperature (ECT) Sensor Circuit Diagram**

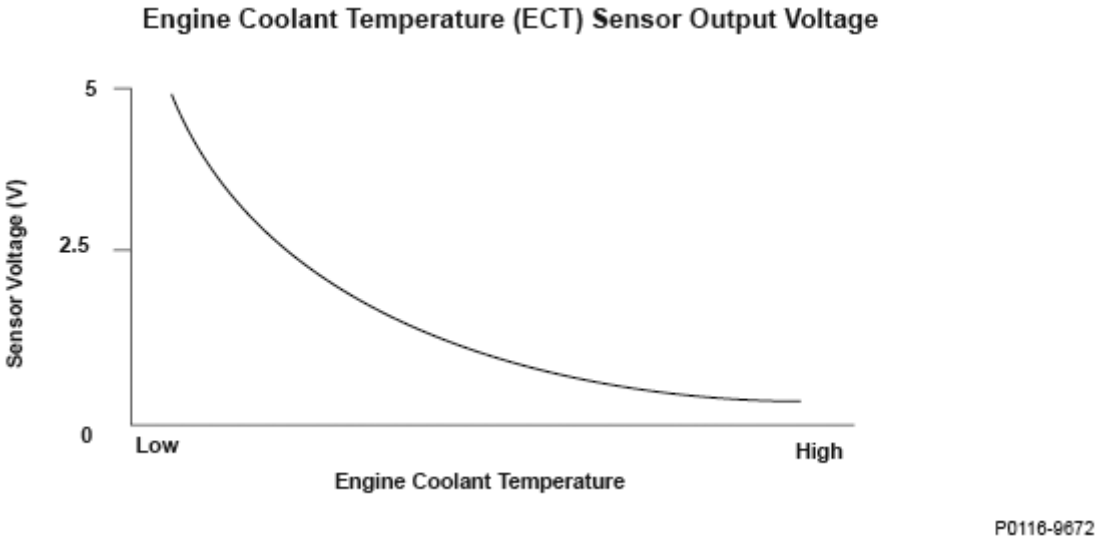



**Fig. 16: Engine Coolant Temperature (ECT) Sensor Output Voltage Graph**

**General Description**

The engine coolant temperature (ECT) sensor is used for air/fuel ratio feedback control, ignition timing control, idle speed control, and other functions. The ECT sensor resistance varies depending on the engine coolant temperature. As the engine coolant cools, the ECT sensor resistance increases, and the powertrain control module (PCM) detects a high signal voltage. As the engine coolant warms, the ECT sensor resistance decreases, and the PCM detects a low signal voltage. If the ECT sensor output voltage is more than a set value when the engine coolant temperature is low, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0117 |

**Malfunction Threshold**

The ECT sensor output voltage is 4.92 V or more for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0122 (7): ADVANCED DIAGNOSTICS

## DTC P0122: THROTTLE POSITION (TP) SENSOR A CIRCUIT LOW VOLTAGE

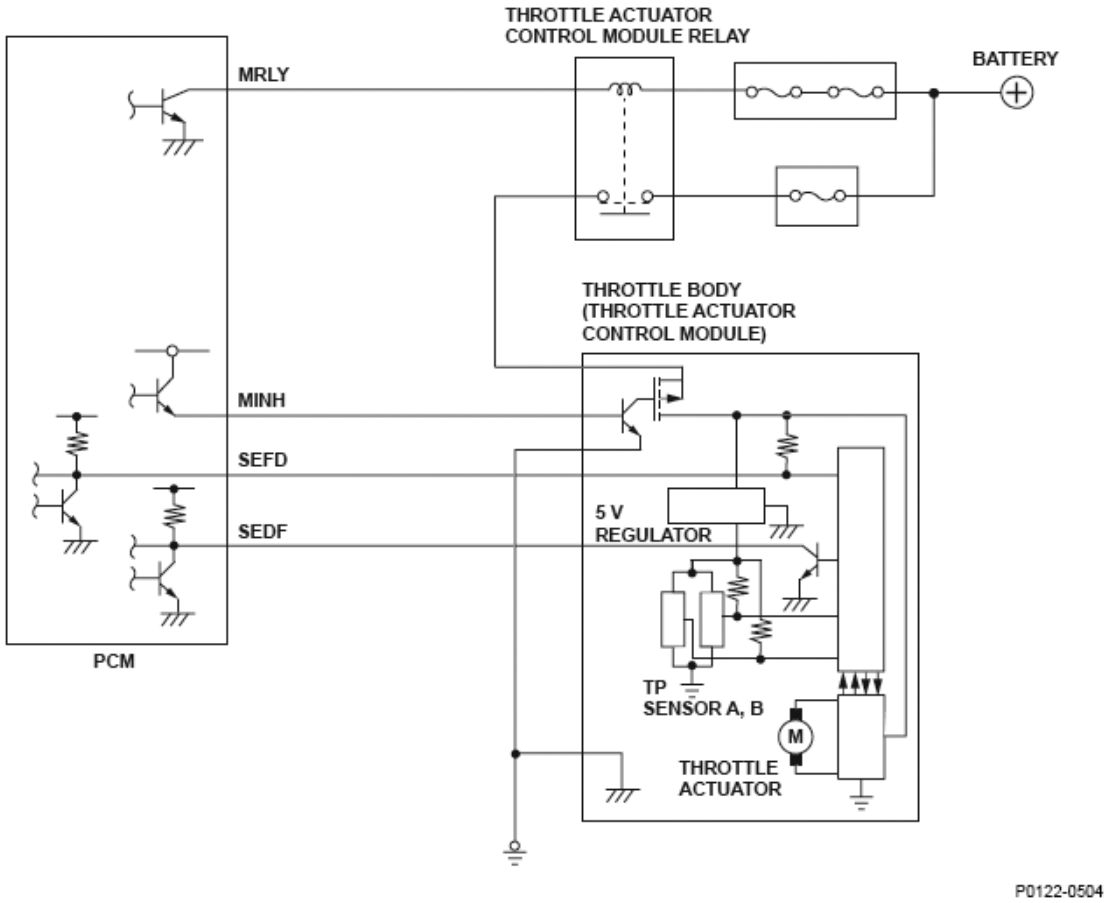



**Fig. 17: Throttle Position (TP) Sensor A Circuit Diagram**

**General Description**

Throttle position (TP) sensor A is a semiconductor type, and it is attached to the throttle body and shaft to determine throttle valve position.

The throttle valve position signal from TP sensor A is transmitted to the throttle actuator control module for target position feedback control, then to the powertrain control module (PCM) as an actual throttle valve position signal.

If the signal from TP sensor A is less than a fixed value for a set time, the throttle actuator control module detects a malfunction and sends the malfunction data to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects a TP sensor A malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |

| | |
|---|---|
| Sequence | None |
| Duration | 0.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0123, P2101, P2108, P2118, P2135, P2176, U0107 |

**Malfunction Threshold**

The TP sensor A output voltage is 0.3 V or less for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0123 (7): ADVANCED DIAGNOSTICS

## DTC P0123: THROTTLE POSITION (TP) SENSOR A CIRCUIT HIGH VOLTAGE

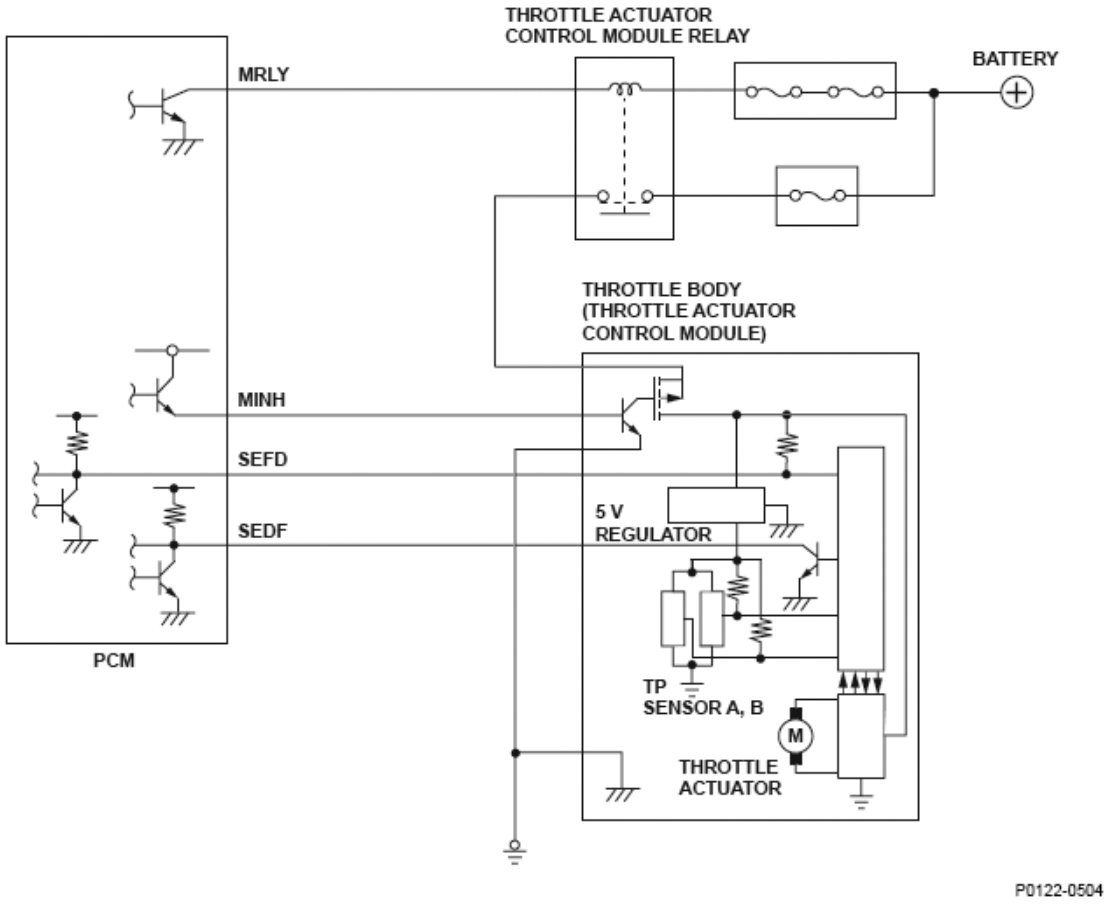



**Fig. 18: Throttle Position (TP) Sensor A Circuit Diagram**

**General Description**

Throttle position (TP) sensor A is a semiconductor type, and it is attached to the throttle body and shaft to determine throttle valve position.

The throttle valve position signal from TP sensor A is transmitted to the throttle actuator control module for target position feedback control, then to the powertrain control module (PCM) as an actual throttle valve position signal.

If the signal from TP sensor A is more than a fixed value for a set time, the throttle actuator control module detects a malfunction and sends the malfunction data to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects a TP sensor A malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |

| | |
|---|---|
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0122, P2101, P2108, P2118, P2135, P2176, U0107 |

**Malfunction Threshold**

The TP sensor A output voltage is 4.8 V or more for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0125 (86): ADVANCED DIAGNOSTICS

## DTC P0125: ENGINE COOLANT TEMPERATURE (ECT) SENSOR MALFUNCTION/SLOW RESPONSE

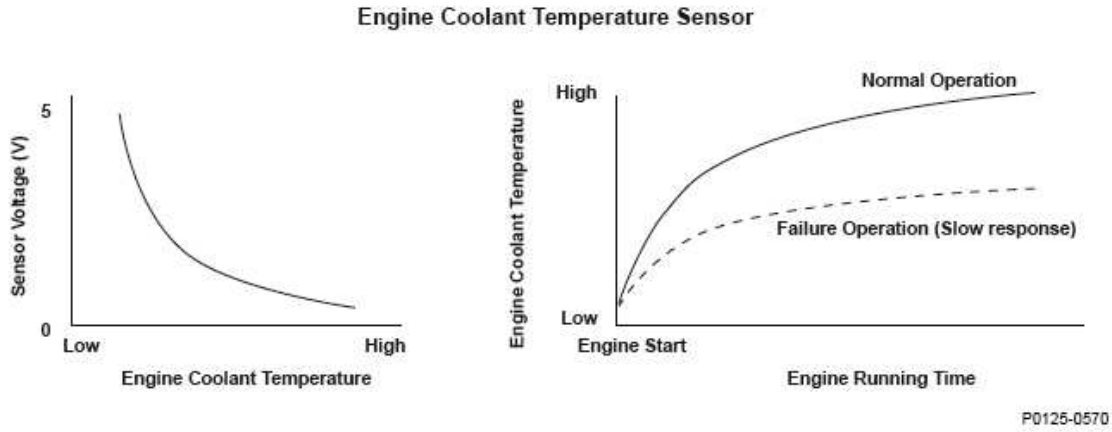



**Fig. 19: Engine Coolant Temperature (ECT) Sensor - Graph**

**General Description**

The powertrain control module (PCM) supplies voltage to the engine coolant temperature (ECT) signal circuit (about 5 V) through a pull-up resistor. As the engine coolant cools, the ECT sensor resistance increases, and the PCM detects a high signal voltage. As the engine coolant warms, the ECT sensor resistance decreases, and the PCM detects a low signal voltage.

If the ECT output voltage does not reach a specified temperature at which closed-loop control for stoichiometric air/fuel ratio starts within a set time, depending on the initial coolant temperature after starting the engine, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 20 minutes or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Initial engine coolant temperature | - | 10°F (-12°C) |
| Fuel feedback | Other than during fuel cut-off operation | |
| | P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0134, P0135, P0154, P0155, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, | |

| | |
|---|---|
| No active DTCs | P0403, P0404, P0443, P0496, P0506, P0507, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1172, P1174, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2413, P2627, P2628, P2630, P2631, P2646, P2647, P2648, P2649 |

**Malfunction Threshold**

The engine running time before the engine coolant temperature reaches 10°F (-12°C), based on the initial engine coolant temperatures, is as follows.

**MALFUNCTION THRESHOLD**

| | | |
|---|---|---|
| Initial engine coolant temperature | -24°F (-31°C) | 10°F (-12°C) |
| Engine running time | 300 seconds or more | 60 seconds or more |

**Driving Pattern**

1. Start the engine at an initial engine coolant temperature as specified under Enable Conditions.
2. Let the engine idle for at least 20 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0128 (87): ADVANCED DIAGNOSTICS

## DTC P0128: COOLING SYSTEM MALFUNCTION

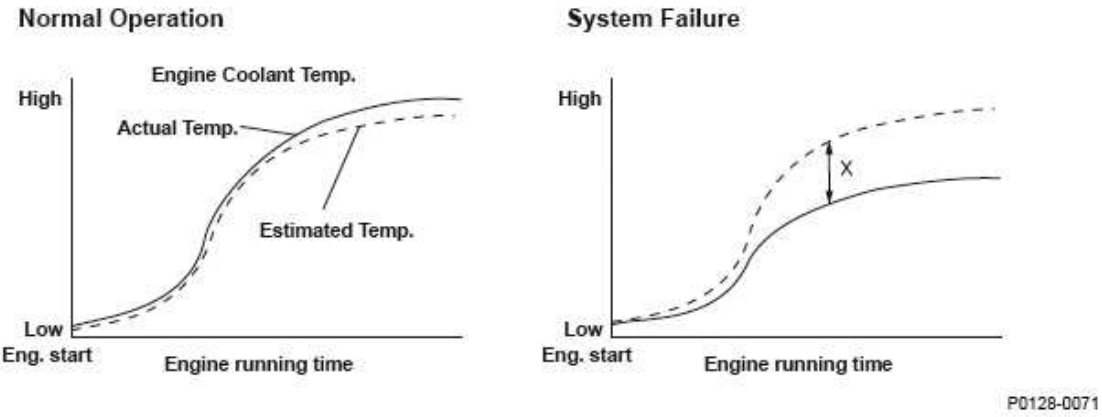



**Fig. 20: Cooling System Malfunction Operation Graph**

**General Description**

The thermostat is closed when the engine coolant temperature is low, and it stops the circulation of engine coolant to speed engine warm up. When the engine coolant temperature increases, the thermostat opens and circulates engine coolant to control its temperature. When the engine coolant temperature decreases, the opening area of the thermostat is reduced to regulate the engine coolant temperature. If the thermostat sticks open, engine warm up is delayed, and exhaust emissions are adversely affected. The powertrain control module (PCM) estimates the engine coolant temperature after starting the engine from the initial engine coolant temperature and driving conditions, and compares it with the actual engine coolant temperature that is detected by the engine coolant temperature (ECT) sensor.

If the actual engine coolant temperature is below the estimated engine coolant temperature (when X shown in the graph is large), a thermostat malfunction is detected and a DTC is stored.

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | Depending on driving conditions |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Initial engine coolant temperature | 20°F (-7°C) | 123°F (50°C) |
| Initial intake air temperature | 20°F (-7°C) | 123°F (50°C) |
| The difference | | |

| | | |
|---|---|---|
| between initial engine coolant temperature and initial intake air temperature | - | 10°F (6°C) |
| The difference between intake air temperature and initial intake air temperature | - | 3°F (2°C) |
| The difference between engine coolant temperature and max engine coolant temperature(1) | 4°F (2°C) | - |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0122, P0123, P0125, P0134, P0135, P0154, P0155, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0506, P0507, P0627, P0641, P0657, P1077, P1078, P1109, P1116, P1128, P1129, P1172, P1174, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2413, P2610, P2627, P2628, P2630, P2631, P2646, P2647, P2648, P2649, U0107 | |
| Other | Test-drive on a flat road | |
| (1) Engine speed is 5,000 rpm or more. | | |

**Malfunction Threshold**

- The ECT sensor output is 158°F (70°C) or less when the estimated engine coolant temperature is 167°F (75°C) or more.
- The difference between the estimated engine coolant temperature and the ECT sensor output is 18°F (10° C) or more.

**Confirmation Procedure with the HDS**

Do the RADIATOR FAN TEST in the INSPECTION MENU with the HDS for 20 minutes.

**Driving Pattern**

1. Start the engine at an engine coolant temperature and intake air temperature as specified under Enable Conditions.
2. Drive the vehicle at a speed between 15 - 75 mph (24 - 120 km/h) for at least 10 minutes.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0133 (157): ADVANCED DIAGNOSTICS

## DTC P0133: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) SLOW RESPONSE

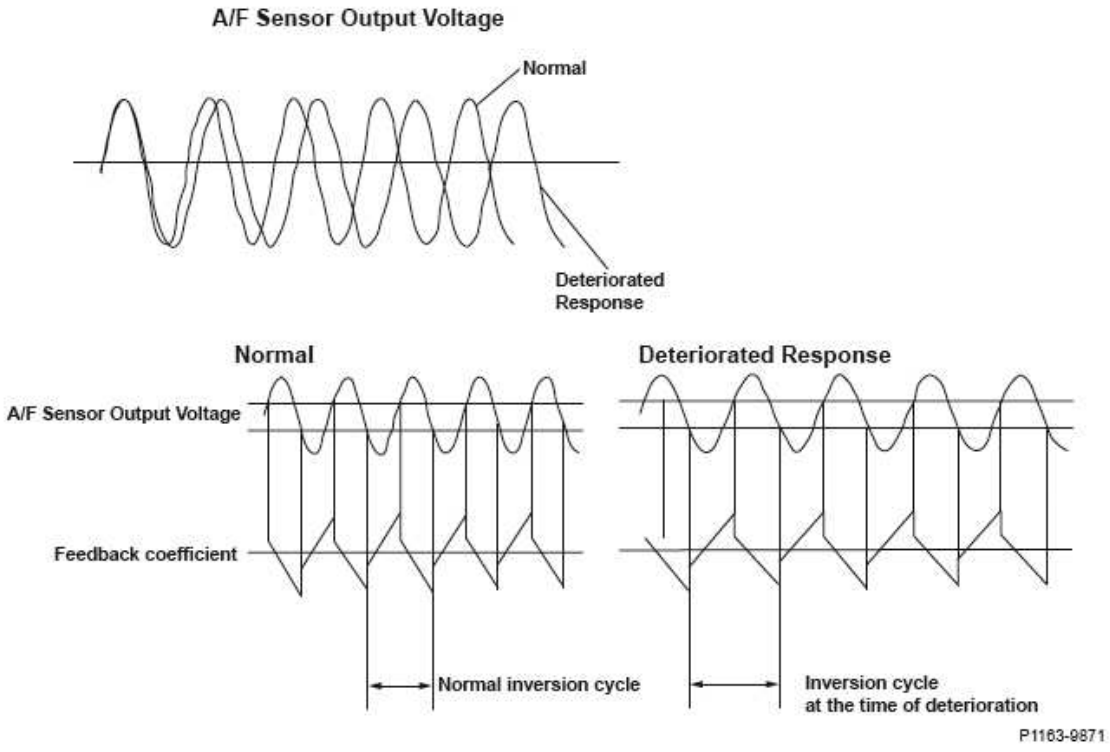



**Fig. 21: Identifying A/F Sensor Output Voltage**

**General Description**

The rear air/fuel ratio (A/F) sensor has a linear signal output in relation to the oxygen concentration. The powertrain control module (PCM) computes the rear air/fuel ratio from rear A/F sensor output voltage and uses fuel feedback control to improve exhaust emissions. The PCM measures the inversion cycle of the rear A/F sensor output voltage during closed loop control of the stoichiometric ratio, detects a deteriorated response, and stores a DTC if the inversion cycle has extended to a specified time or more.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 14.5 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | | Minimum | Maximum |
|---|---|---|---|
| Engine coolant temperature | | 156°F (69°C) | - |
| Intake air temperature | | 0°F (-18°C) | - |
| Engine speed | | 1,100 rpm | 2,100 rpm |
| MAP value | 1,200 rpm | 34 kPa (9.9 in.Hg, 250 mmHg) | 86 kPa (25.5 in.Hg, 650 mmHg) |
| | 1,800 rpm | 27 kPa (7.9 in.Hg, 200 mmHg) | |
| Vehicle speed | | 30 mph (48 km/h) | - |
| Fuel trim | | 0.73 | 1.47 |
| Fuel feedback | | Closed loop at stoichiometric | |
| Monitoring priority | | P0456, P0457, P0497 | |
| No active DTCs | | P0107, P0108, P0112, P0113, P0117, P0118, P0134, P0135, P0171, P0172, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1172, P2195, P2227, P2228, P2229, P2237, P2238, P2243, P2245, P2251, P2252, P2413, P2627, P2628, P2646, P2647, P2648, P2649, P2A00 | |

**Malfunction Threshold**

The rear A/F sensor (bank 1, sensor 1) inversion cycle is 2.2 seconds or more.

**Driving Pattern**

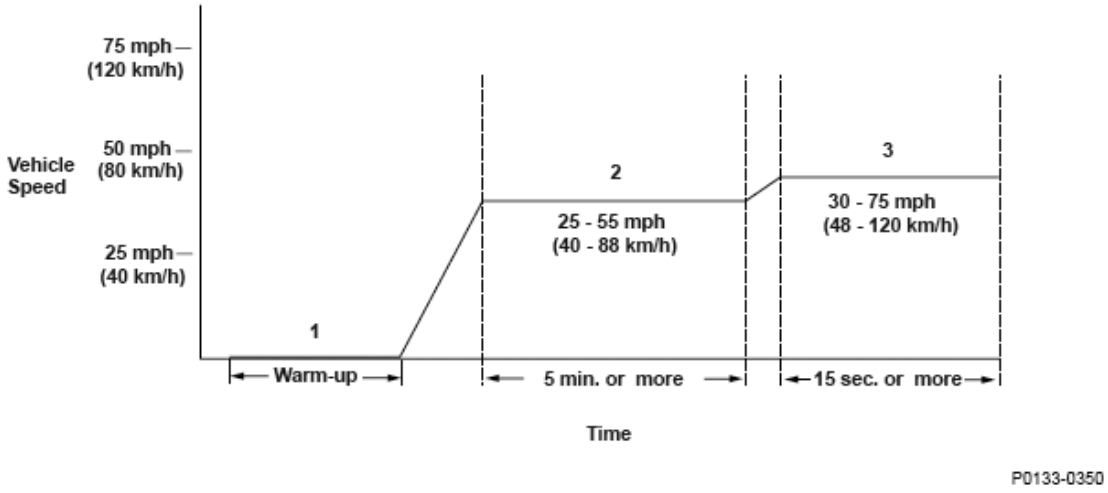



**Fig. 22: Vehicle Speed Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
3. Then, drive immediately at a steady speed between 30 - 75 mph (48 - 120 km/h) for at least 15 seconds.

- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0134 (151): ADVANCED DIAGNOSTICS

### DTC P0134: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) HEATER SYSTEM MALFUNCTION

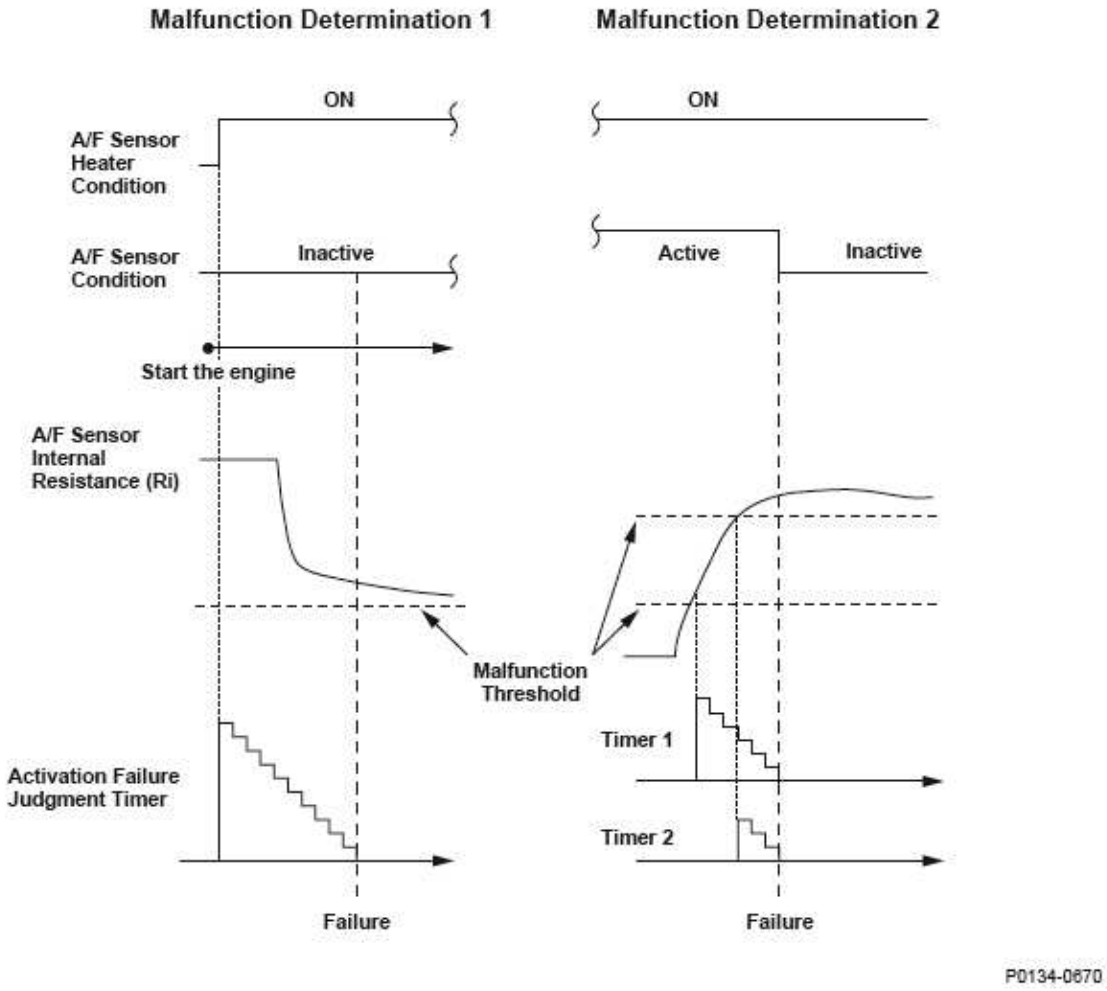



**Fig. 23: Air/Fuel Ratio (A/F) Sensor (Sensor 1) Heater System Diagram**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is activated by warming the element with the heater any by maintaining it at a steady high temperature to accurately calculate the air/fuel (A/F) ratio. The rear A/F sensor does not become active when the element is not properly heated due to a heater malfunction, and the exhaust emissions deteriorate. The powertrain control module (PCM) monitors the rear A/F sensor internal resistance.

1. When the rear A/F sensor does not activate within a set time after the rear A/F sensor heater starts to warm up (with high rear A/F sensor internal resistance), a malfunction of the rear A/F sensor heater is detected, and a DTC is stored.
2. When the rear A/F sensor heater cycles ON and OFF within a set time, and the resistance remains high when the heater is ON, a malfunction in the rear A/F sensor heater is detected, and a DTC is stored.

   Because the effect engine control differs according to the rear A/F sensor internal resistance, there are two types of malfunction detection threshold levels. When either one is reached, a malfunction is detected.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 40 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |
| Fuel feedback | Other than during fuel cut-off operation | |
| No active DTCs | P0135, P0657, P1172, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2627, P2628 | |

**Malfunction Threshold**

Malfunction determination 1:

The rear A/F sensor (bank 1, sensor 1) internal resistance value is 110 ohms or more for at least 40 seconds right after the engine starts.

Malfunction determination 2:

- The rear A/F sensor (bank 1, sensor 1) internal resistance value is 110 ohms is more for at least 15 seconds.
- The rear A/F sensor (bank 1, sensor 1) internal resistance value is 200 ohms or more for at least 1 seconds.

**Driving Pattern**

Start the engine, then let it idle for at least 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0135 (151): ADVANCED DIAGNOSTICS

### DTC P0135: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) HEATER CIRCUIT MALFUNCTION

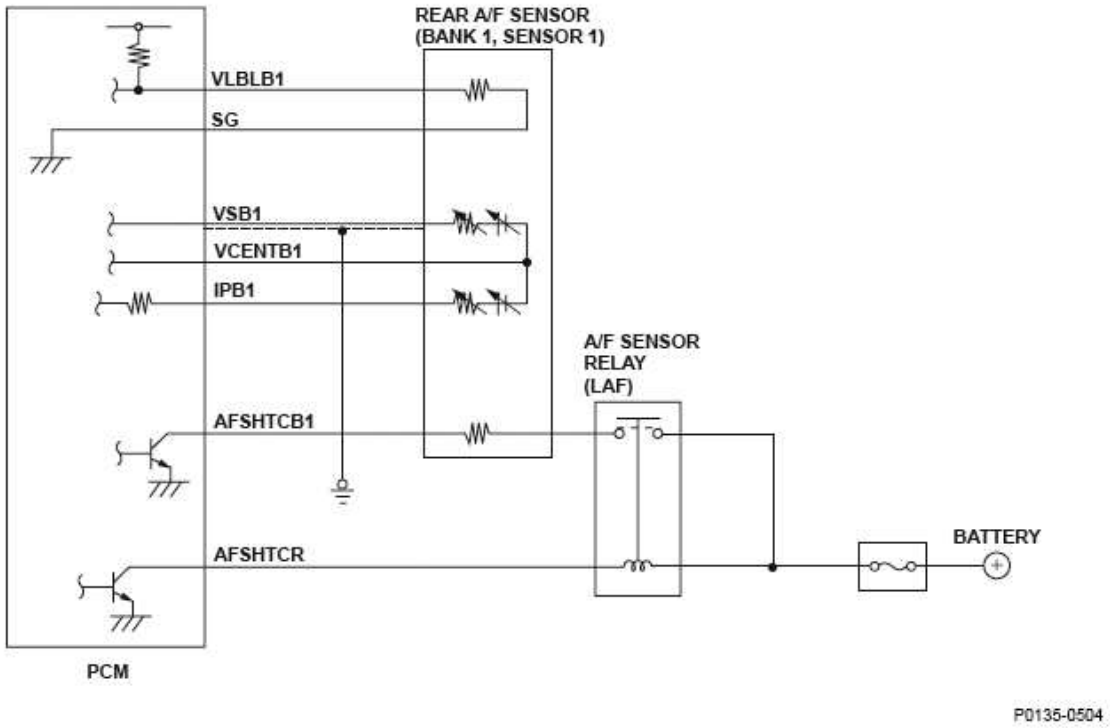



**Fig. 24: Rear Air/Fuel Ratio (A/F) Sensor Heater Circuit Diagram**

**General Description**

A heater for the zirconia element is embedded in the rear air/fuel ratio (A/F) sensor (bank 1, sensor 1), and it is controlled by the powertrain control module (PCM). When activated, it heats the sensor to stabilize and speed up the detection of oxygen content when the exhaust gas temperature is cold.

The PCM reads the return signal against the rear A/F sensor (bank 1, sensor 1) drive signal.

When the drive signal and the return signal do not match, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 9.0 V | - |
| State of the engine | Running | |

**Malfunction Threshold**

One of these conditions continues for at least 1 second.

- The return signal is OFF when the PCM outputs the ON signal to the rear A/F sensor (bank 1, sensor 1).
- The return signal is ON when the PCM outputs the OFF signal to the rear A/F sensor (bank 1, sensor 1).

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0137 (161): ADVANCED DIAGNOSTICS

### DTC P0137: REAR SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 1, SENSOR 2)) CIRCUIT LOW VOLTAGE

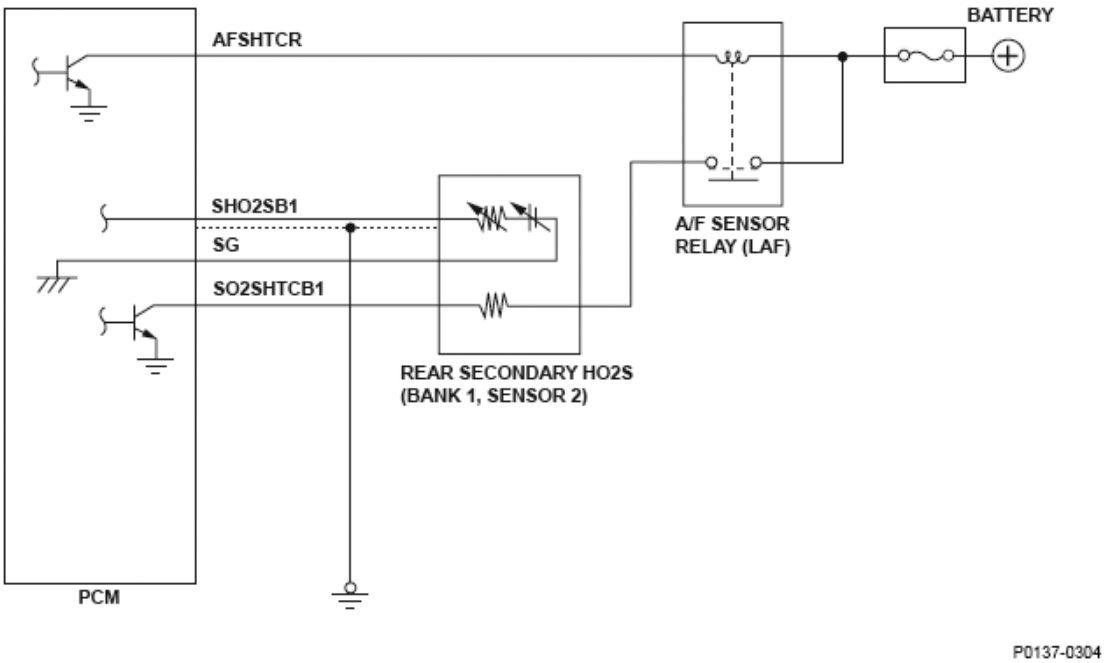



**Fig. 25: Rear Secondary Heated Oxygen Sensor Heater Circuit Diagram**

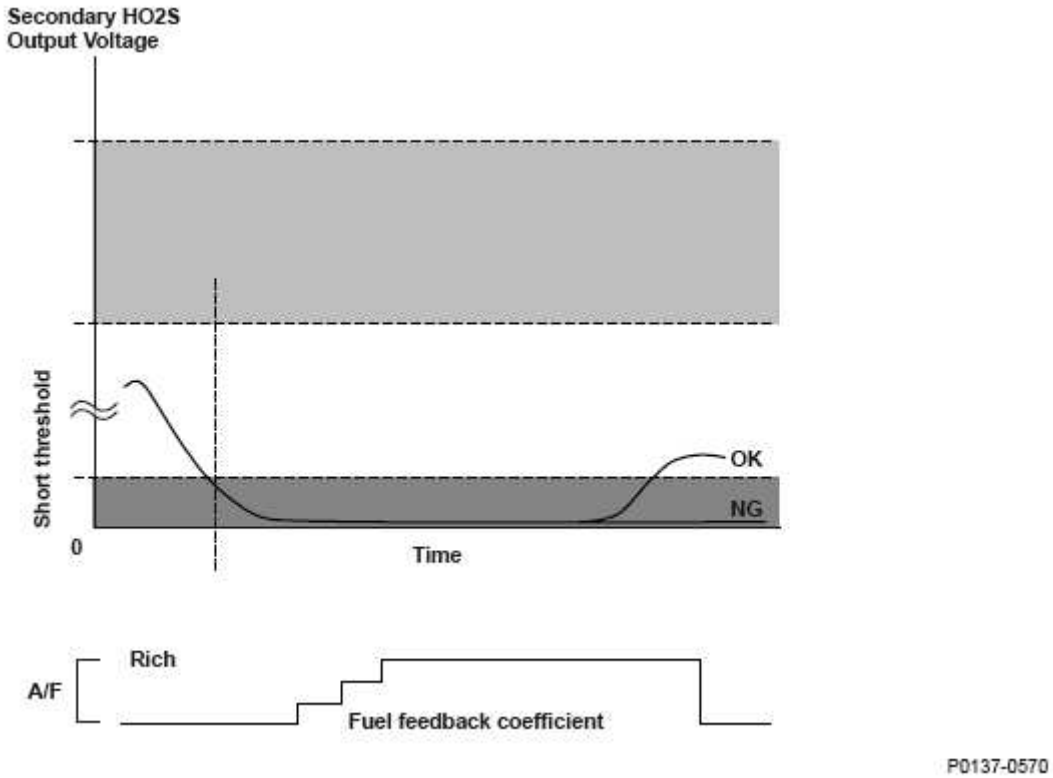



**Fig. 26: Secondary Heated Oxygen Sensor Output Voltage - Graph**

**General Description**

The rear secondary heated oxygen sensor (HO2S) (bank 1, sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control. The rear secondary HO2S controls the air/fuel ratio from the rear A/F sensor output voltage so that the TWC efficiency is optimized.

After current is applied to the rear secondary HO2S heater, if the rear secondary HO2S output continues low (lean) during feedback control, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 40 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S activity is not monitored after starting the engine | 20 seconds | - |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0133, P0134, P0135, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1172, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2413, P2627, P2628, P2646, P2647, P2648, P2649, P2A00 | |

**Malfunction Threshold**

The rear secondary HO2S output voltage is 0.293 V or less for at least 40 seconds.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.

2. Then, drive immediately at a steady engine speed between 1,500 - 3,000 rpm for at least 1 minute.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0138 (161): ADVANCED DIAGNOSTICS

## DTC P0138: REAR SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 1, SENSOR 2)) CIRCUIT HIGH VOLTAGE

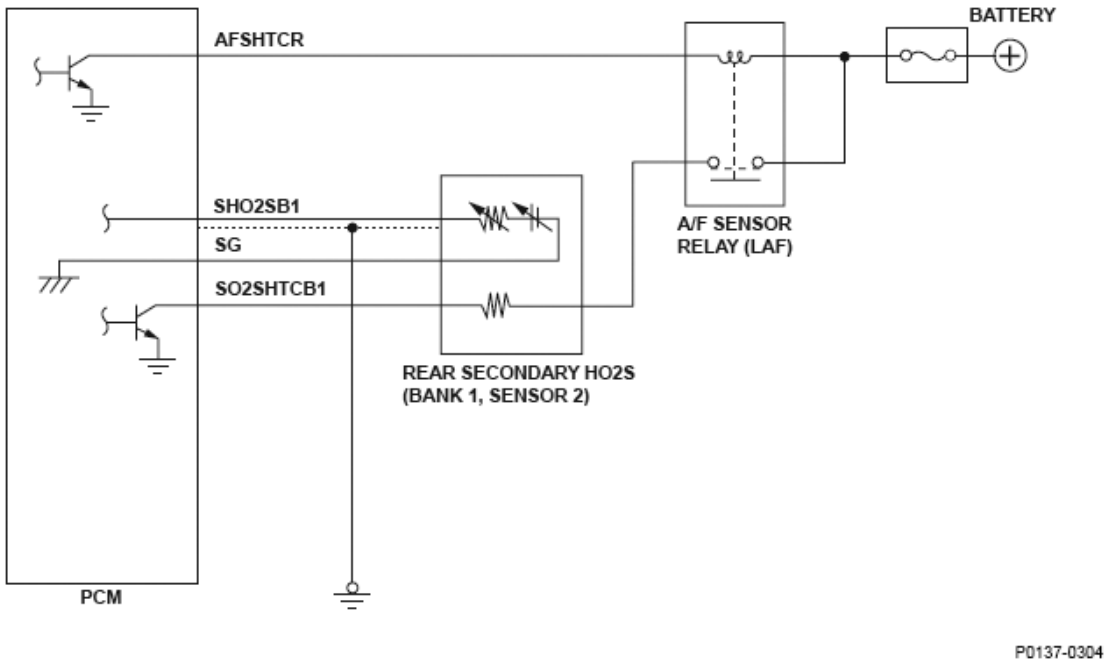



**Fig. 27: Rear Secondary Heated Oxygen Sensor Heater Circuit Diagram**

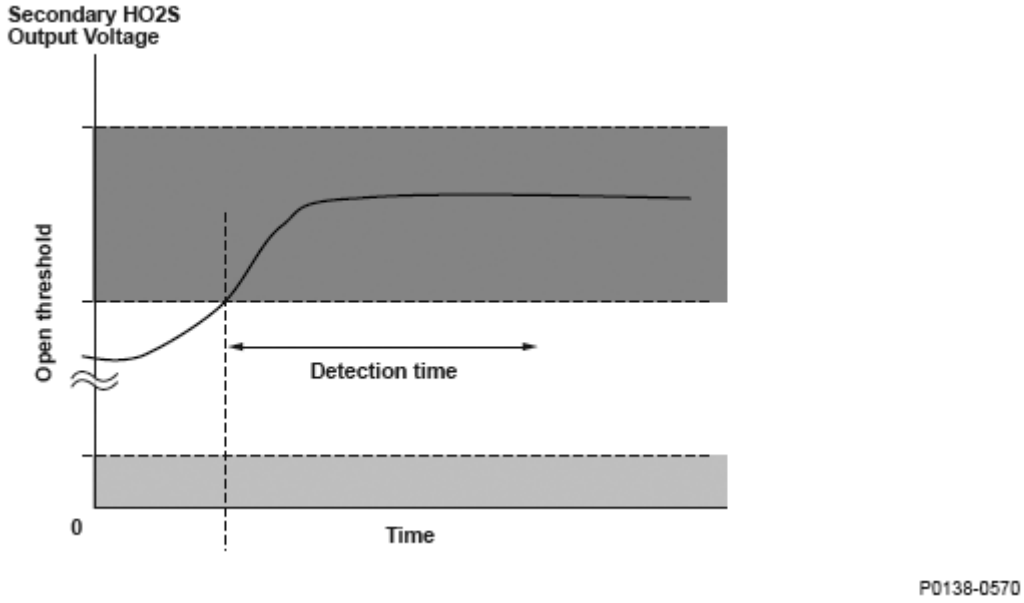



**Fig. 28: Secondary Heated Oxygen Sensor Output Voltage - Graph**

**General Description**

The rear secondary heated oxygen sensor (HO2S) (bank 1, sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control. The rear secondary HO2S controls the air/fuel ratio from the rear A/F sensor output voltage to optimize TWC efficiency.

After current is applied to the rear secondary HO2S heater, if the rear secondary HO2S output continues high (rich) exceeding the upper limit used during feedback control, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S activity is not | 20 seconds | - |

| | | |
|---|---|---|
| monitored after starting the engine | | |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0133, P0134, P0135, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1172, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2413, P2627, P2628, P2646, P2647, P2648, P2649, P2A00 | |

**Malfunction Threshold**

The rear secondary HO2S output voltage is 1.270 V or more for at least 5 seconds.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Then, drive immediately at a steady engine speed between 1,500 - 3,000 rpm for at least 1 minute.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0139 (161): ADVANCED DIAGNOSTICS

### DTC P0139: REAR SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 1, SENSOR 2)) CIRCUIT SLOW RESPONSE

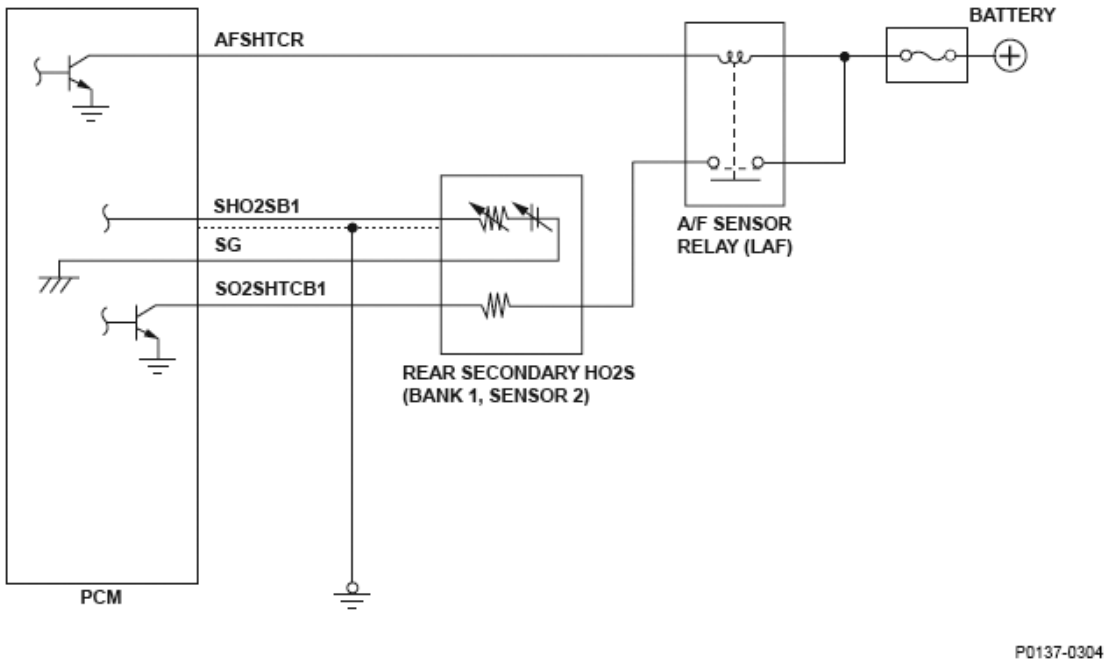



**Fig. 29: Rear Secondary Heated Oxygen Sensor Heater Circuit Diagram**

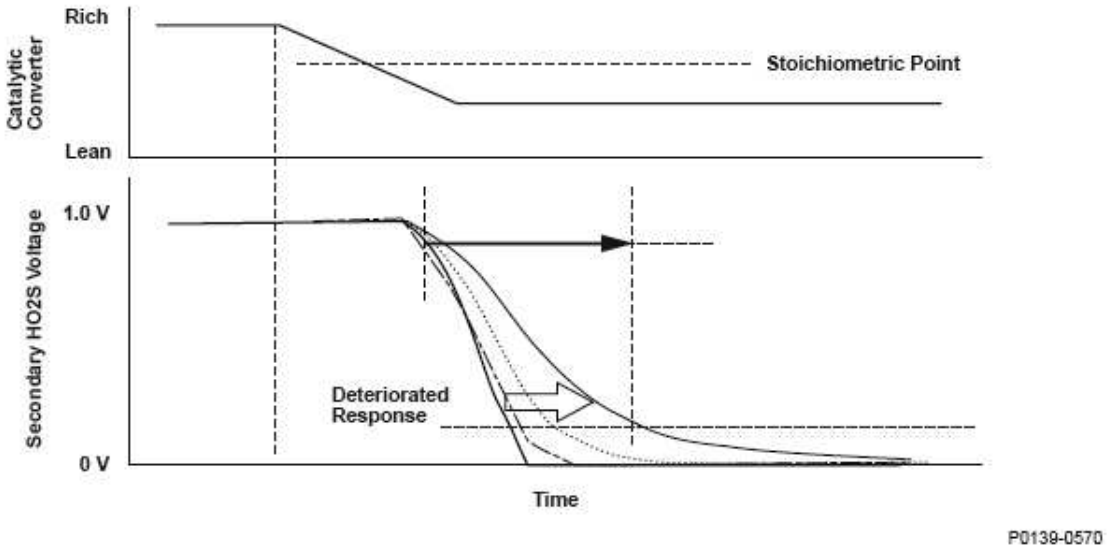



**Fig. 30: Secondary Heated Oxygen Sensor Output Voltage - Graph**

**General Description**

The rear secondary heated oxygen sensor (HO2S) (bank 1, sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control. The rear secondary HO2S controls the air/fuel ratio with the rear A/F sensor output voltage to optimize TWC efficiency.

If the response time of the rear secondary HO2S becomes longer than the specified time after current to the

secondary HO2S heater is applied, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 19 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S activity is not monitored after starting the engine | 20 seconds | - |
| Elapsed time after fuel cut-off | - | 150 seconds |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Engine speed | 1,150 rpm | 1,900 rpm |
| MAP value | 22 kPa (6.3 in.Hg, 160 mmHg) | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Vehicle speed | 30 mph (48 km/h) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0133, P0134, P0135, P0137, P0138, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1172, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2270, P2271, P2413, P2627, P2628, P2646, P2647, P2648, P2649, P2A00 | | |

**Malfunction Threshold**

1. When the rear secondary HO2S output drops to the response deterioration judgment threshold value and the response characteristics measurement is finished.

**MALFUNCTION THRESHOLD**

| | |
|---|---|
| MIN | 0.77 seconds |

| | |
|---|---|
| MAX | 4.35 seconds |

2. The voltage does not drop to the response deterioration judgment threshold value after a predetermined time (4.35 seconds) has elapsed.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Then, drive immediately at a steady speed of 35 mph (57 km/h) or more for at least 19 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0141 (163): ADVANCED DIAGNOSTICS

## DTC P0141: REAR SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S) (BANK 1, SENSOR 2) HEATER CIRCUIT MALFUNCTION

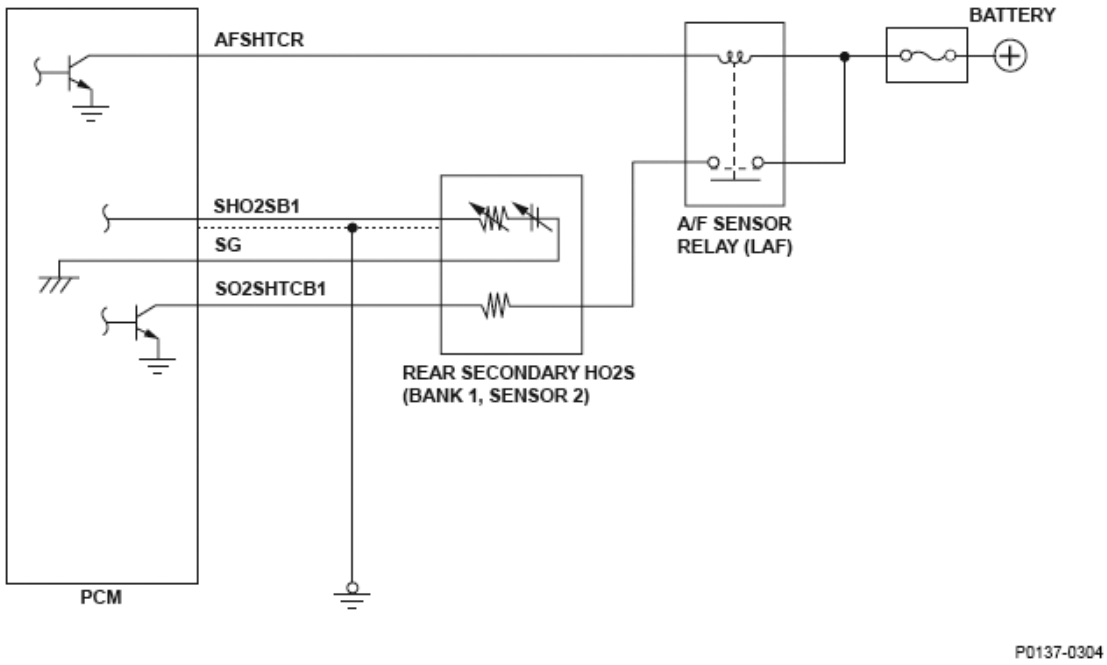



**Fig. 31: Rear Secondary Heated Oxygen Sensor Heater Circuit Diagram**

**General Description**

A heater for the zirconia element is embedded in the rear secondary heated oxygen sensor (rear secondary HO2S) (bank 1, sensor 2), and it is controlled by the powertrain control module (PCM). When activated, it heats the sensor to stabilize and speed up the detection of oxygen content when the exhaust gas temperature is cold.

If the rear secondary HO2S heater draws more or less than a specified amperage, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage (IGP terminal of PCM) | 10.5 V | 16 V |
| State of the engine | Running | |
| | | |

| | |
|---|---|
| No active DTCs | P0117, P0118 |

**Malfunction Threshold**

The rear secondary HO2S heater output is 0.38 A or less, or 3.33 A or more, for at least 5 seconds when the heater is on.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0153 (158): ADVANCED DIAGNOSTICS

## DTC P0153: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) SLOW RESPONSE

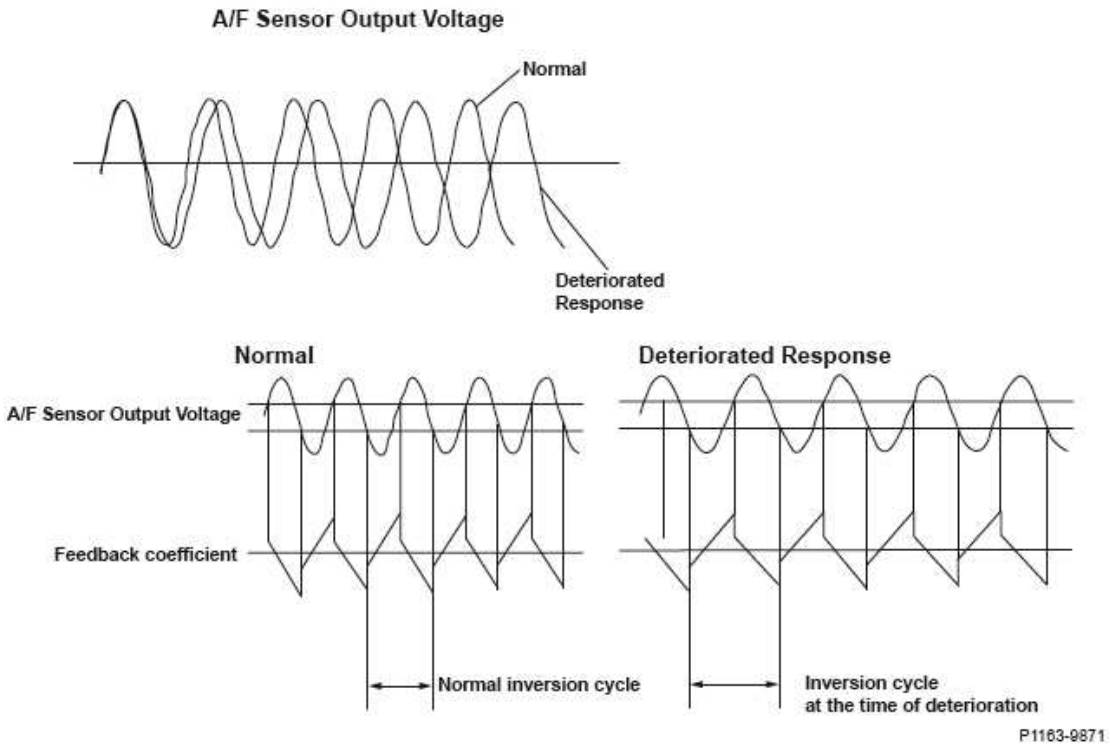



**Fig. 32: A/F Sensor Output Voltage Blinking Pattern**

**General Description**

The front air/fuel ratio (A/F) sensor has a linear signal output in relation to the oxygen concentration. The powertrain control module (PCM) computes the rear air/fuel ratio from the front A/F sensor output voltage and uses fuel feedback control to improve exhaust emissions. The PCM measures the inversion cycle of the front A/F sensor output voltage during closed loop control of the stoichiometric ratio, detects a deteriorated response, and stores a DTC if the inversion cycle has extended to a specified time or more.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 14.5 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine | | |

| | | | |
|---|---|---|---|
| coolant temperature | | 156°F (69°C) | - |
| Intake air temperature | | 0°F (-18°C) | - |
| Engine speed | | 1,100 rpm | 2,100 rpm |
| MAP value | 1,200 rpm | 34 kPa (9.9 in.Hg, 250 mmHg) | 86 kPa (25.5 in.Hg, 650 mmHg) |
| | 1,800 rpm | 27 kPa (7.9 in.Hg, 200 mmHg) | |
| Vehicle speed | | 30 mph (48 km/h) | - |
| Fuel trim | | 0.73 | 1.47 |
| Fuel feedback | | Closed loop at stoichiometric | |
| Monitoring priority | | P0456, P0457, P0497 | |
| No active DTCs | | P0107, P0108, P0112, P0113, P0117, P0118, P0154, P0155, P0174, P0175, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1174, P2197, P2227, P2228, P2229, P2240, P2241, P2247, P2249, P2254, P2255, P2413, P2630, P2631, P2646, P2647, P2648, P2649, P2A03 | |

**Malfunction Threshold**

The front A/F sensor (bank 2, sensor 1) inversion cycle is 2.2 seconds or more.

**Driving Pattern**

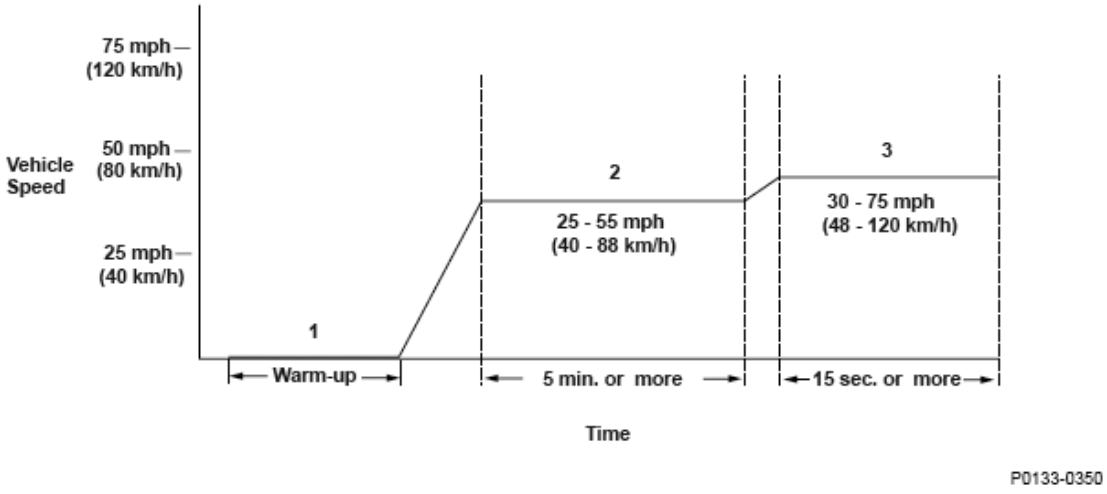



**Fig. 33: Vehicle Speed Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.

3. Then, drive immediately at a steady speed between 30 - 75 mph (48 - 120 km/h) for at least 15 seconds.

- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0154 (152): ADVANCED DIAGNOSTICS

### DTC P0154: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) HEATER SYSTEM MALFUNCTION

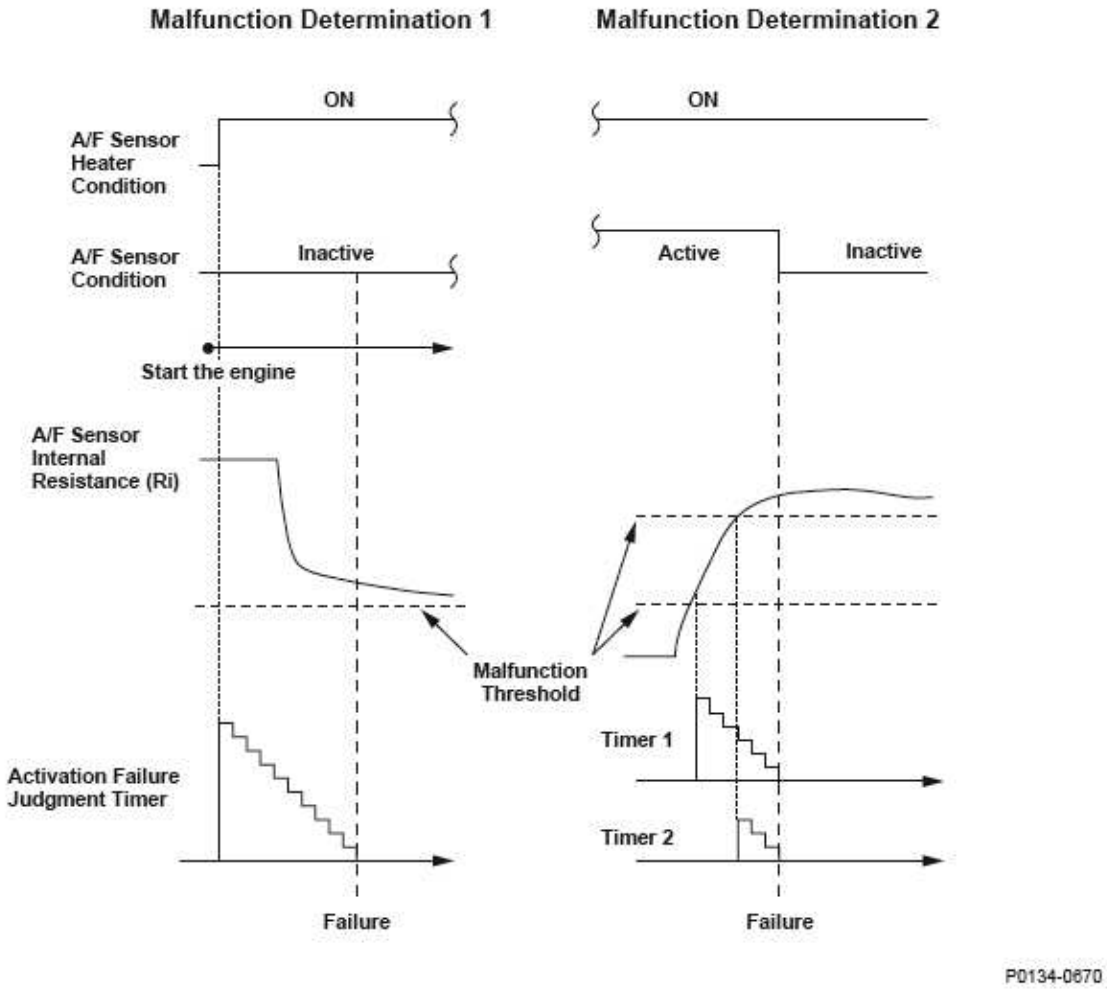



**Fig. 34: Air/Fuel Ratio (A/F) Sensor (Sensor 1) Heater System Malfunction Diagram**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 2, sensor 1) is activated by warming the element with the heater any by maintaining it at a steady high temperature to accurately calculate the air/fuel (A/F) ratio. The front A/F sensor does not become active when the element is not properly heated due to a heater malfunction, and the exhaust emissions deteriorate. The powertrain control module (PCM) monitors the front A/F sensor internal resistance.

1. When the front A/F sensor does not activate within a set time after the front A/F sensor heater starts to warm up (with high front A/F sensor internal resistance), a malfunction of the front A/F sensor heater is detected, and a DTC is stored.
2. When the front A/F sensor heater cycles ON and OFF within a set time, and the resistance remains high when the heater is ON, a malfunction in the front A/F sensor heater is detected, and a DTC is stored.

   Because the effect engine control differs according to the front A/F sensor internal resistance, there are two types of malfunction detection threshold levels. When either one is reached, a malfunction is detected.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 40 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |
| Fuel feedback | Other than during fuel cut-off operation | |
| No active DTCs | P0155, P0657, P1174, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2630, P2631 | |

**Malfunction Threshold**

Malfunction determination 1

The front A/F sensor (bank 2, sensor 1) heater internal resistance value is 110 ohms or more for at least 40 seconds right after the engine starts.

Malfunction determination 2

- The front A/F sensor (bank 2, sensor 1) heater internal resistance value is 110 ohms or more for at least 15 seconds.
- The front A/F sensor (bank 2, sensor 1) heater internal resistance value is 200 ohms or more for at least 1 second.

**Driving Pattern**

Start the engine, and let it idle for at least 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0155 (152): ADVANCED DIAGNOSTICS

### DTC P0155: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) HEATER CIRCUIT MALFUNCTION

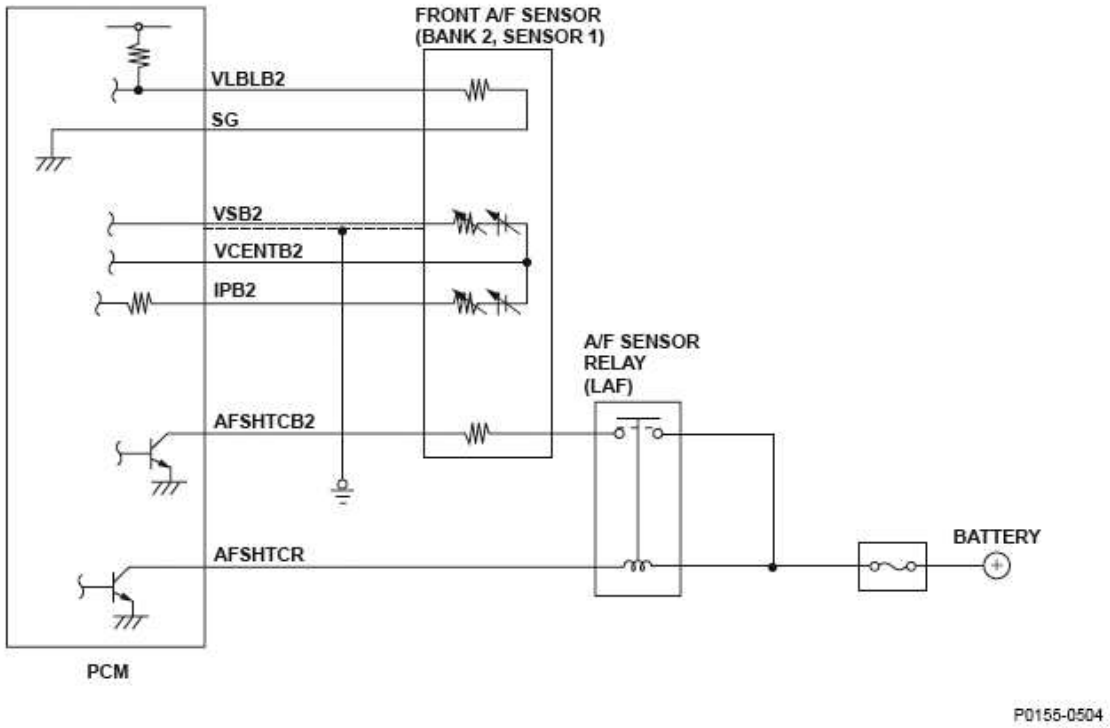



**Fig. 35: Front Air/Fuel Ratio (A/F) Sensor Heater Circuit Diagram**

**General Description**

A heater for the zirconia element is embedded in the front air/fuel ratio (A/F) sensor (bank 2, sensor 1), and it is controlled by the powertrain control module (PCM). When activated, it heats the sensor to stabilize and speed up the detection of oxygen content when the exhaust gas temperature is cold.

The PCM reads the return signal against the front A/F sensor (bank 2, sensor 1) drive signal.

When the drive signal and the return signal do not match, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 9.0 V | - |
| State of the engine | Running | |

**Malfunction Threshold**

One of these conditions continues for at least 1 second.

- The return signal is OFF when the PCM outputs the ON signal to the front A/F sensor (bank 2, sensor 1).
- The return signal is ON when the PCM outputs the OFF signal to the front A/F sensor (bank 2, sensor 1).

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0157 (162): ADVANCED DIAGNOSTICS

### DTC P0157: FRONT SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 2, SENSOR 2)) CIRCUIT LOW VOLTAGE

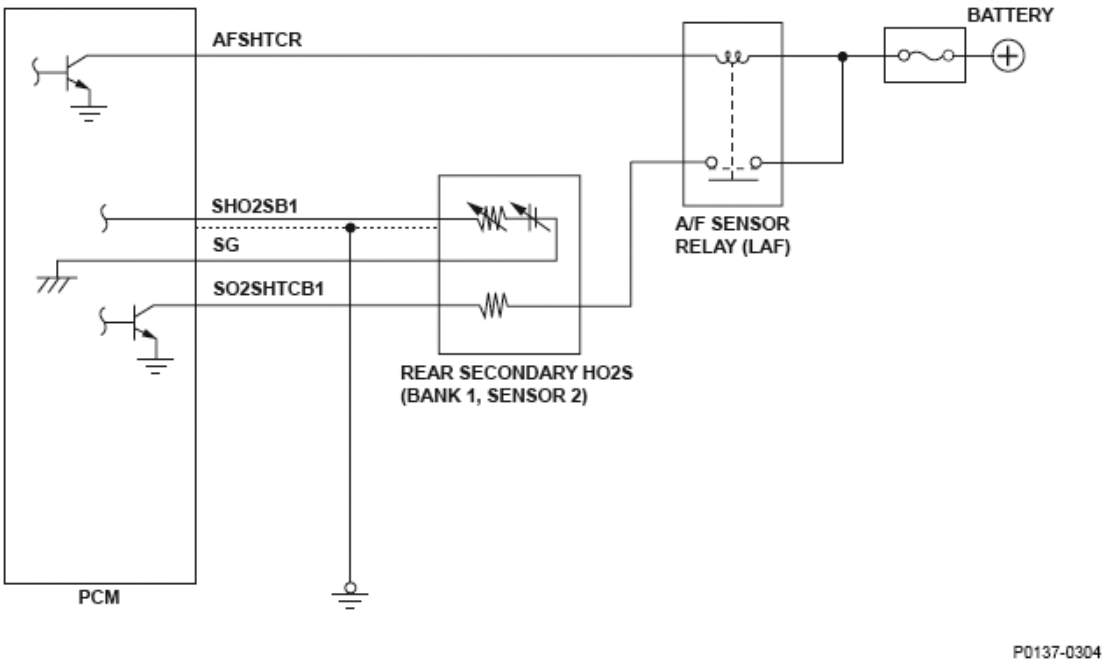



**Fig. 36: Secondary Heated Oxygen Sensor Heater Circuit Diagram**

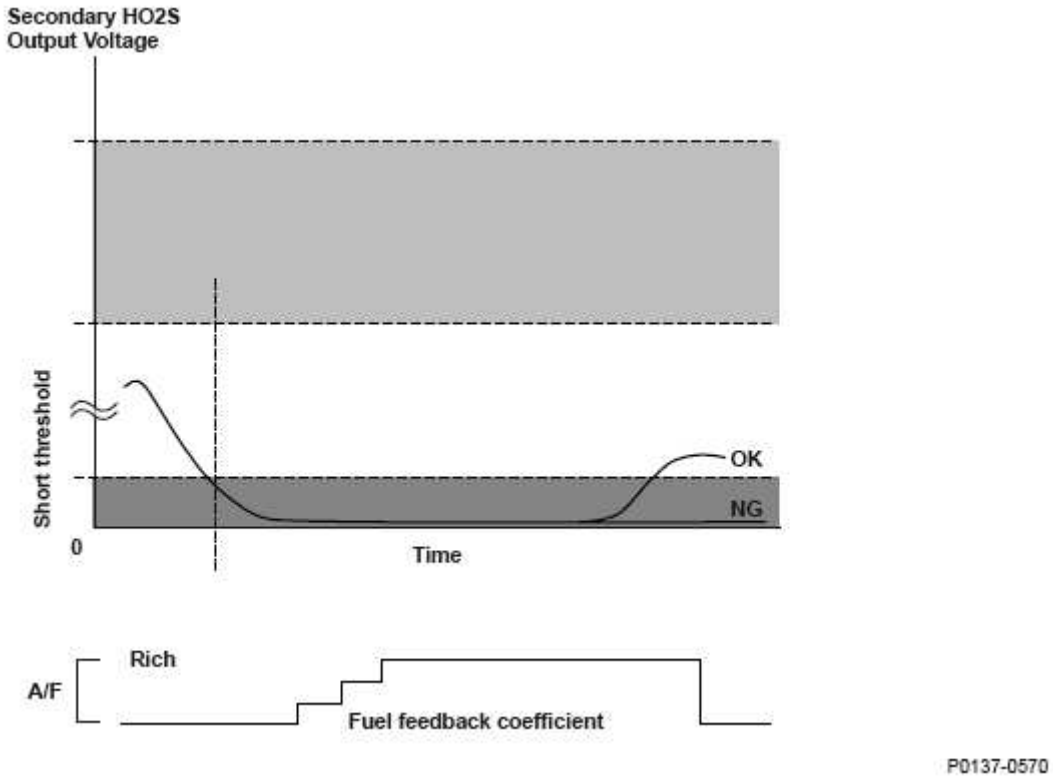



**Fig. 37: Secondary Heated Oxygen Sensor Output Voltage - Graph**

**General Description**

The front secondary heated oxygen sensor (HO2S) (bank 2, sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control. The front secondary HO2S controls the air/fuel ratio from the front A/F sensor output voltage so that the TWC efficiency is optimized.

After current is applied to the front secondary HO2S heater, if the front secondary HO2S sensor output continues low (lean) during feedback control, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 40 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S activity is not monitored after starting the engine | 20 seconds | - |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0153, P0154, P0155, P0161, P0174, P0175, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1174, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2413, P2630, P2631, P2646, P2647, P2648, P2649, P2A03 | |

**Malfunction Threshold**

The front secondary HO2S output voltage is 0.293 V or less for at least 40 seconds.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.

2. Then, drive immediately at a steady engine speed between 1,500 - 3,000 rpm for at least 1 minute.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0158 (162): ADVANCED DIAGNOSTICS

## DTC P0158: FRONT SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 2, SENSOR 2)) CIRCUIT HIGH VOLTAGE

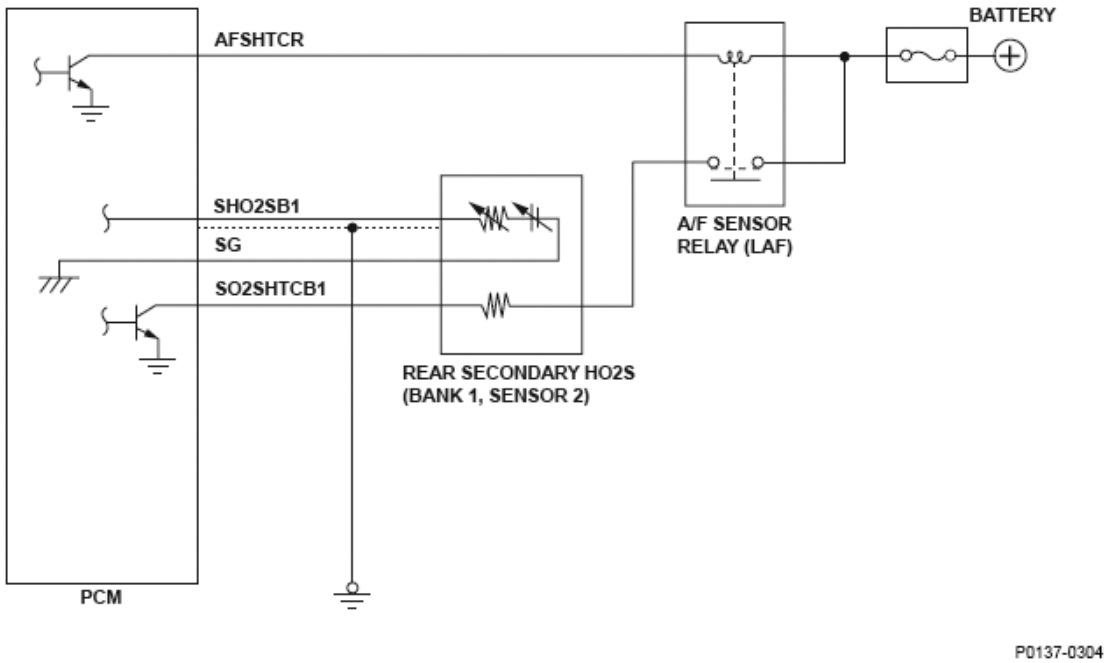



**Fig. 38: Secondary Heated Oxygen Sensor Heater Circuit Diagram**

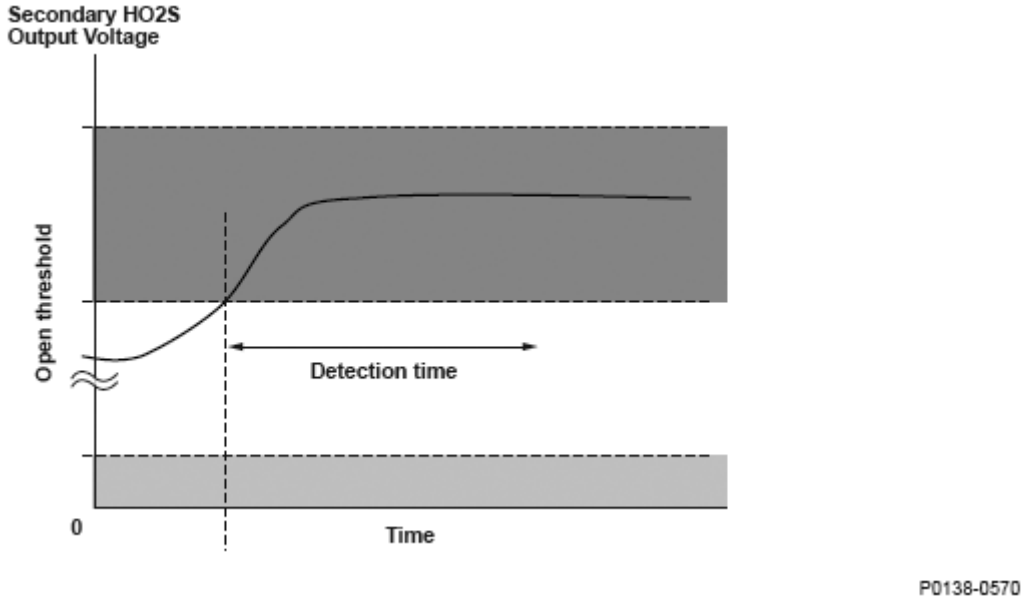



**Fig. 39: Secondary Heated Oxygen Sensor Output Voltage - Graph**

**General Description**

The front secondary heated oxygen sensor (HO2S) (bank 2, sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control. The front secondary HO2S controls the air/fuel ratio from the front A/F sensor output voltage to optimize TWC efficiency.

After current is applied to the front secondary HO2S heater, if the front secondary HO2S sensor output continues high exceeding the upper limit used during feedback control, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S | | |

| | | |
|---|---|---|
| activity is not monitored after starting the engine | 20 seconds | - |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0153, P0154, P0155, P0161, P0174, P0175, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1174, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2413, P2630, P2631, P2646, P2647, P2648, P2649, P2A03 | |

**Malfunction Threshold**

The front secondary HO2S output voltage is 1.270 V or more for at least 5 seconds.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Then, drive immediately at a steady engine speed between 1,500 - 3,000 rpm for at least 1 minute.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0159 (162): ADVANCED DIAGNOSTICS

### DTC P0159: FRONT SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 2, SENSOR 2)) CIRCUIT SLOW RESPONSE

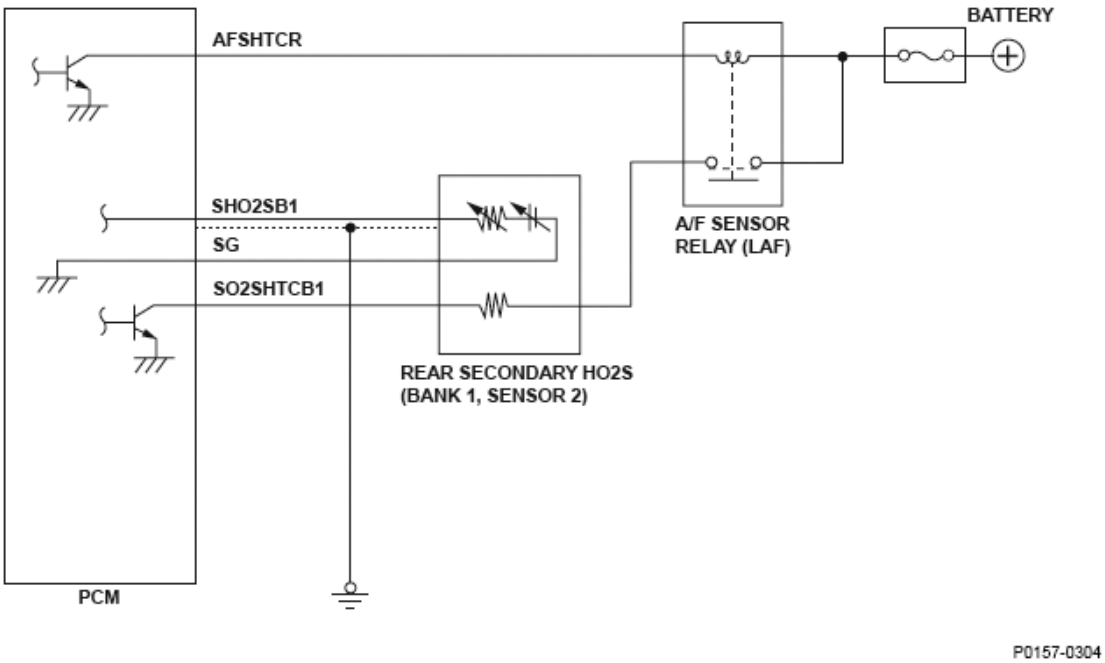



**Fig. 40: Front Secondary Heated Oxygen Sensor Circuit Diagram**

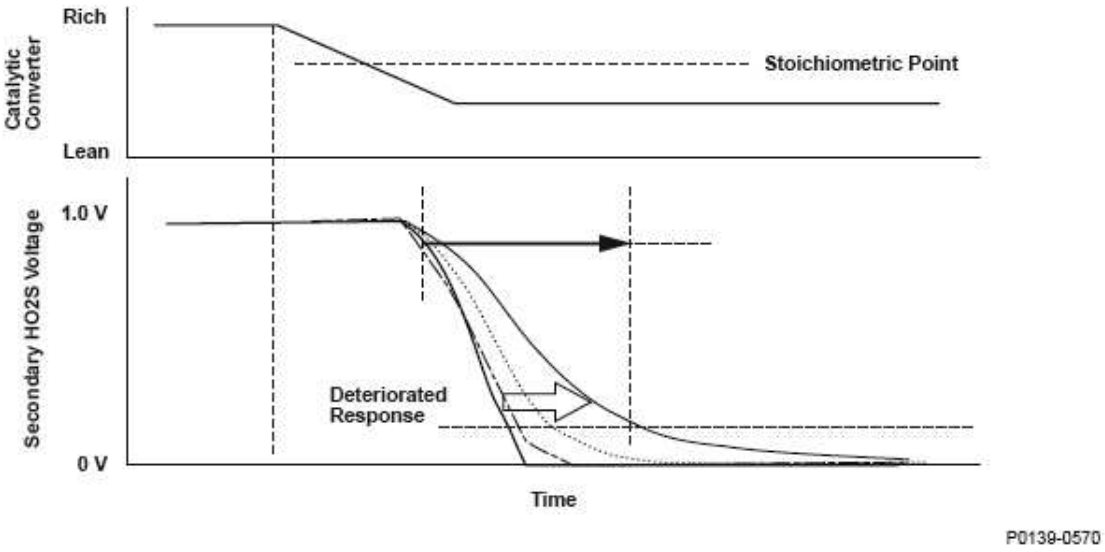



**Fig. 41: Secondary Heated Oxygen Sensor Output Voltage - Graph**

**General Description**

The front secondary heated oxygen sensor (HO2S) (bank 2, sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control. The front secondary HO2S controls the air/fuel ratio with the front A/F sensor output voltage to optimize TWC efficiency.

If the response time of the front secondary HO2S becomes longer than the specified time after current to the

secondary HO2S heater is applied, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 19 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S activity is not monitored after starting the engine | 20 seconds | - |
| Elapsed time after fuel cut-off | - | 150 seconds |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Engine speed | 1,150 rpm | 1,900 rpm |
| MAP value | 22 kPa (6.3 in.Hg, 160 mmHg) | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Vehicle speed | 30 mph (48 km/h) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0153, P0154, P0155, P0157, P0158, P0161, P0174, P0175, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1174, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2272, P2273, P2413, P2630, P2631, P2646, P2647, P2648, P2649, P2A03 | |

**Malfunction Threshold**

1. When the front secondary HO2S output drops to the response deterioration judgment threshold value and the response characteristics measurement is finished.

**MALFUNCTION THRESHOLD**

| | |
|---|---|
| MIN | 0.77 seconds |

| | |
|---|---|
| MAX | 16.0 seconds |

2. The voltage does not drop to the response deterioration judgment threshold value after a predetermined time (4.35 seconds) has elapsed.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Then, drive immediately at a steady speed of 35 mph (57 km/h) or more for at least 19 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0161 (164): ADVANCED DIAGNOSTICS

## DTC P0161: FRONT SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S) (BANK 2, SENSOR 2) HEATER CIRCUIT MALFUNCTION

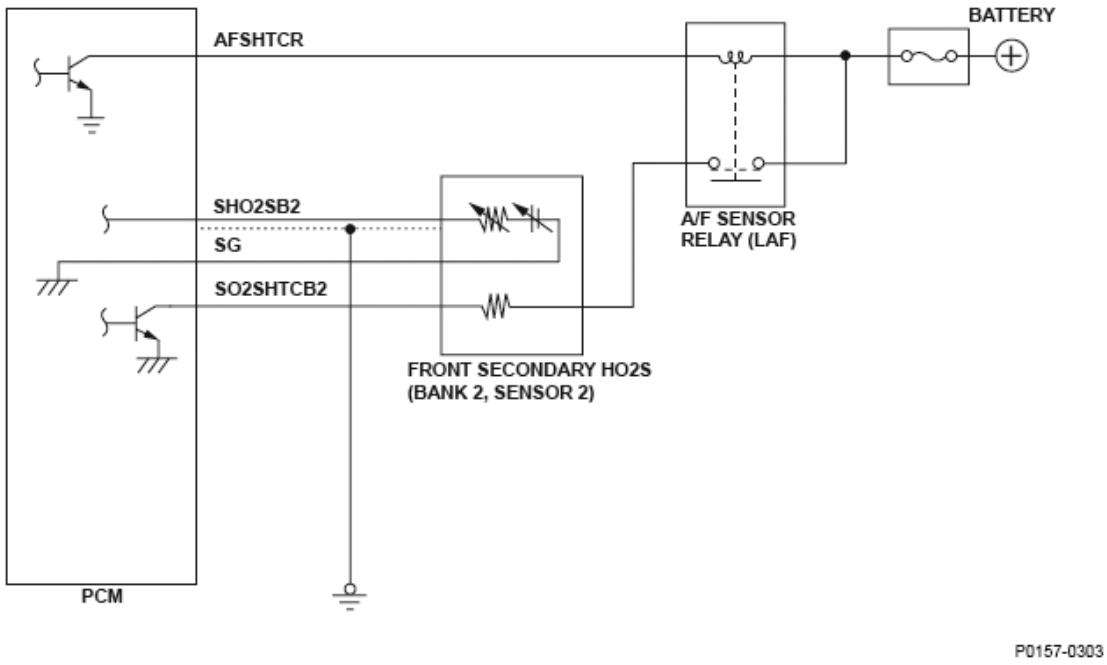



**Fig. 42: Front Secondary Heated Oxygen Sensor Heater Circuit Diagram**

**General Description**

A heater for the zirconia element is embedded in the front secondary heated oxygen sensor (front secondary HO2S) (bank 2, sensor 2) and is controlled by the powertrain control module (PCM). When activated, it heats the sensor to stabilize and speed up the detection of oxygen content when the exhaust gas temperature is cold.

If the front secondary HO2S heater draws more or less than a specified amperage, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage (IGP terminal of PCM) | 10.5 V | 16 V |
| State of the engine | Running | |
| | | |

| | |
|---|---|
| No active DTCs | P0117, P0118 |

**Malfunction Threshold**

The front secondary HO2S heater output is 0.38 A or less, or 3.33 A or more, for at least 5 seconds when the heater is on.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0171 (153): ADVANCED DIAGNOSTICS

## DTC P0171: REAR BANK (BANK 1) FUEL SYSTEM TOO LEAN

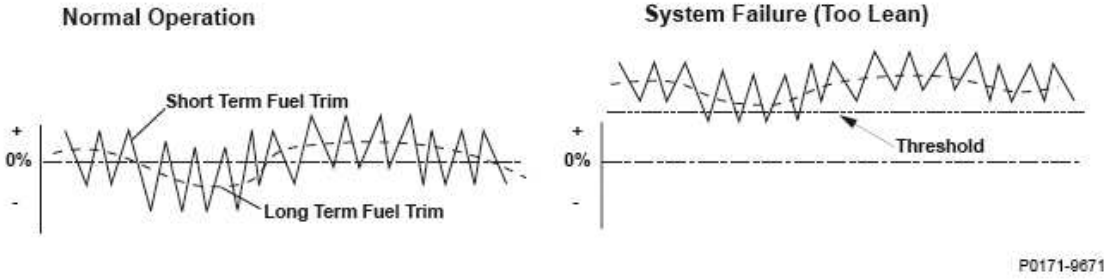



**Fig. 43: Bank (Bank 1) Fuel System Diagram**

**General Description**

The powertrain control module (PCM) detects the oxygen content in the exhaust gas from the rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) signal voltage, and it performs fuel feedback control to maintain the optimal air/fuel ratio. The air/fuel ratio coefficient for correcting the amount of injected fuel is the short term fuel trim.

The PCM varies short term fuel trim continuously to keep the air/fuel ratio close to the stoichiometric ratio for all driving conditions.

Long term fuel trim is computed from short term fuel trim and is used to regulate long term deviation from the stoichiometric air/fuel ratio, which occurs when fuel metering components deteriorate with age or system failures occur. In addition, long term fuel trim is stored in the PCM memory and is used to determine when fuel metering components malfunction. When long term fuel trim is higher than normal, which is about 1.0 (0 %), the amount of injected fuel must be increased, and when lower than normal, it must be decreased. If long term fuel trim is higher than normal (too lean), a malfunction in the fuel metering components is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle(1) |
| Sequence | None |
| Duration | Every 7 seconds |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

(1) The malfunction judgment is cleared when it is judged as normal under the same driving conditions in which the malfunction was detected.

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 32°F (0°C) | - |
| Engine speed | 600 rpm | 4,000 rpm |
| MAP value | 24 kPa (7.1 in.Hg, 180 mmHg) | - |
| Fuel feedback | Closed loop | |
| Monitoring priority | P0420, P0430, P0456, P0457 | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0134, P0135, P0137, P0138, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1172, P2195, P2227, P2228, P2229, P2237, P2238, P2243, P2245, P2251, P2252, P2270, P2271, P2413, P2627, P2628, P2646, P2647, P2648, P2649 | |

**Malfunction Threshold**

Long term fuel trim is higher than 1.19 (+19 %).

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Then, drive at a steady speed between 15 - 75 mph (24 - 120 km/h) for at least 15 minutes, and watch the long term fuel trim. If the long term fuel trim stays at about 1.0, the vehicle is OK or it is a very minor problem. If a significant fault is still present, the long term fuel trim will move up or down while driving.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Pattern 2.
- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- After clearing the DTC by disconnecting the battery or using the scan tool, extend Driving Pattern 2 to 40 minutes or longer to allow time for long term fuel trim to recover.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0172 (153): ADVANCED DIAGNOSTICS

## DTC P0172: REAR BANK (BANK 1) FUEL SYSTEM TOO RICH

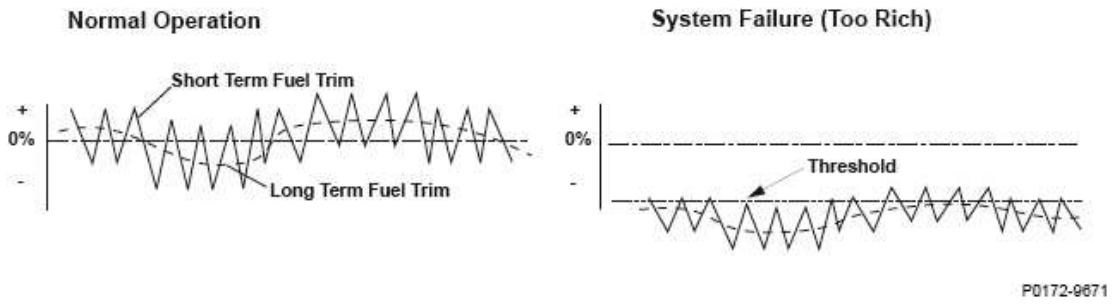


**Fig. 44: Fuel System - Graph**

**General Description**

The powertrain control module (PCM) detects the oxygen content in the exhaust gas from the rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) signal voltage, and it performs fuel feedback control to maintain the optimal air/fuel ratio. The air/fuel ratio coefficient for correcting the amount of injected fuel is the short term fuel trim. The PCM varies short term fuel trim continuously to keep the air/fuel ratio close to the stoichiometric ratio for all driving conditions. Long term fuel trim is computed from short term fuel trim and is used to regulate long term deviation from the stoichiometric air/fuel ratio, which occurs when fuel metering components deteriorate with age or system failures occur. In addition, long term fuel trim is stored in the PCM memory and is used to determine when fuel metering components malfunction. When long term fuel trim is higher than normal, which is about 1.0 (0 %), the amount of injected fuel must be increased, and when lower than normal, it must be decreased. If long term fuel trim is lower than normal (too rich), a malfunction in the fuel metering components is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle(1) |
| Sequence | None |
| Duration | Every 7 seconds |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |
| (1) The malfunction judgment is cleared when it is judged as normal under the same driving conditions in which the malfunction was detected. | |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 32°F (0°C) | - |
| Engine speed | 600 rpm | 4,000 rpm |
| MAP value | 24 kPa (7.1 in.Hg, 180 mmHg) | - |
| Fuel feedback | Closed loop | |
| Monitoring priority | P0420, P0430, P0456, P0457 | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0134, P0135, P0137, P0138, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1172, | |

| | |
|---|---|
| | P2195, P2227, P2228, P2229, P2237, P2238, P2243, P2245, P2251, P2252, P2270, P2271, P2413, P2627, P2628, P2646, P2647, P2648, P2649 |

**Malfunction Threshold**

Long term fuel trim is lower than 0.84 (-16 %).

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Then, drive at a steady speed between 15 - 75 mph (24 - 120 km/h) for at least 15 minutes, and watch the long term fuel trim. If the long term fuel trim stays at about 1.0, the vehicle is OK or it is a very minor problem. If a significant fault is still present, the long term fuel trim will move up or down while driving.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Pattern 2.
- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- After clearing the DTC by disconnecting the battery or using the scan tool, extend Driving Pattern 2 to 40 minutes or longer to allow time for long term fuel trim to recover.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0174 (154): ADVANCED DIAGNOSTICS

### DTC P0174: FRONT BANK (BANK 2) FUEL SYSTEM TOO LEAN

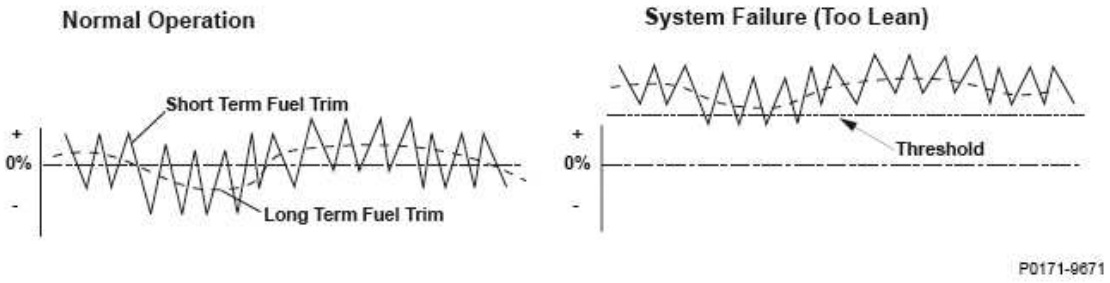



**Fig. 45: Fuel System - Graph**

**General Description**

The powertrain control module (PCM) detects the oxygen content in the exhaust gas from the front air/fuel ratio (A/F) sensor (bank 2, sensor 1) signal voltage, and it performs fuel feedback control to maintain the optimal air/fuel ratio. The air/fuel ratio coefficient for correcting the amount of injected fuel is the short term fuel trim. The PCM varies short term fuel trim continuously to keep the air/fuel ratio close to the stoichiometric ratio for all driving conditions.

Long term fuel trim is computed from short term fuel trim and is used to regulate long term deviation from the stoichiometric air/fuel ratio, which occurs when fuel metering components deteriorate with age or system failures occur. In addition, long term fuel trim is stored in the PCM memory and is used to determine when fuel metering components malfunction. When long term fuel trim is higher than normal, which is about 1.0 (0 %), the amount of injected fuel must be increased, and when lower than normal, it must be decreased. If long term fuel trim is higher than normal (too lean), a malfunction in the fuel metering components is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle(1) |
| Sequence | None |
| Duration | Every 7 seconds |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |
| (1) The malfunction judgment is cleared when it is judged as normal under the same driving conditions in which the malfunction was detected. | |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air | | |

| | | |
|---|---|---|
| temperature | 32°F (0°C) | - |
| Engine speed | 600 rpm | 4,000 rpm |
| MAP value | 24 kPa (7.1 in.Hg, 180 mmHg) | - |
| Fuel feedback | Closed loop | |
| Monitoring priority | P0420, P0430, P0456, P0457 | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0154, P0155, P0157, P0158, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1174, P2197, P2227, P2228, P2229, P2240, P2241, P2247, P2249, P2254, P2255, P2272, P2273, P2413, P2630, P2631, P2646, P2647, P2648, P2649 | |

**Malfunction Threshold**

Long term fuel trim is higher than 1.19 (+19 %).

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Then, drive at a steady speed between 15 - 75 mph (24 - 120 km/h) for at least 15 minutes, and watch the long term fuel trim. If the long term fuel trim stays at about 1.0, the vehicle is OK or it is a very minor problem. If a significant fault is still present, the long term fuel trim will move up or down while driving.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Pattern 2.
- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- After clearing the DTC by disconnecting the battery or using the scan tool, extend Driving Pattern 2 to 40 minutes or longer to allow time for long term fuel trim to recover.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear

command or by disconnecting the battery.

# DTC P0175 (154): ADVANCED DIAGNOSTICS

## DTC P0175: FRONT BANK (BANK 2) FUEL SYSTEM TOO RICH

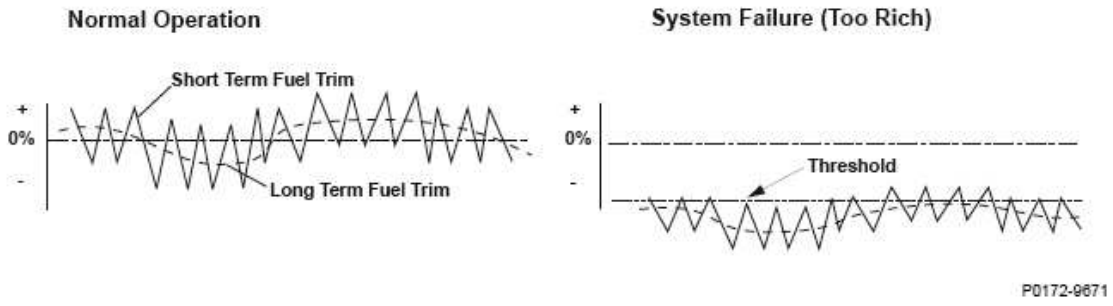



**Fig. 46: Fuel System - Graph**

### General Description

The powertrain control module (PCM) detects the oxygen content in the exhaust gas from the front air/fuel ratio (A/F) sensor (bank 2, sensor 1) signal voltage, and it performs fuel feedback control to maintain the optimal air/fuel ratio. The air/fuel ratio coefficient for correcting the amount of injected fuel is the short term fuel trim. The PCM varies short term fuel trim continuously to keep the air/fuel ratio close to the stoichiometric ratio for all driving conditions. Long term fuel trim is computed from short term fuel trim and is used to regulate long term deviation from the stoichiometric air/fuel ratio, which occurs when fuel metering components deteriorate with age or system failures occur. In addition, long term fuel trim is stored in the PCM memory and is used to determine when fuel metering components malfunction. When long term fuel trim is higher than normal, which is about 1.0 (0 %), the amount of injected fuel must be increased, and when lower than normal, it must be decreased. If long term fuel trim is lower than normal (too rich), a malfunction in the fuel metering components is detected and a DTC is stored.

### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle(1) |
| Sequence | None |
| Duration | Every 7 seconds |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |
| (1) The malfunction judgment is cleared when it is judged as normal under the same driving conditions in which the malfunction was detected. | |

### Enable Conditions

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 32°F (0°C) | - |
| Engine speed | 600 rpm | 4,000 rpm |
| MAP value | 24 kPa (7.1 in.Hg, 180 mmHg) | - |
| Fuel feedback | Closed loop | |
| Monitoring priority | P0420, P0430, P0456, P0457 | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0154, P0155, P0157, P0158, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1174, P2197, P2227, P2228, P2229, P2240, P2241, P2247, P2249, P2254, P2255, P2272, P2273, P2413, P2630, P2631, P2646, P2647, P2648, P2649 | |

**Malfunction Threshold**

Long term fuel trim is lower than 0.84 (-16 %).

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Then, drive at a steady speed between 15 - 75 mph (24 - 120 km/h) for at least 15 minutes, and watch the long term fuel trim. If the long term fuel trim stays at about 1.0, the vehicle is OK or it is a very minor problem. If a significant fault is still present, the long term fuel trim will move up or down while driving.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Pattern 2.
- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- After clearing the DTC by disconnecting the battery or using the scan tool, extend Driving Pattern 2 to 40 minutes or longer to allow time for long term fuel trim to recover.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0201 (71): P0202 (72):, P0203 (73):, P0204 (74):, P0205 (75):, P0206 (76):, ADVANCED DIAGNOSTICS

**DTC P0201: NO.1 INJECTOR CIRCUIT MALFUNCTION; DTC P0202: NO.2 INJECTOR CIRCUIT MALFUNCTION; DTC P0203: NO.3 INJECTOR CIRCUIT MALFUNCTION; DTC P0204: NO.4 INJECTOR CIRCUIT MALFUNCTION; DTC P0205: NO.5 INJECTOR CIRCUIT MALFUNCTION; DTC P0206: NO.6 INJECTOR CIRCUIT MALFUNCTION**

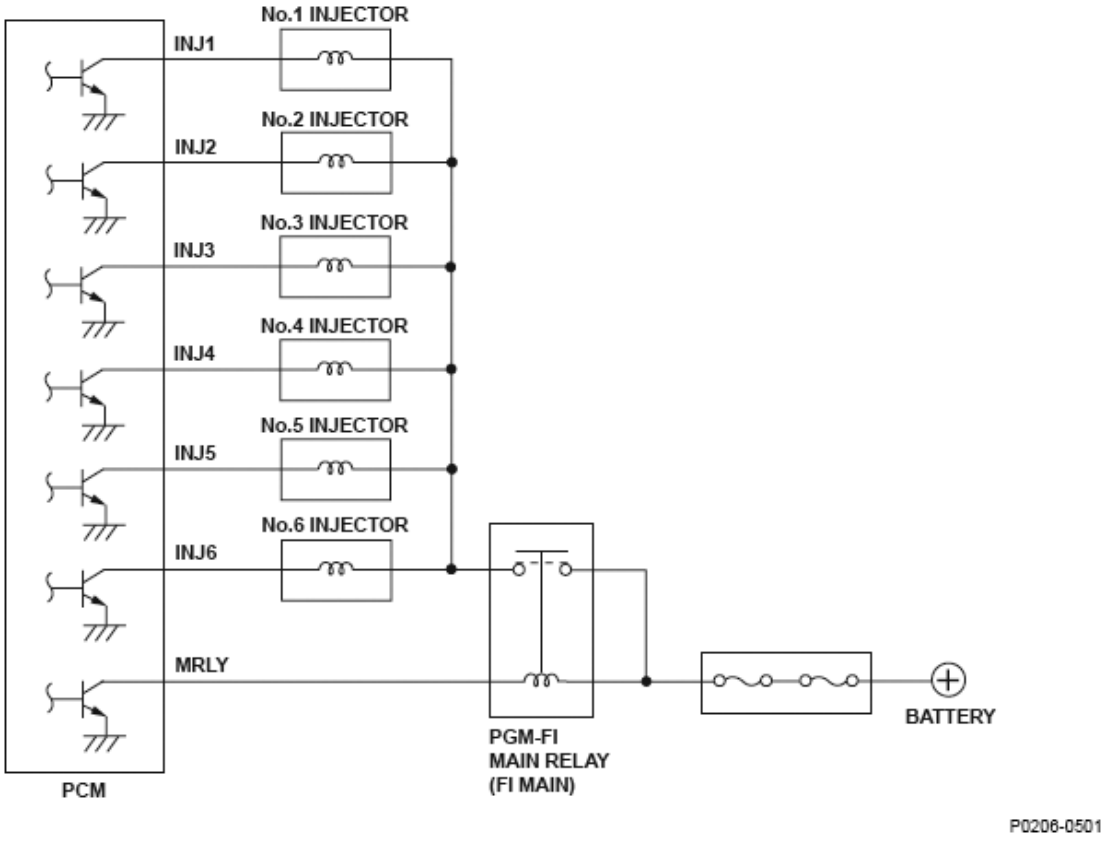



**Fig. 47: Injector Malfunction Circuit Diagram**

**General Description**

The powertrain control module (PCM) supplies fuel to the engine by controlling the on/off status of the injector.

The PCM reads the return signal against the injector drive signal.

When the drive signal and the return signal do not match, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |

**Malfunction Threshold**

Either of the following conditions continues for at least 1 second.

- The return signal is OFF when the PCM outputs the ON signal to the injector.
- The return signal is ON when the PCM outputs the OFF signal to the injector.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0222 (7): ADVANCED DIAGNOSTICS

### DTC P0222: THROTTLE POSITION (TP) SENSOR B CIRCUIT LOW VOLTAGE

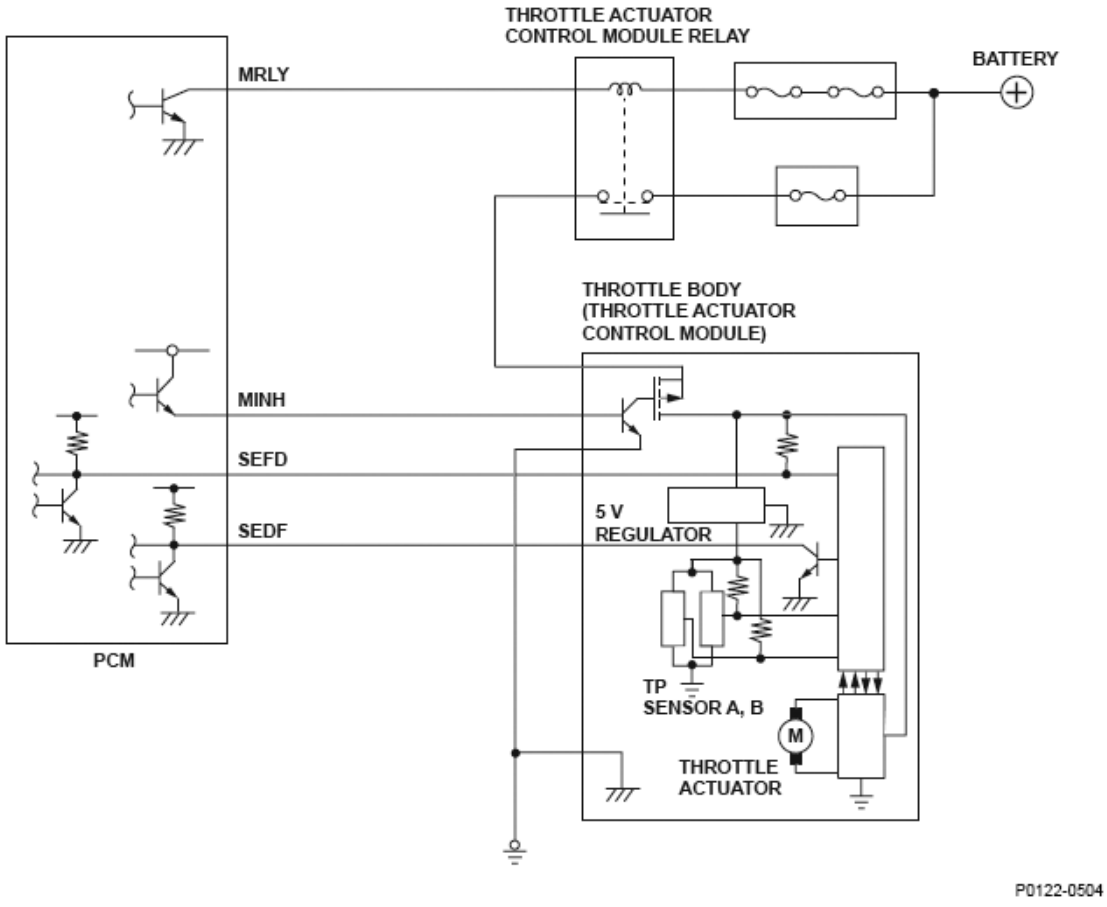



**Fig. 48: Throttle Position (TP) Sensor A Circuit Diagram**

**General Description**

Throttle position (TP) sensor B is a semiconductor type, and it is attached to the throttle body and shaft to determine throttle valve position.

The throttle valve position signal from TP sensor B is transmitted to the throttle actuator control module for target position feedback control, then to the powertrain control module (PCM) as an actual throttle valve position signal.

If the signal from TP sensor B is less than a fixed value for a set time, the throttle actuator control module detects a malfunction and sends the malfunction data to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects a TP sensor B malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |

| | |
|---|---|
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0223, P2101, P2108, P2118, P2135, P2176, U0107 |

**Malfunction Threshold**

The TP sensor B output voltage is 0.3 V or less for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0223 (7): ADVANCED DIAGNOSTICS

## DTC P0223: THROTTLE POSITION (TP) SENSOR B CIRCUIT HIGH VOLTAGE

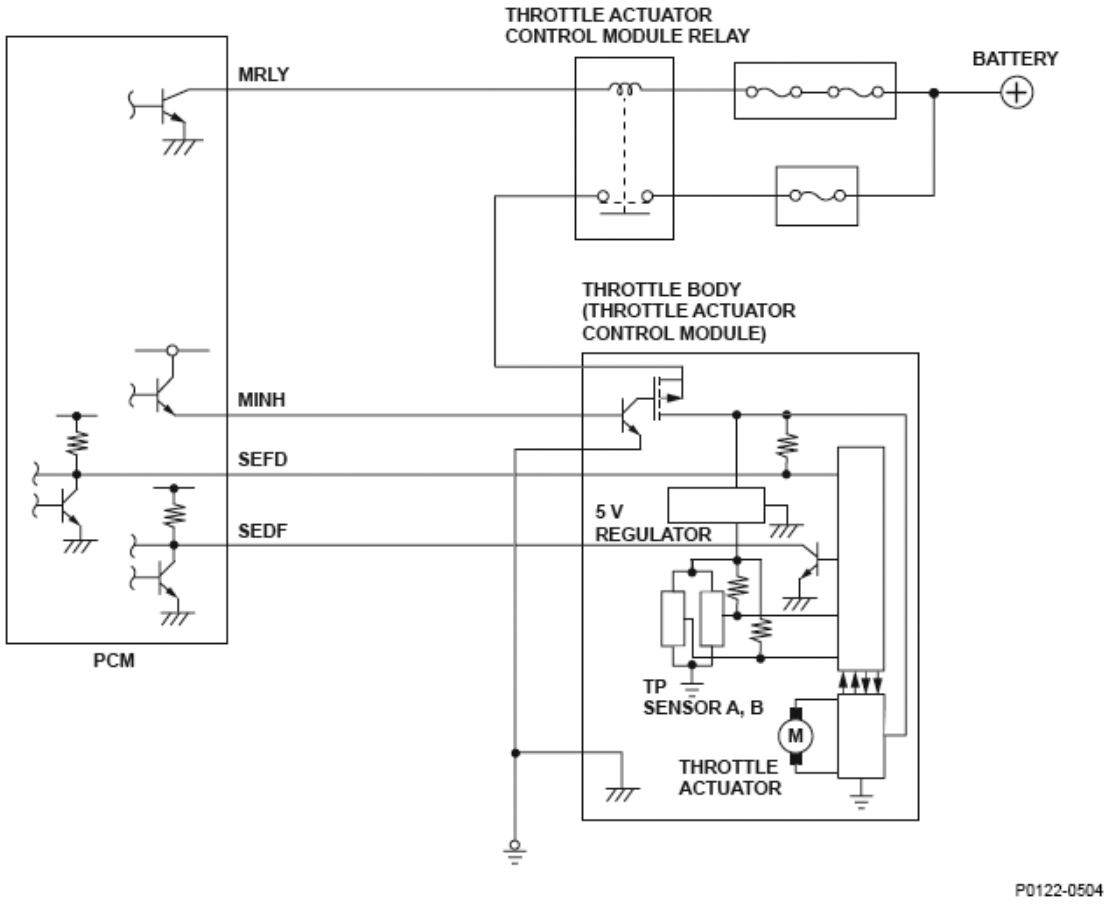



**Fig. 49: Throttle Position (TP) Sensor B Circuit Diagram**

**General Description**

Throttle position (TP) sensor B is a semiconductor type, and it is attached to the throttle body and shaft to determine throttle valve position.

The throttle valve position signal from TP sensor B is transmitted to the throttle actuator control module for target position feedback control, then to the powertrain control module (PCM) as an actual throttle valve position signal.

If the signal from TP sensor B is more than a fixed value for a set time, the throttle actuator control module detects a malfunction and sends the malfunction data to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects a TP sensor B malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |

| | |
|---|---|
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0222, P2101, P2108, P2118, P2135, P2176, U0107 |

**Malfunction Threshold**

The TP sensor B output voltage is 4.8 V or more for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0300 (77): ADVANCED DIAGNOSTICS

**DTC P0300: RANDOM MISFIRE DETECTED**

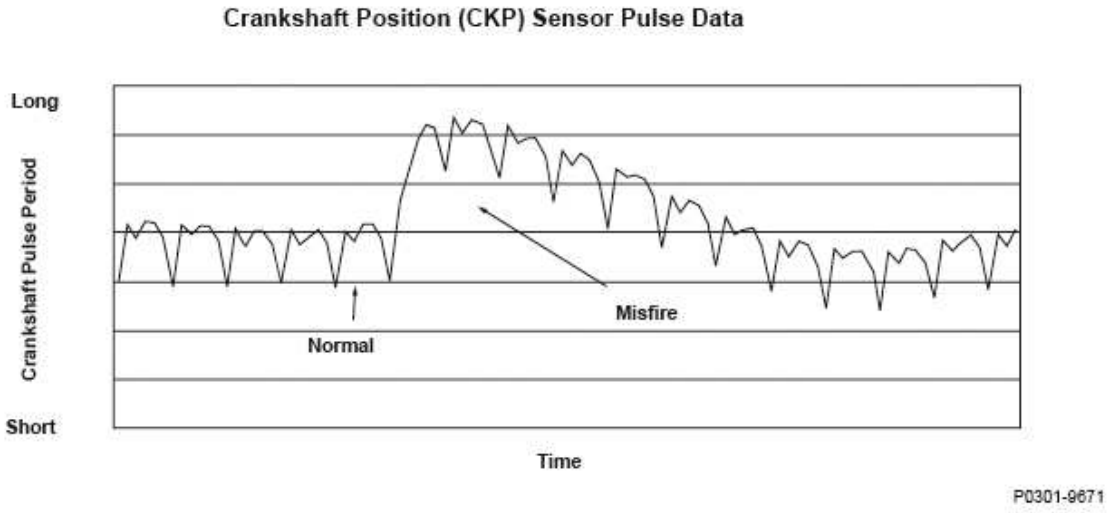



**Fig. 50: Crankshaft Position Sensor Pulse Data - Graph**

**General Description**

The crankshaft vibrates slightly when each cylinder fires. If a misfire occurs, the crankshaft rotation speed changes rapidly. The powertrain control module (PCM) monitors the crankshaft rotation speed based on the output pulses from the crankshaft position (CKP) sensor. By monitoring changes in the crankshaft rotation speed, the PCM counts the number of misfires and determines which cylinder is misfiring. If more than one DTC from P0301 through P0306 has been stored while misfires in multiple cylinders are detected, a malfunction is detected and a DTC is stored.

There are two types of misfire detection.

Type 1 (1 drive cycle): When the number of misfires per 200 engine revolutions reaches the level that damages the three way catalyst (TWC), a DTC is stored and the MIL blinks. When the misfire ceases, the MIL remains on steady instead of blinking.

Type 2 (2 drive cycles): When the number of misfires per 1,000 engine revolutions reaches the level that affects FTP mode exhaust emissions, a DTC is stored and the MIL comes on.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | | |
|---|---|---|
| Execution | | Continuous |
| Sequence | | None |
| Duration | Type 1 | Every 200 rpm |
| | Type 2 | Every 1,000 rpm |
| DTC Type | | Two drive cycles, MIL ON |
| OBD Status | | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | | | Minimum | Maximum |
|---|---|---|---|---|
| Engine coolant temperature | | | 14°F (-10°C)(1) | - |
| | | | 68°F (20°C)(2) | |
| Engine speed | | | 500 rpm | 6,300 rpm |
| MAP value | Stopped | 500 rpm | 27 kPa (200 mmHg, 7.9 in.Hg) | - |
| | | 2,000rpm | 22 kPa (160 mmHg, 6.3 in.Hg) | |
| | Driving (low gear(3)) | 500 rpm | 33 kPa (245 mmHg, 9.7 in.Hg) | - |
| | | 3,000rpm | 28 kPa (206 mmHg, 8.2 in.Hg) | |
| Fuel feedback | | | Other than during fuel cut-off operation | |
| No active DTCs | | | P0107, P0108, P0117, P0118, P0122, P0123, P0222, P0223, P0335, P0339, P0385, P0389, P0641, P1109, P1128, P1129, P2227, P2228, P2229 | |
| Other | | | Test-drive on a flat road to avoid misdetection | |

(1) When starting the engine at an engine coolant temperature of 14°F (-10°C) or less.

(2) When starting the engine at an engine coolant temperature of more than 14°F (-10°C).

(3) 1st - 2nd gear

**Malfunction Threshold**

The number of misfires versus engine revolutions is equal to or greater than the values in the table.

**MALFUNCTION THRESHOLD**

| Misfire Type | The number of engine revolutions | The number of misfires |
|---|---|---|
| Misfire Type 1 (Severe) | Per 200 revolutions | 30 - 75 times(1) |
| Misfire Type 2 (Light) | Per 1,000 revolutions | 42 times |

(1) Depending on engine speed and load.

**Driving Pattern**

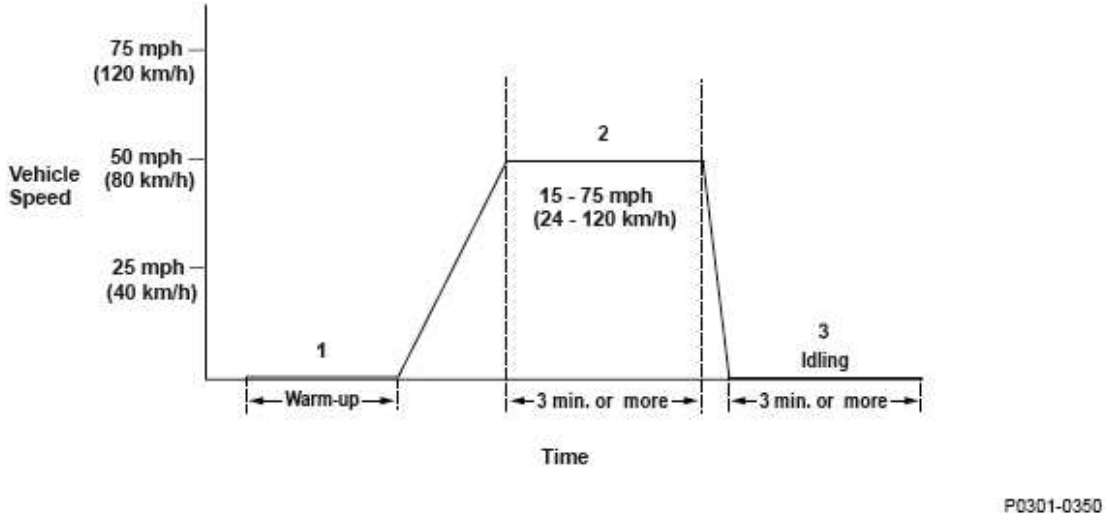



**Fig. 51: Vehicle Speed Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 15 - 75 mph (24 - 120 km/h) for at least 3 minutes.
3. Stop the vehicle, and let the engine idle for at least 3 minutes.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Patterns 2 or 3.
- When you have difficulty duplicating the DTC because of road conditions and traffic situations, repeat the driving pattern several times.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

Misfire Type 1: Under high rpm or high load conditions: The MIL blinks once per second if a type 1 misfire (catalyst damaging) occurs, and a Temporary DTC is stored. If the type 1 misfire ceases, the MIL goes off. If a type 1 misfire occurs during the next (second) drive cycle, the MIL blinks at the first misfire occurrence, and the DTC and the freeze frame data are stored. The MIL remains on steady if the type 1 misfire ceases.

Under normal driving conditions: The MIL blinks once per second if a type 1 misfire occurs a third time, and a Temporary DTC is stored. If a type 1 misfire occurs during the next (second) drive cycle, the MIL blinks during the third type 1 misfire occurrence, and the DTC and the freeze frame data are stored. If the type 1 misfire ceases, the MIL remains on steady.

Misfire Type 2: When a type 2 misfire (emission-related but not severe enough to immediately damage the TWC) occurs within the first 1,000 engine revolutions after engine start-up, a Temporary DTC is stored.

If a type 2 misfire occurs after the first 1,000 engine revolutions after engine start-up, a Temporary DTC is

stored during the fourth type 2 misfire occurrence.

If a type 2 misfire occurs during the next (second) drive cycle, the MIL comes on, and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0301 (71):, P0302 (72):, P0303 (73):, P0304 (74):, P0305 (75):, P0306 (76):, ADVANCED DIAGNOSTICS

### DTC P0301: NO. 1 CYLINDER MISFIRE DETECTED; DTC P0302: NO. 2 CYLINDER MISFIRE DETECTED; DTC P0303: NO. 3 CYLINDER MISFIRE DETECTED; DTC P0304: NO. 4 CYLINDER MISFIRE DETECTED; DTC P0305: NO. 5 CYLINDER MISFIRE DETECTED; DTC P0306: NO. 6 CYLINDER MISFIRE DETECTED

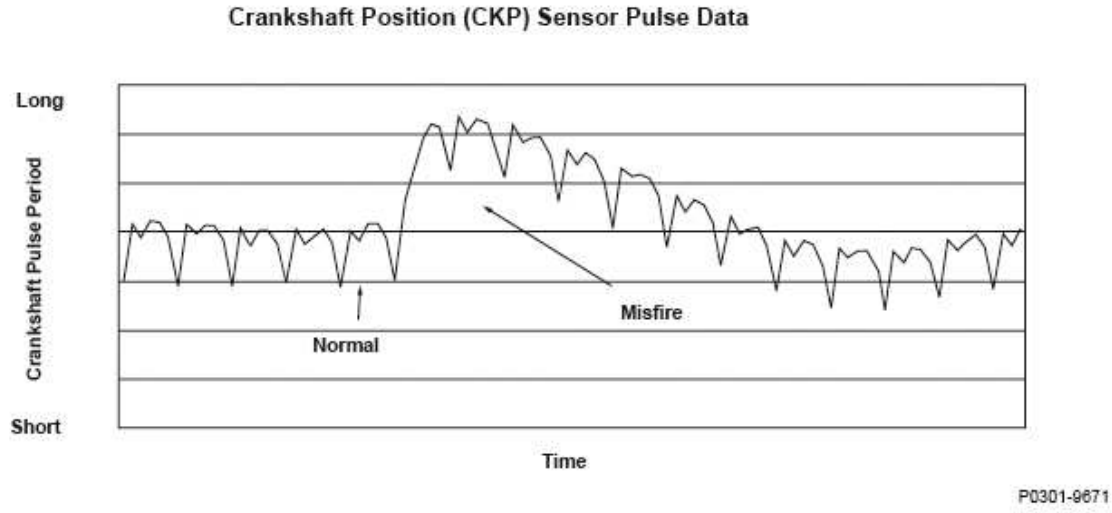



**Fig. 52: Crankshaft Position Sensor Pulse Data - Graph**

**General Description**

The crankshaft vibrates slightly when each cylinder fires. If a misfire occurs, the crankshaft rotation speed changes rapidly. The powertrain control module (PCM) monitors engine misfiring based on the output pulses from the crankshaft position (CKP) sensor, counts the number of misfires, and determines which cylinder is misfiring. If a misfire is detected, a DTC is stored.

There are two types of misfire detection.

Type 1 (1 drive cycle): When the number of misfires per 200 engine revolutions reaches the level that damages the three way catalyst (TWC), a DTC is stored and the MIL blinks. When the misfire ceases, the MIL remains on steady instead of blinking.

Type 2 (2 drive cycles): When the number of misfires per 1,000 engine revolutions reaches the level that affects FTP mode exhaust emissions, a DTC is stored and the MIL comes on.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | | |
|---|---|---|
| Execution | | Continuous |
| Sequence | | None |
| Duration | Type 1 | Every 200 rpm |
| | Type 2 | Every 1,000 rpm |
| DTC Type | | Two drive cycles, MIL ON |
| OBD Status | | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | | | Minimum | Maximum |
|---|---|---|---|---|
| Engine coolant temperature | | | 14°F (-10°C)(1) | - |
| | | | 68°F (20°C)(2) | |
| Engine speed | | | 500 rpm | 6,300 rpm |
| MAP value | Stopped | 500 rpm | 27 kPa (200 mmHg, 7.9 in.Hg) | - |
| | | 2,000rpm | 22 kPa (160 mmHg, 6.3 in.Hg) | |
| | Driving (low gear(3)) | 500 rpm | 33 kPa (245 mmHg, 9.7 in.Hg) | - |
| | | 3,000rpm | 28 kPa (206 mmHg, 8.2 in.Hg) | |
| Fuel feedback | | | Other than during fuel cut-off operation | |
| No active DTCs | | | P0107, P0108, P0117, P0118, P0122, P0123, P0222, P0223, P0335, P0339, P0385, P0389, P0641, P1109, P1128, P1129, P2227, P2228, P2229 | |
| Other | | | Test-drive on a flat road to avoid misdetection | |

(1) When starting the engine at an engine coolant temperature of 14°F (-10°C) or less.

(2) When starting the engine at an engine coolant temperature of more than 14°F (-10°C).

(3) 1st - 2nd gear

**Malfunction Threshold**

The number of misfires versus engine revolutions is equal to or greater than the values in the table.

**MALFUNCTION THRESHOLD**

| Misfire Type | The number of engine revolutions | The number of misfires |
|---|---|---|
| Misfire Type 1 (Severe) | Per 200 revolutions | 30 - 75 times(1) |
| Misfire Type 2 (Light) | Per 1,000 revolutions | 42 times |
| (1) Depending on engine speed and load. | | |

**Driving Pattern**

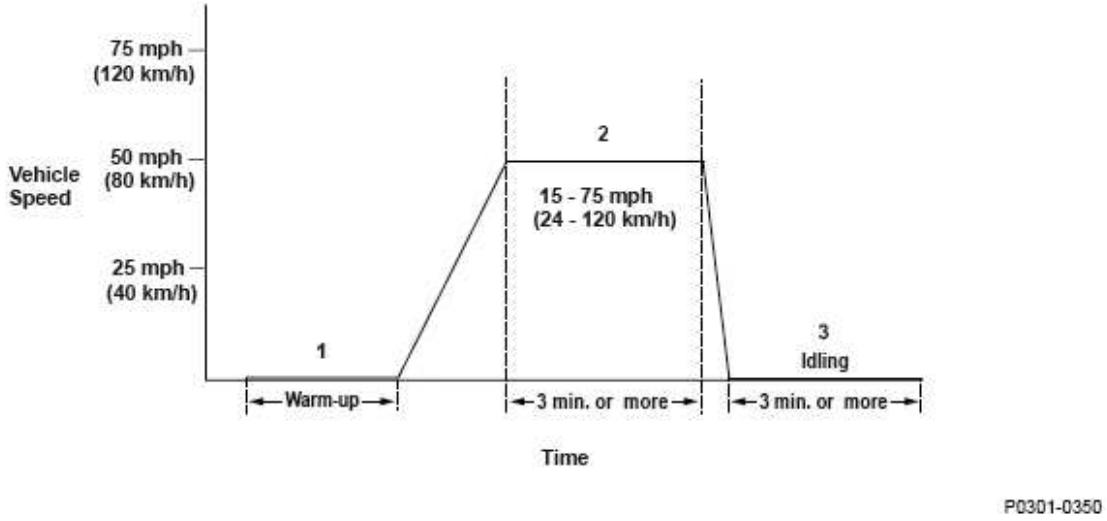



**Fig. 53: Driving Pattern - Graph**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 15 - 75 mph (24 - 120 km/h) for at least 3 minutes.
3. Stop the vehicle, and let the engine idle for at least 3 minutes.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Patterns 2 or 3.
- When you have difficulty duplicating the DTC because of road conditions and traffic situations, repeat the driving pattern several times.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

Misfire Type 1: Under high rpm or high load conditions: The MIL blinks once per second if a type 1 misfire (catalyst damaging) occurs, and a Temporary DTC is stored. If the type 1 misfire ceases, the MIL goes off. If a type 1 misfire occurs during the next (second) drive cycle, the MIL blinks at the first misfire occurrence, and the DTC and the freeze frame data are stored. The MIL remains on steady if the type 1 misfire ceases.

Under normal driving conditions: The MIL blinks once per second if a type 1 misfire occurs a third time, and a Temporary DTC is stored. If a type 1 misfire occurs during the next (second) drive cycle, the MIL blinks during the third type 1 misfire occurrence, and the DTC and the freeze frame data are stored. If the type 1 misfire ceases, the MIL remains on steady.

Misfire Type 2: When a type 2 misfire (emission-related but not severe enough to immediately damage the TWC) occurs within the first 1,000 engine revolutions after engine start-up, a Temporary DTC is stored.

If a type 2 misfire occurs after the first 1,000 engine revolutions after engine start-up, a Temporary DTC is stored during the fourth type 2 misfire occurrence.

If a type 2 misfire occurs during the next (second) drive cycle, the MIL comes on, and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0325 (23): ADVANCED DIAGNOSTICS

### DTC P0325: KNOCK SENSOR CIRCUIT MALFUNCTION

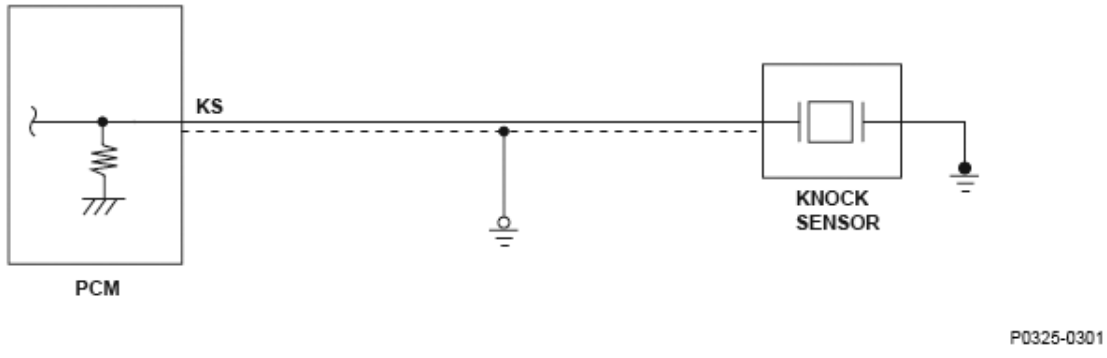



**Fig. 54: Knock Sensor Circuit Diagram**

**General Description**

The knock sensor is mounted on the engine block and detects engine knocking. The vibrations caused by the knocking are converted into electrical signals through the piezo ceramic element. The powertrain control module (PCM) controls the ignition timing based on the electrical signals. If the signals from the knock sensor do not vary for a set time, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 2,000 rpm | - |
| Engine coolant temperature | 140°F (60°C) | - |
| No active DTCs | P0117, P0118 | |

**Malfunction Threshold**

No signals from the knock sensor are detected for at least 5 seconds.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Hold the engine speed at 3,000 - 4,000 rpm for at least 60 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0335 (4): ADVANCED DIAGNOSTICS

**DTC P0335: CRANKSHAFT POSITION (CKP) SENSOR A NO SIGNAL**

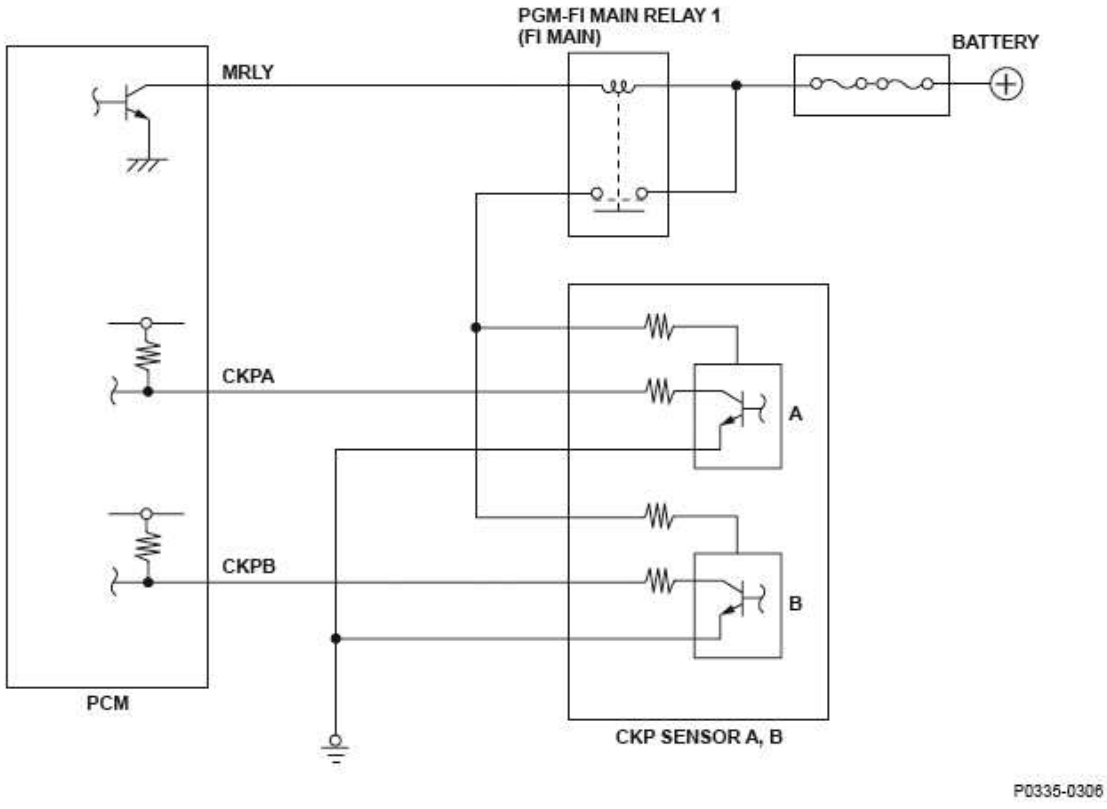



**Fig. 55: Crankshaft Position (CKP) Sensor A No Signal Circuit Diagram**

**General Description**

Crankshaft position (CKP) sensor A consists of a rotor and a semiconductor that detects rotor position. When the engine starts, the rotor turns and the magnetic flux in the semiconductor changes. The changes of magnetic flux are converted into pulsing signals to the powertrain control module (PCM). CKP sensor A detects injection/ignition timing for each cylinder and engine speed.

If no pulsing signals are detected from CKP sensor A, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | - |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0385, P0389 |

**Malfunction Threshold**

No signals from CKP sensor A are detected while signals from CKP sensor B are detected 127 times in succession.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0339 (4): ADVANCED DIAGNOSTICS

### DTC P0339: CRANKSHAFT POSITION (CKP) SENSOR A INTERMITTENT INTERRUPTION

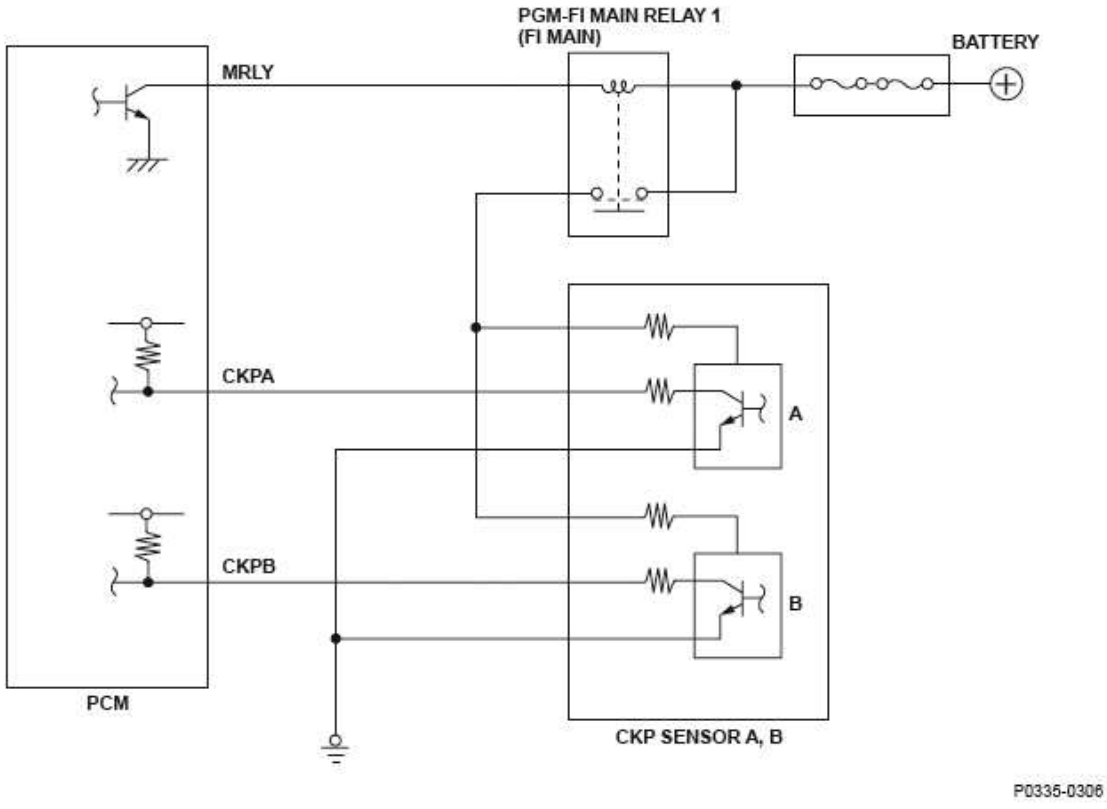



**Fig. 56: Crankshaft Position (CKP) Sensor A Intermittent Interruption Circuit Diagram**

**General Description**

Crankshaft position (CKP) sensor A consists of a rotor and a semiconductor that detects rotor position. When the engine starts, the rotor turns and the magnetic flux in the semiconductor changes. The changes of magnetic flux are converted into pulsing signals to the powertrain control module (PCM). CKP sensor A detects injection/ignition timing for each cylinder and engine speed.

If an abnormal amount of pulsing signals are detected from CKP sensor A, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | - |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |

**Malfunction Threshold**

Other than 22 pulses are detected during intervals between reference pulses for each crankshaft revolution. This condition has been detected at least 30 times.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0340 (9): ADVANCED DIAGNOSTICS

**DTC P0340: CAMSHAFT POSITION (CMP) SENSOR NO SIGNAL**

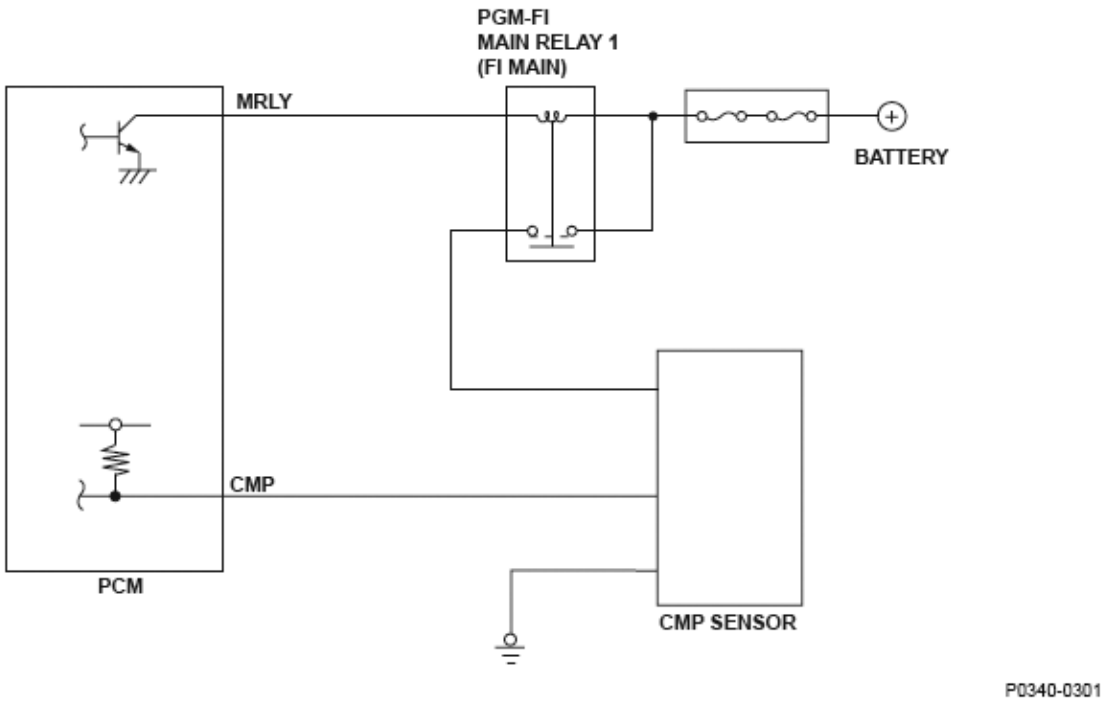



**Fig. 57: Camshaft Position (CMP) Sensor No Signal Circuit Diagram**

**General Description**

The camshaft position (CMP) sensor detects the intake camshaft timing and sends pulsing signals to the powertrain control module (PCM). The PCM determines the camshaft position according to the signals from the crankshaft position (CKP) sensor and the CMP sensor. If no pulsing signals are detected from the CMP sensor, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | - |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0335, P0339, P0344 |

**Malfunction Threshold**

No signals from CMP sensor A are detected while signals from the CKP sensor are detected 352 times in succession.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0344 (9): ADVANCED DIAGNOSTICS

## DTC P0344: CAMSHAFT POSITION (CMP) SENSOR INTERMITTENT INTERRUPTION

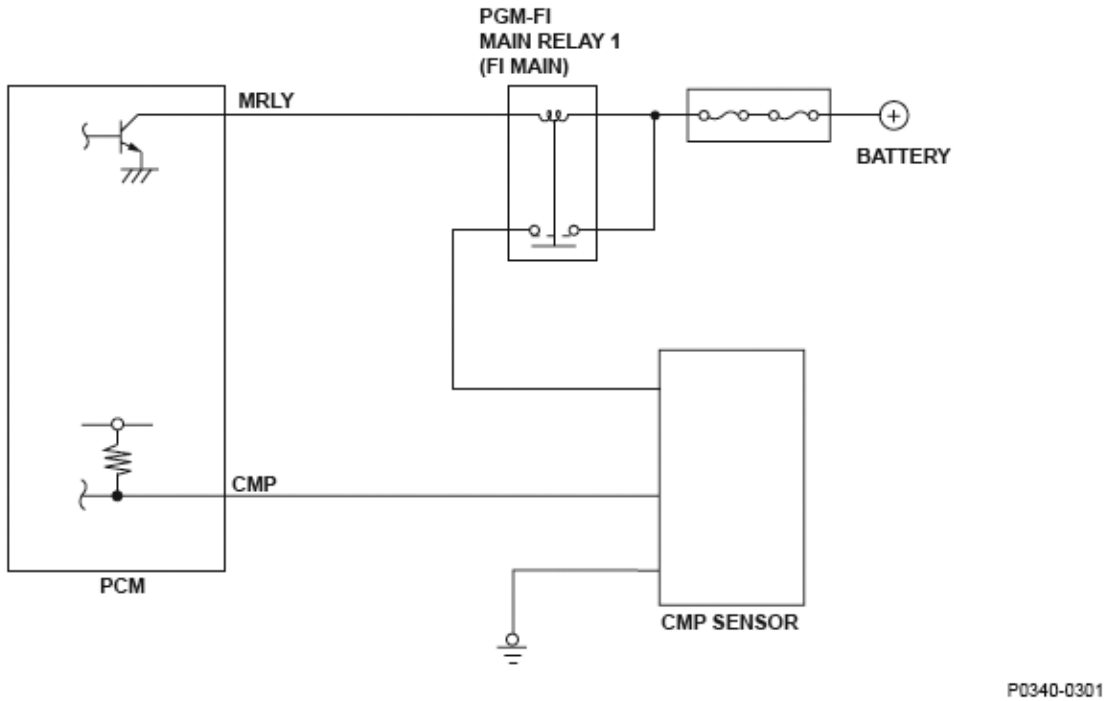



**Fig. 58: Camshaft Position (CMP) Sensor Intermittent Interruption Circuit Diagram**

**General Description**

The camshaft position (CMP) sensor detects the intake camshaft timing and sends pulsing signals to the powertrain control module (PCM). The PCM determines the camshaft position according to the signals from the crankshaft position (CKP) sensor and the CMP sensor. If the number of pulsing signals from the CMP sensor during intervals between the CKP standard pulses is more or less than the proper number, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | - |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0335, P0339, P0340 |

**Malfunction Threshold**

More or less than two CMP sensor pulses are detected during intervals between the CKP standard pulses. This condition occurs at least 30 times.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0385 (54): ADVANCED DIAGNOSTICS

**DTC P0385: CRANKSHAFT POSITION (CKP) SENSOR B NO SIGNAL**

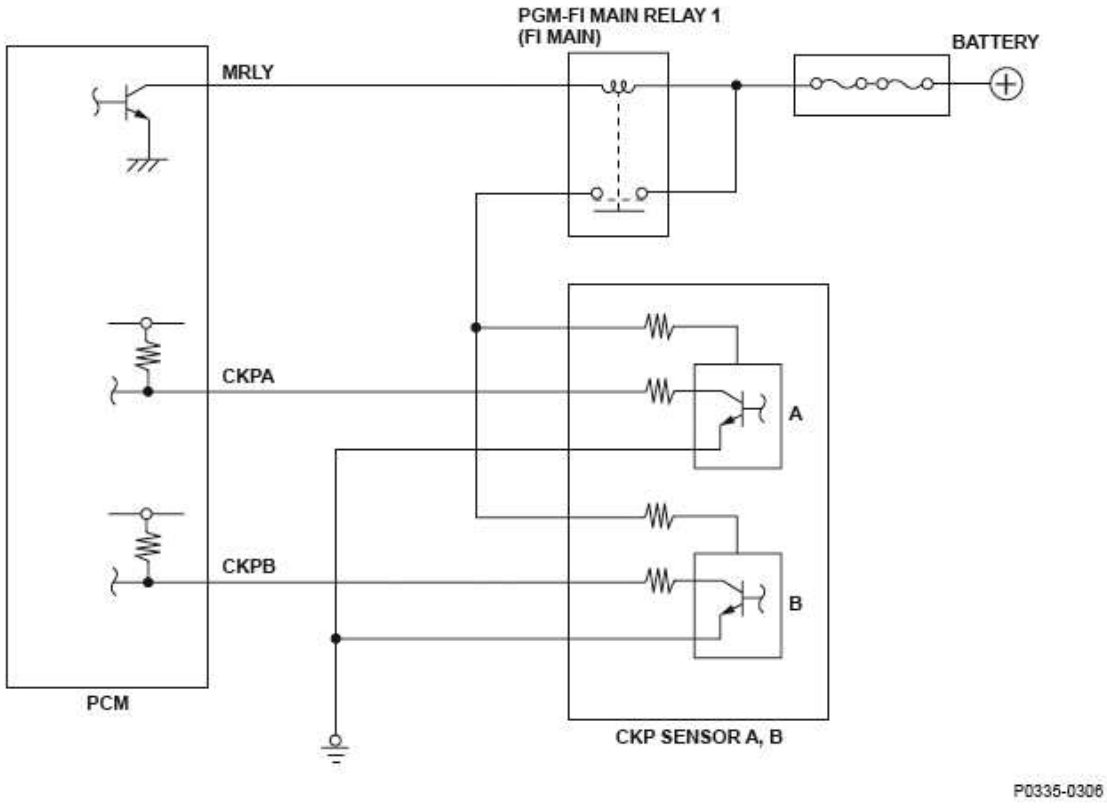



**Fig. 59: Crankshaft Position (CKP) Sensor B No Signal Circuit Diagram**

**General Description**

Crankshaft position (CKP) sensor B consists of a rotor and a semiconductor that detects rotor position. When the engine starts, the rotor turns and the magnetic flux in the semiconductor changes. The changes of magnetic flux are converted into pulsing signals to the powertrain control module (PCM). CKP sensor B detects injection/ignition timing for each cylinder and engine speed.

If no pulsing signals are detected from CKP sensor B, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | - |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0335, P0339 |

**Malfunction Threshold**

No signals from CKP sensor B are detected while signals from CKP sensor A are detected 352 times in succession.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0389 (54): ADVANCED DIAGNOSTICS

## DTC P0389: CRANKSHAFT POSITION (CKP) SENSOR B INTERMITTENT INTERRUPTION

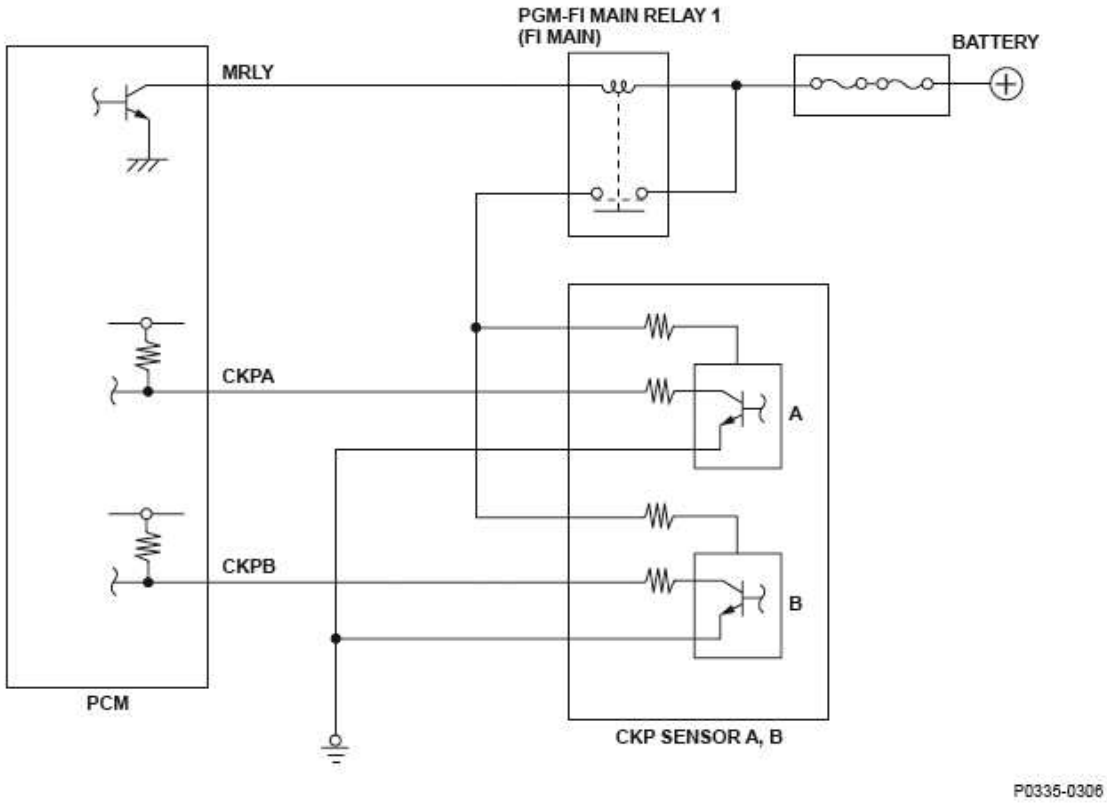



**Fig. 60: Crankshaft Position (CKP) Sensor B Intermittent Interruption Circuit Diagram**

**General Description**

Crankshaft position (CKP) sensor B consists of a rotor and a semiconductor that detects rotor position. When the engine starts, the rotor turns and the magnetic flux in the semiconductor changes. The changes of magnetic flux are converted into pulsing signals to the powertrain control module (PCM). CKP sensor B detects injection/ignition timing for each cylinder and engine speed.

If an abnormal amount of pulsing signals are detected from CKP sensor B, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | - |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |

**Malfunction Threshold**

Other than 22 pulses are detected during intervals between reference pulses for each crankshaft revolution. This condition has been detected at least 30 times.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0401 (80): ADVANCED DIAGNOSTICS

## DTC P0401: EXHAUST GAS RECIRCULATION (EGR) INSUFFICIENT FLOW

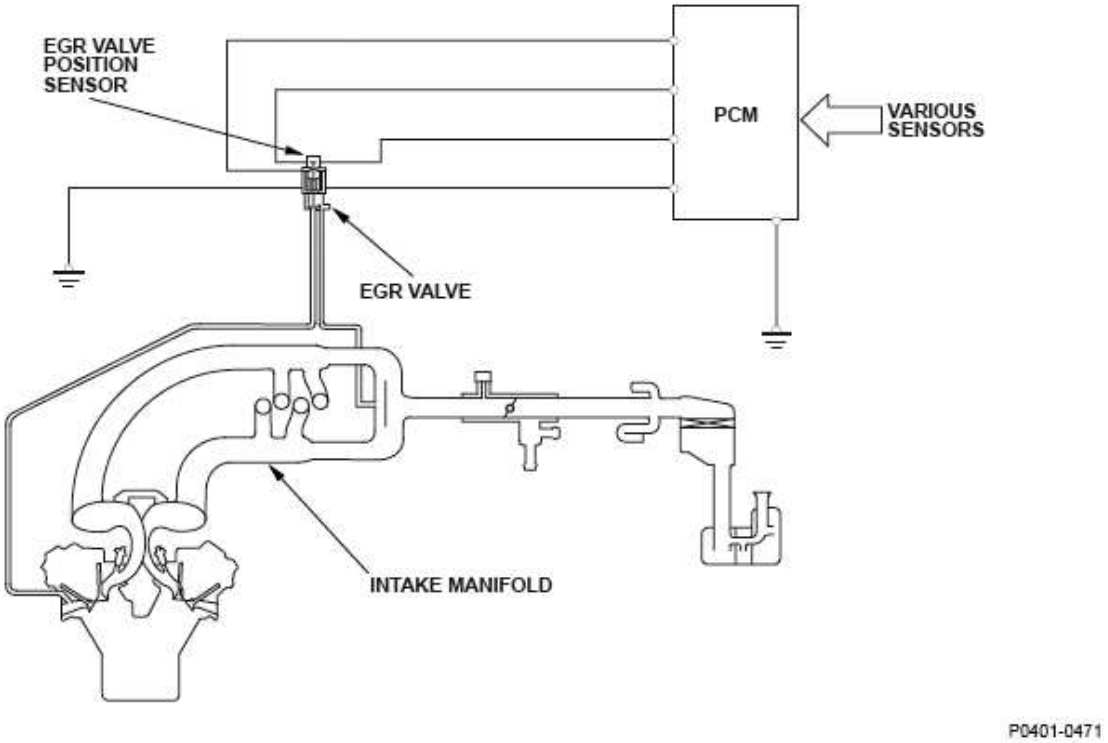



**Fig. 61: Exhaust Gas Recirculation (EGR) Insufficient Flow Diagram**

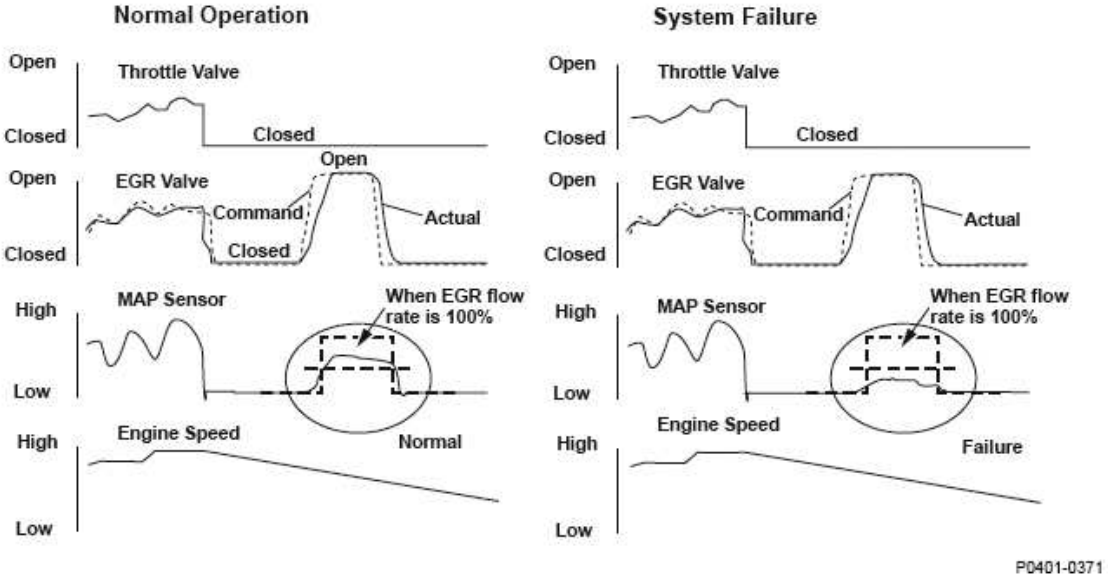



**Fig. 62: Exhaust Gas Recirculation Valve Operation Graph**

**General Description**

The exhaust gas recirculation (EGR) valve is controlled by the powertrain control module (PCM). When the valve is opened, the exhaust gas flows from the exhaust manifold to the intake manifold through the EGR system. It is mixed with the air/fuel mixture to be drawn into the combustion chamber to lower peak

combustion temperature to reduce NOx.

The EGR flow is inspected as follows. The EGR valve is closed during deceleration with the throttle valve fully closed. Then the PCM fully opens the EGR valve. After a set time, the PCM computes the ratio of the present EGR flow to the normal EGR flow by monitoring the fluctuation of the intake manifold pressure between when the EGR valve is fully opened and when it is fully closed. If the EGR flow rate is lower than normal, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | "EGR valve insufficient lift" P0404, P2413 is OK |
| Duration | 3 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Engine speed | 1,100 rpm | 2,300 rpm |
| MAP value | 14 kPa (4.0 in.Hg, 100 mmHg) | - |
| Vehicle speed | 30 mph (48 km/h) | - |
| Battery voltage | 10.5 V | - |
| Throttle position | Fully closed | |
| Fuel feedback | During deceleration | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0134, P0135, P0154, P0155, P0222, P0223, P0335, P0339, P0403, P0404, P0406, P0443, P0496, P0506, P0507, P0641, P0651, P0657, P1077, P1078, P1109, P1128, P1129, P1172, P1174, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2279, P2413, P2627, P2628, P2630, P2631, P2646, P2647, P2648, P2649, U0107 | |

**Malfunction Threshold**

The ratio of the current EGR flow to the normal EGR flow is 15 % or less.

The difference between the MAP value before and after the Enable Conditions are met is no more than the values in the table. The change in pressure should occur for at least 3 seconds.

**MALFUNCTION THRESHOLD**

| Engine speed | Barometric pressure | |
|---|---|---|
| | 62 kPa (18.2 in.Hg, 460 mmHg) | 102 kPa (30.0 in.Hg, 760 mmHg) |
| 1,100 rpm | 9 kPa (2.8 in.Hg, 72 mmHg) | 14 kPa (4.3 in.Hg, 110 mmHg) |
| 2,000 rpm | 4 kPa (1.4 in.Hg, 35 mmHg) | 8 kPa (2.4 in.Hg, 61 mmHg) |

**Confirmation Procedure with the HDS**

Do the EGR TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

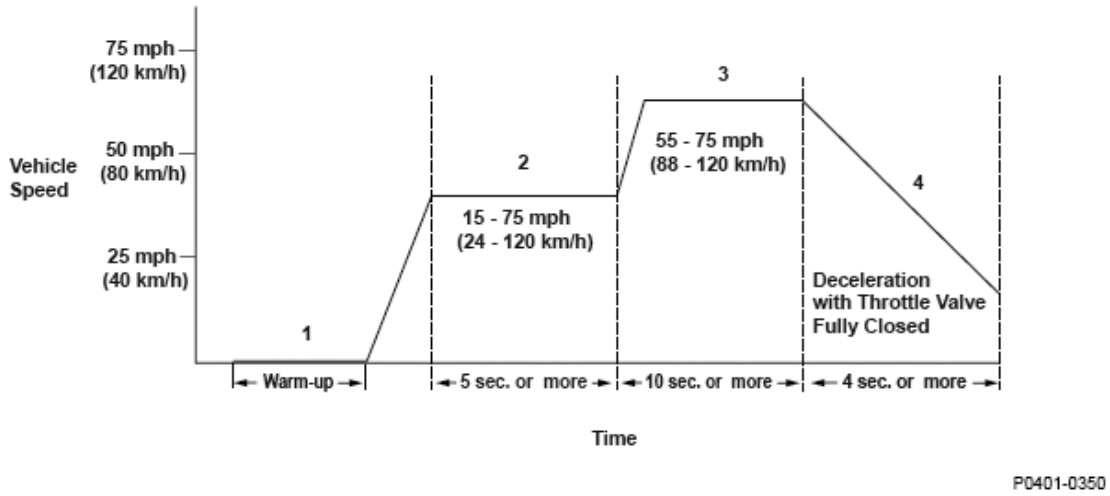



**Fig. 63: Vehicle Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 15 - 75 mph (24 - 120 km/h) for at least 5 seconds.
3. Then, drive at a steady speed between 55 - 75 mph (88 - 120 km/h) for at least 10 seconds.
4. Decelerate with the throttle valve fully closed for at least 4 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze

frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0403 (12): ADVANCED DIAGNOSTICS

## DTC P0403: EXHAUST GAS RECIRCULATION (EGR) CONTROL CIRCUIT MALFUNCTION

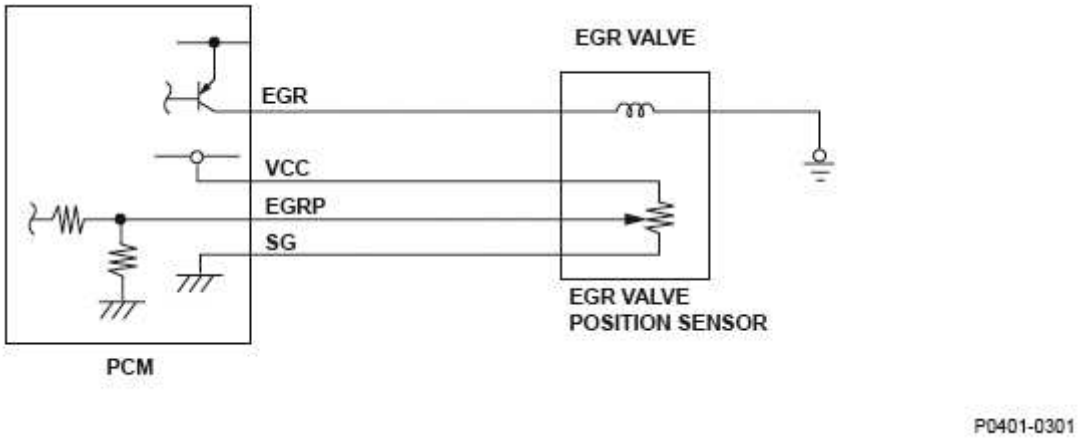



**Fig. 64: Exhaust Gas Recirculation (EGR) Control Circuit Diagram**

**General Description**

The exhaust gas recirculation (EGR) system re-burns the exhaust gas by recirculating a some of it into the induction system in order to reduce oxides of nitrogen (NOx).

The powertrain control module (PCM) controls the recirculation of the exhaust gas by controlling the opening and closing of the EGR valve.

The PCM reads the return signal of the EGR valve control signal output, and when the return signal against the EGR valve control signal does not change and this condition continues for a certain time, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |

| | |
|---|---|
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |
| EGR valve output duty | 2% | 98% |
| State of the engine | Running | |

**Malfunction Threshold**

The return signal against the EGR valve control output does not change for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0404 (12): ADVANCED DIAGNOSTICS

**DTC P0404: EXHAUST GAS RECIRCULATION (EGR) CONTROL CIRCUIT RANGE/PERFORMANCE PROBLEM**

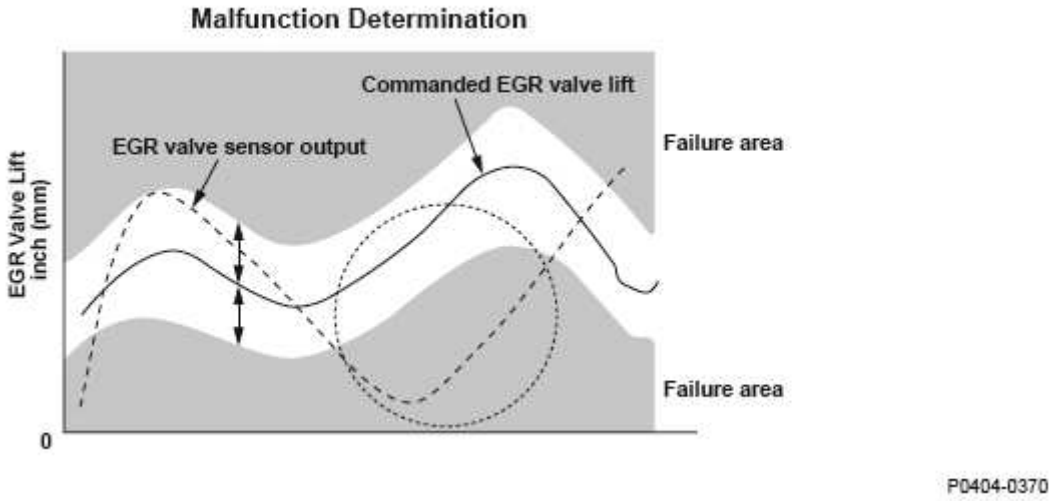



**Fig. 65: Exhaust Gas Recirculation Valve Lift Graph**

**General Description**

The exhaust gas recirculation (EGR) valve, which is controlled by the powertrain control module (PCM), is opened and the exhaust gas flows from the exhaust manifold through the EGR valve and the intake manifold and the EGR passage. The exhaust gas is circulated into the air/fuel mixture and the mixture is drawn into the combustion chamber to lower combustion temperatures, thus reducing oxides of nitrogen (NOx) emissions.

A sensor (lift sensor) is built into the EGR valve and detects the amount of valve lift. The command value for the target valve lift is stored in the PCM so that exhaust gas recirculation can be optimized according to driving conditions.

Comparing this command value with the lift sensor output signal value, the PCM controls the EGR valve to make the amount of actual valve lift equal to the command value.

If the lift sensor output (actual valve lift) is greater than the commanded valve lift, an abnormality in the EGR valve or the lift sensor output is determined.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | - | 4,000 rpm |
| Battery voltage | 10.5 V | - |
| Commanded EGR valve lift | 0.012 in. (0.30 mm) | - |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0134, P0135, P0154, P0155, P0335, P0339, P0401, P0403, P0406, P0641, P0651, P0657, P1128, P1129, P1172, P1174, P2195, P2197, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2627, P2628, P2630, P2631 | |

**Malfunction Threshold**

The difference between the command value of the amount of EGR valve lift in the PCM and the actual amount of valve lift is 0.041 in. (1.020 mm) or more for at least 5 seconds.

**Confirmation Procedure with the HDS**

Do the EGR TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 15 - 75 mph (24 - 120 km/h) for at least 5 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0406 (12): ADVANCED DIAGNOSTICS

**DTC P0406: EXHAUST GAS RECIRCULATION (EGR) VALVE POSITION SENSOR CIRCUIT**

## HIGH VOLTAGE

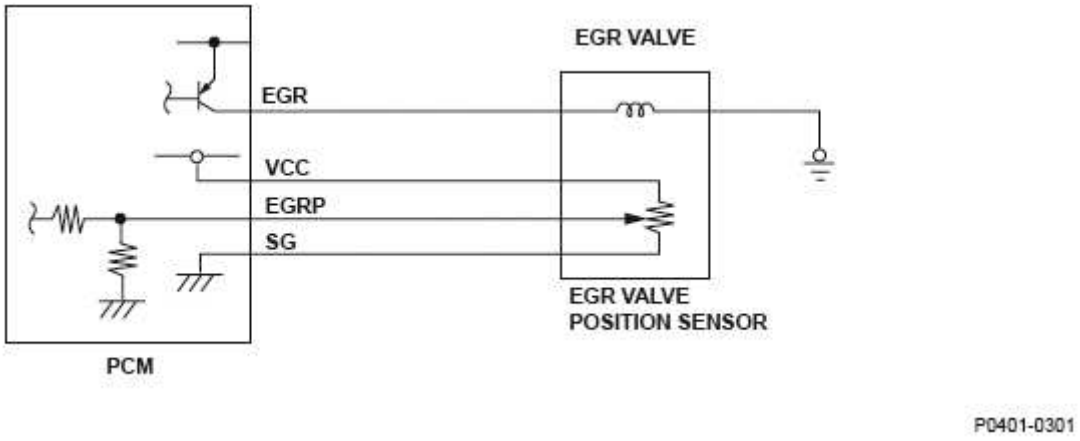



**Fig. 66: Exhaust Gas Recirculation (EGR) Valve Position Sensor Circuit Diagram**

**General Description**

The exhaust gas recirculation (EGR) system reduces oxides of nitrogen (NOx). NOx is generated by high combustion temperatures. The EGR system lowers peak combustion temperature by recirculating exhaust gas into the air/fuel mixture, thus reducing NOx emissions. To determine the optional amount of recirculating exhaust gas depending on driving conditions, a command value (the amount of valve lift) is stored in the powertrain control module (PCM). The EGR valve position sensor indicates the amount of valve lift, and the PCM controls the EGR valve so that the amount of actual valve lift equals the command value.

If the EGR valve position sensor output signal voltage is not within a specified value, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |

**Malfunction Threshold**

The EGR valve position sensor output voltage is 4.88 V or more for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0420 (165): ADVANCED DIAGNOSTICS

## DTC P0420: REAR BANK CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

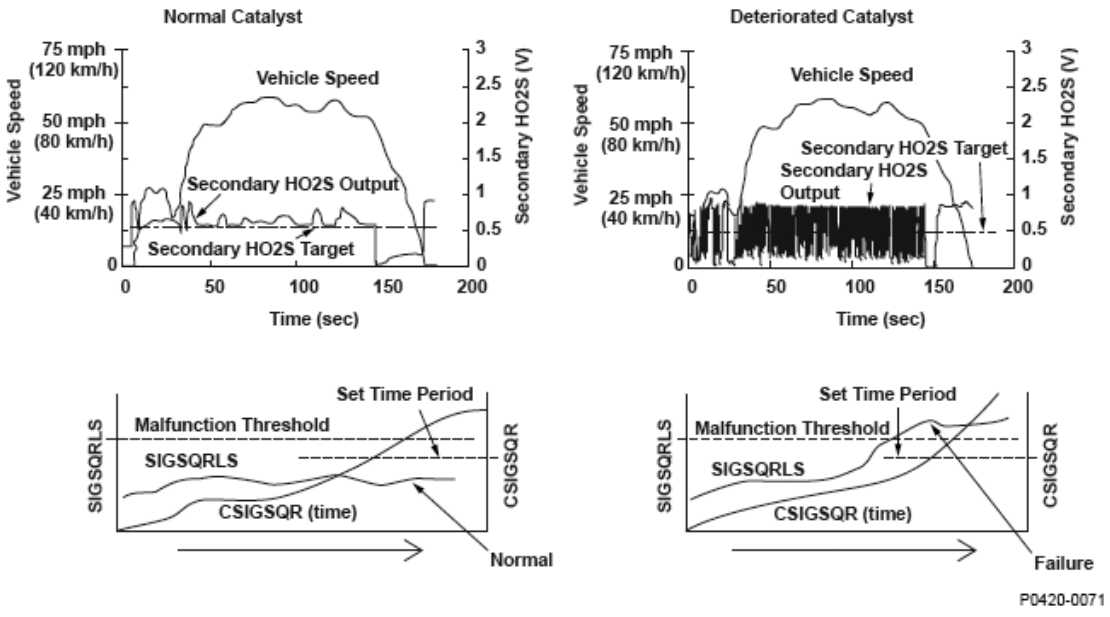



**Fig. 67: Catalyst System Efficiency Voltage And Time - Graph**

**General Description**

The three way catalytic converter (TWC) converts hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) in the exhaust gas to water vapor, carbon dioxide (CO2), and dinitrogen (N2).

The TWC efficiency does not depend entirely on engine conditions or the deterioration level of the TWC. It can

be optimized by stabilizing the secondary HO2S output.

If the TWC deteriorates, the air/fuel ratio downstream of the TWC (the secondary HO2S output) often differs from the target secondary HO2S output, and the status is represented by the parameter (SIGSQRLS).

Therefore, if the SIGSQRLS exceeds a specified value for a set time, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 102 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Estimated TWC temperature | 932°F (500°C) | - |
| Engine speed | 1,150 rpm | 2,100 rpm |
| MAP value | 22 kPa (6.3 in.Hg, 160 mmHg) | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Vehicle speed | 4 mph (5 km/h) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| Monitoring priority | P0456, P0457, P0497 | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0133, P0134, P0135, P0137, P0138, P0139, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1172, P2195, P2227, P2228, P2229, P2237, P2238, P2243, P2245, P2251, P2252, P2270, P2271, P2413, P2627, P2628, P2646, P2647, P2648, P2649, P2A00 | |

**Malfunction Threshold**

The number of detections is 736 (CTAGLT67) or more.

**Driving Pattern**

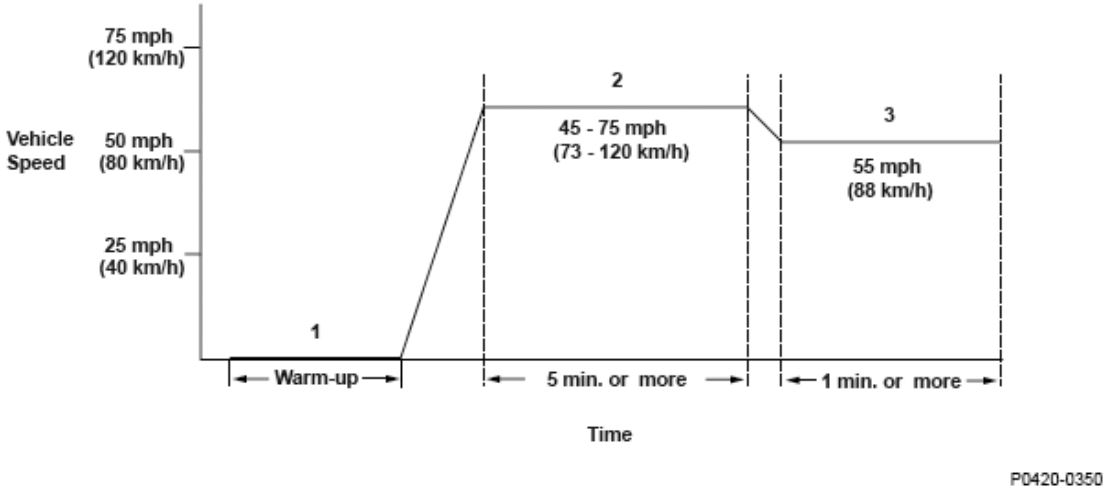



**Fig. 68: Vehicle Speed Driving Pattern - Graph**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 45 - 75 mph (73 - 120 km/h) for at least 5 minutes, to warm up the TWC.
3. Set a vehicle speed of 55 mph (88 km/h) on the cruise control, and drive for at least 1 minute.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0430 (166): ADVANCED DIAGNOSTICS

## DTC P0430: FRONT BANK CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 2)

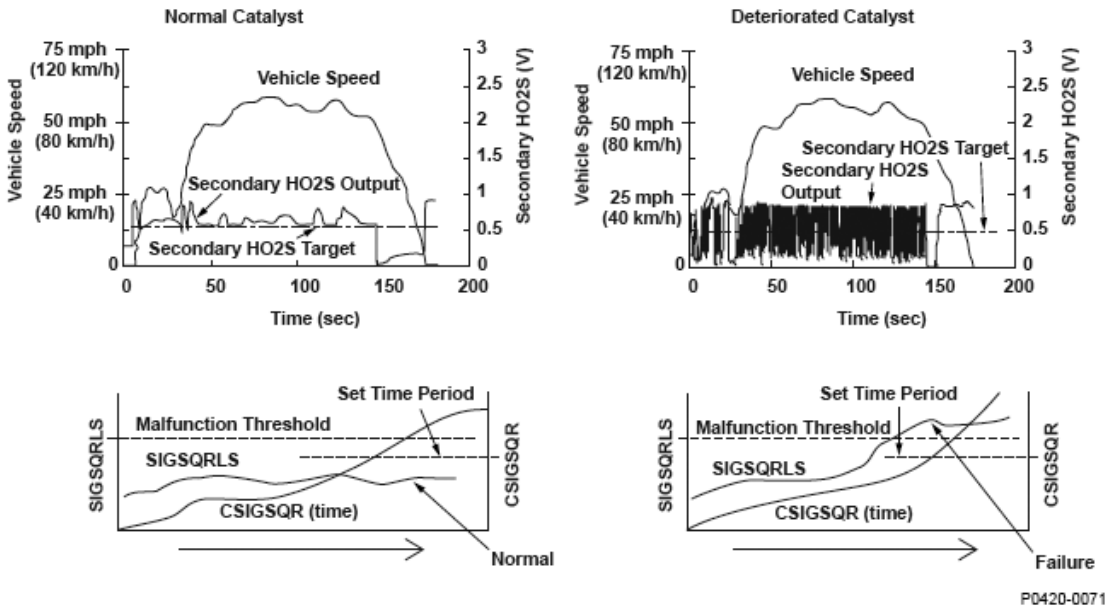



**Fig. 69: Catalyst System Efficiency - Graph**

**General Description**

The three way catalytic converter (TWC) converts hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) in the exhaust gas to water vapor, carbon dioxide (CO2), and dinitrogen (N2).

The TWC efficiency does not depend entirely on engine conditions or the deterioration level of the TWC. It can be optimized by stabilizing the secondary HO2S output.

If the TWC deteriorates, the air/fuel ratio downstream of the TWC (the secondary HO2S output) often differs from the target secondary HO2S output, and the status is represented by the parameter (SIGSQRLS).

Therefore, if the SIGSQRLS exceeds a specified value for a set time, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 102 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Estimated TWC temperature | 932°F (500°C) | - |
| Engine speed | 1,150 rpm | 2,100 rpm |
| MAP value | 22 kPa (6.3 in.Hg, 160 mmHg) | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Vehicle speed | 4 mph (5 km/h) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| Monitoring priority | P0456, P0457, P0497 | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0153, P0154, P0155, P0157, P0158, P0159, P0161, P0174, P0175, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1109, P1128, P1129, P1174, P2197, P2227, P2228, P2229, P2240, P2241, P2247, P2249, P2254, P2255, P2272, P2273, P2413, P2630, P2631, P2646, P2647, P2648, P2649, P2A03 | |

**Malfunction Threshold**

The number of detections is 624 (CTAGLT68) or more.

**Driving Pattern**

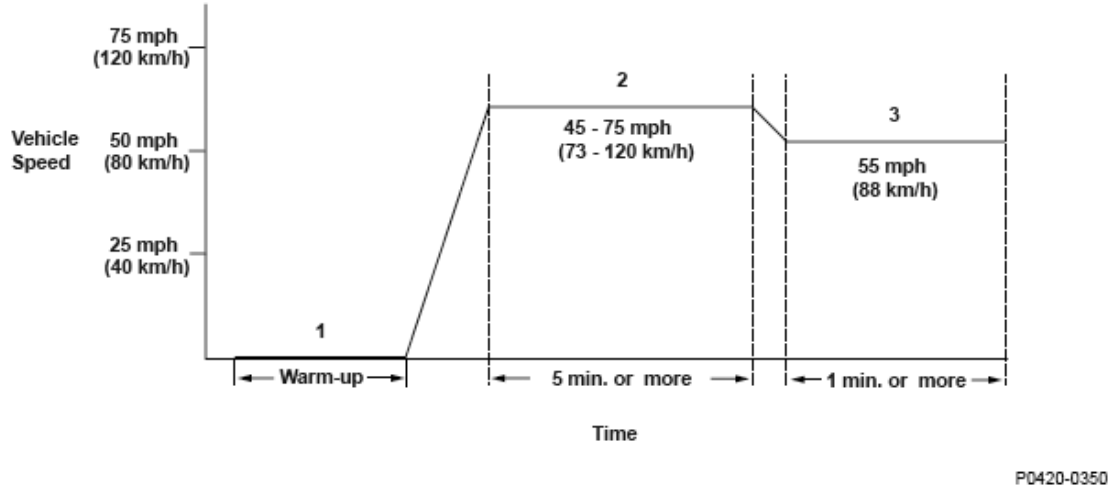



**Fig. 70: Driving Pattern - Graph**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 45 - 75 mph (73 - 120 km/h) for at least 5 minutes, to warm up the TWC.
3. Set a vehicle speed of 55 mph (88 km/h) on the cruise control, and drive for at least 1 minute.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0443 (92): ADVANCED DIAGNOSTICS

## DTC P0443: EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE CIRCUIT MALFUNCTION

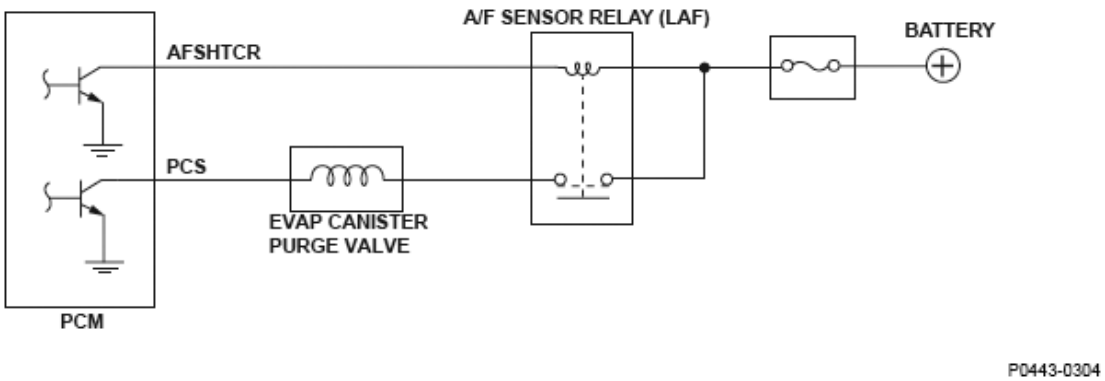



**Fig. 71: Evaporative Emission (EVAP) Canister Purge Valve Circuit Diagram**

**General Description**

The evaporative emission (EVAP) canister purge valve is attached to the vacuum port between the EVAP canister and the intake manifold.

The powertrain control module (PCM) does not turn on the EVAP canister purge valve when the engine coolant temperature is 149°F (65°C) or less.

The PCM adjusts the amount of fuel vapor sent to the engine by controlling the EVAP canister purge valve duty cycle.

When the return signal does not change according to the EVAP canister purge valve duty cycle for a set time, the PCM detects a malfunction, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.1 V | - |
| EVAP canister purge valve output duty | 2 % | 98 % |
| State of the engine | Running | |

**Malfunction Threshold**

The return signal does not change according to the EVAP canister purge valve output for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0451 (91): ADVANCED DIAGNOSTICS

## DTC P0451: FUEL TANK PRESSURE (FTP) SENSOR RANGE/PERFORMANCE PROBLEM

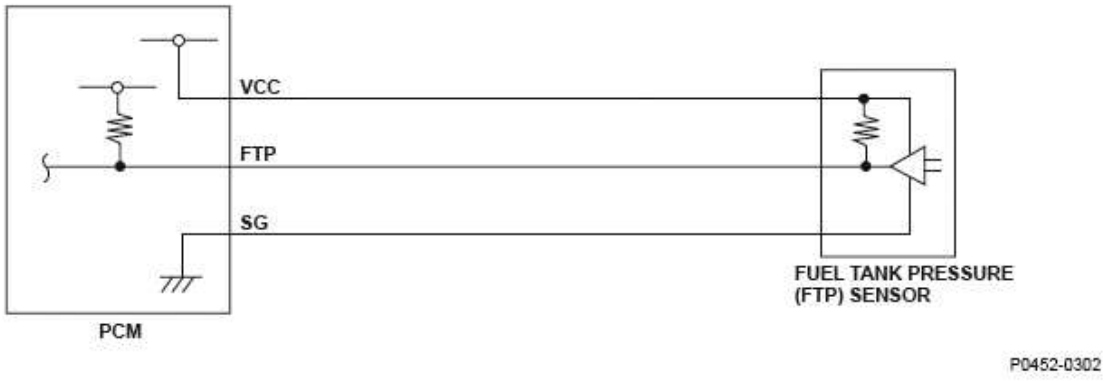



**Fig. 72: Fuel Tank Pressure (FTP) Sensor Circuit Diagram**

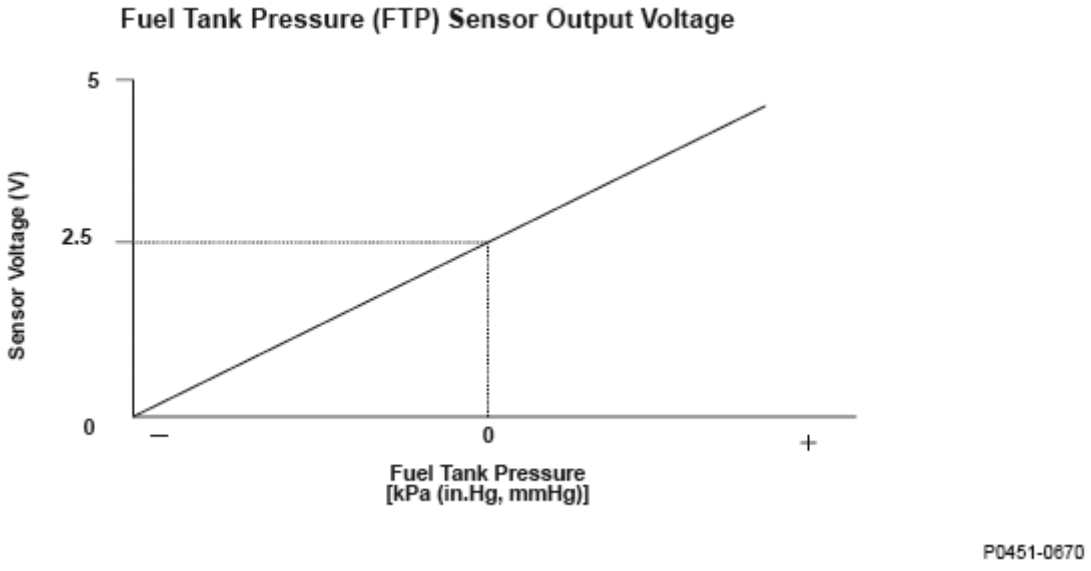



**Fig. 73: Fuel Tank Pressure (FTP) Sensor Voltage - Graph**

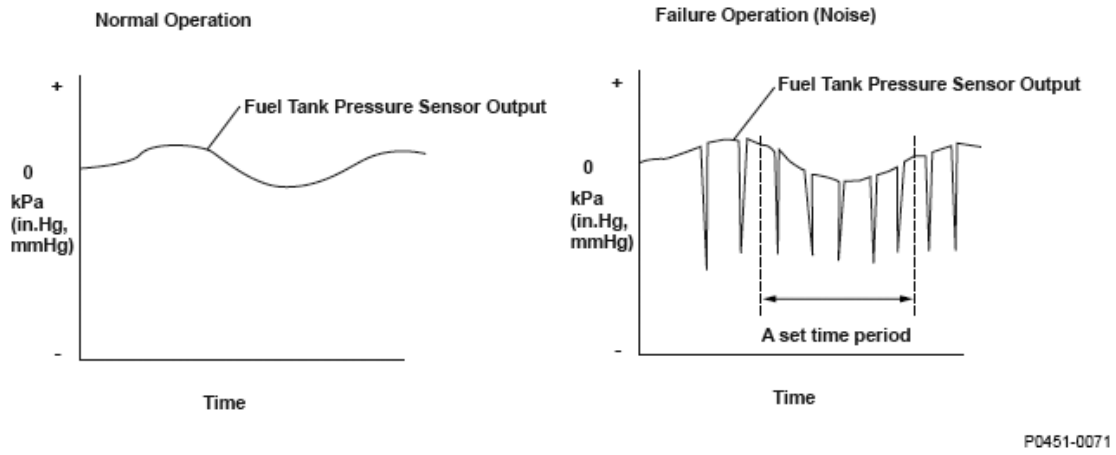



**Fig. 74: Fuel Tank Pressure - Graph**

**General Description**

The fuel tank pressure (FTP) sensor is installed on the evaporative emission (EVAP) canister. The FTP sensor is used to detect leaks in the EVAP system. The powertrain control module (PCM) monitors the FTP sensor output voltage. The FTP sensor output voltage rises as the fuel tank pressure increases. Conversely, the FTP sensor output voltage drops as the fuel tank pressure decreases. Rapid changes in the FTP sensor output voltage due to electrical noise or an intermittent open during the EVAP leak detection may cause incorrect leak detection, so abnormal output is monitored.

If the FTP sensor output voltage changes a specified number of times within a set time, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 20 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time after starting the engine | 2 seconds | - |
| Throttle position | Fully closed | |
| No active DTCs | P0122, P0123, P0222, P0223, P0452, P0452, P0453, P0453, P0641, P0651, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, | |

| | |
|---|---|
| | U0107 |

**Malfunction Threshold**

The FTP sensor output fluctuates by 0.3 kPa (0.1 in.Hg, 2 mmHg) or more at least five times within 3 seconds.

**Driving Pattern**

Start the engine in a cold condition, and let it idle for at least 20 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0455 (90): ADVANCED DIAGNOSTICS

## DTC P0455: EVAPORATIVE EMISSION (EVAP) SYSTEM LARGE LEAK DETECTED

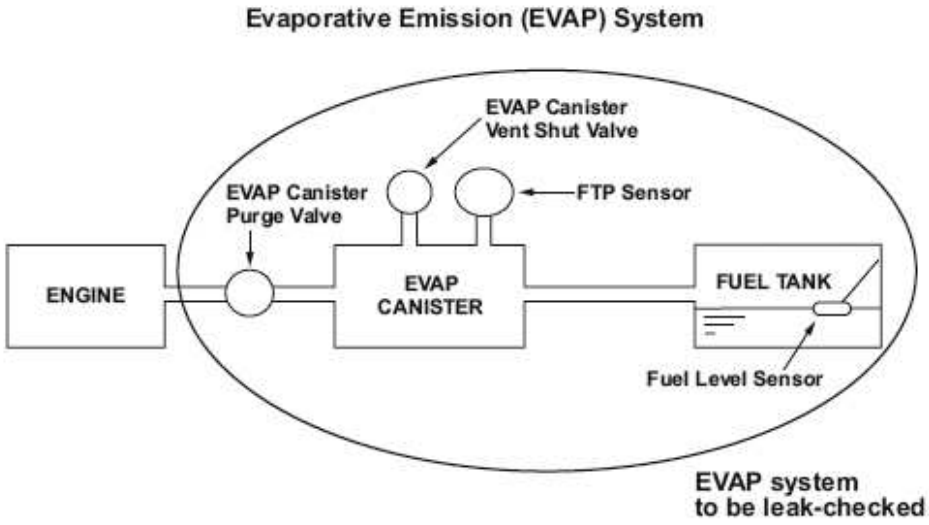


**Fig. 75: Evaporative Emission (EVAP) System Diagram**

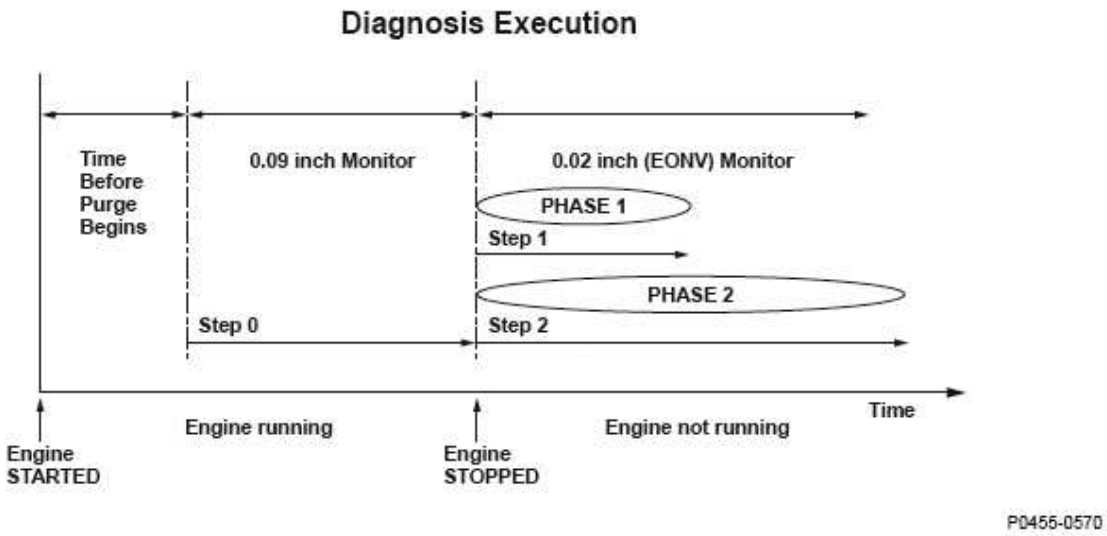



**Fig. 76: Evaporative Emission (EVAP) System - Diagnosis Execution**

**General Description**

The evaporative emission (EVAP) leak detection system uses a vacuum-retention (decompression) method and an engine off natural vacuum (EONV) method. This method detects leakage by monitoring the vacuum-retention ability of the EVAP system (from EVAP canister purge valve to fuel tank). The EONV method detects leakage from the change in fuel tank pressure via the fuel tank pressure (FTP) sensor with the engine off.

Here is an overview of the malfunction detection for the EONV method:

Step 0: Judgement of detection of 0.09 inch leak as normal operation < decompressing monitor >

Step 1: Judgement of detection of 0.02 inch leak as normal operation < phase 1 >

Step 2: Detection of 0.02 inch leak < phase 2 >

Step 0:

Once required conditions for the monitor are met, the powertrain control module (PCM) applies vacuum to the EVAP system line from the purge control solenoid (PCS) valve through the fuel tank, and monitors the variation of the FTP sensor output to detect a "0.09 inch leak".

- If a "0.09 inch leak" is detected, it is identified as a malfunction; the diagnosis is complete.
- If "no 0.09 inch leak" is detected, the PCM goes to step 1, judgement of detection of a 0.02 inch leak as normal operation < phase 1 >.
- If sufficient vacuum cannot be drawn on the EVAP system line, it is identified as either "EVAP system low purge flow (P0497)" or "EVAP system leak detected fuel fill cap loose/off (P0457)" (refer to the ).

Step 1:

After the engine has stopped, the PCM monitors the variation of the FTP sensor output to detect "no 0.02 inch leak" depending on the variation corresponding to the increasing pressure inside the fuel tank.

- If "no 0.02 inch leak" is detected, it is identified as normal; the diagnosis is complete.
- If "no 0.02 inch leak" is not detected, the PCM goes to step 2, detection of a 0.02 inch leak < phase 2 >.

Step 2:

The PCM continues to monitor the FTP sensor output to detect "no 0.02 inch leak" depending on the variation corresponding to the decreasing pressure inside the fuel tank.

- If a "0.02 inch leak" is detected, it is identified as a malfunction; the diagnosis is complete.
- If "no leakage" is detected, it is identified as normal; the diagnosis is complete.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 45 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time before starting the engine | 6 hours | - |
| Initial condition A (1) | - | 18°F (10°C) |
| Initial condition B (2) | - | 18°F (10°C) |
| Initial engine coolant temperature | 40°F (5°C) | 95°F (35°C) |
| Initial intake air temperature | 40°F (5°C) | 95°F (35°C) |
| Engine coolant temperature | 156°F (69°C) | 212°F (100°C) |
| Engine coolant temperature before EVAP purge | 140°F (60°C) | - |

| | | |
|---|---|---|
| control starts | | |
| Vehicle speed | 7 mph (10 km/h) | - |
| Barometric pressure | 76 kPa (22.5 in.Hg, 569 mmHg) | - |
| Battery voltage | 10.5 V | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop at stoichiometric | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0134, P0135, P0154, P0155, P0335, P0339, P0443, P0451, P0452, P0453, P0496, P0498, P0499, P0641, P0651, P0657, P1109, P1116, P1128, P1129, P1172, P1174, P1454, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2422, P2627, P2628, P2630, P2631 | |
| Others | Other than when there is excessive vapor generation (fuel level is not full) | |
| | Avoid abrupt acceleration, deceleration, and turns | |
| | Test-drive on a flat road to avoid misdetection | |
| | No refueling is required | |
| (1) The initial intake air temperature minus the current intake air temperature<br>(2) The initial engine coolant temperature minus the initial intake air temperature | | |

**Malfunction Threshold**

The variation of pressure inside the fuel tank is -2 kPa (-0.4 in.Hg, -9 mmHg) or more.

**Confirmation Procedure with the HDS**

Do the EVAP FUNCTION TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

1. After the vehicle has been left for an appropriate amount of time as specified, with the engine coolant temperature and intake air temperature within the specified range, start the engine.
2. Warm up the engine at idle until the radiator fan comes on.
3. Drive the vehicle immediately at a speed between 45 - 75 mph (72 - 120 km/h) for at least 20 minutes.
4. After stopping the engine, turn the ignition switch off, and leave the vehicle for 32 minutes or more (EONV executes).

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during

the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0456 (90): ADVANCED DIAGNOSTICS

### DTC P0456: EVAPORATIVE EMISSION (EVAP) SYSTEM VERY SMALL LEAK DETECTED

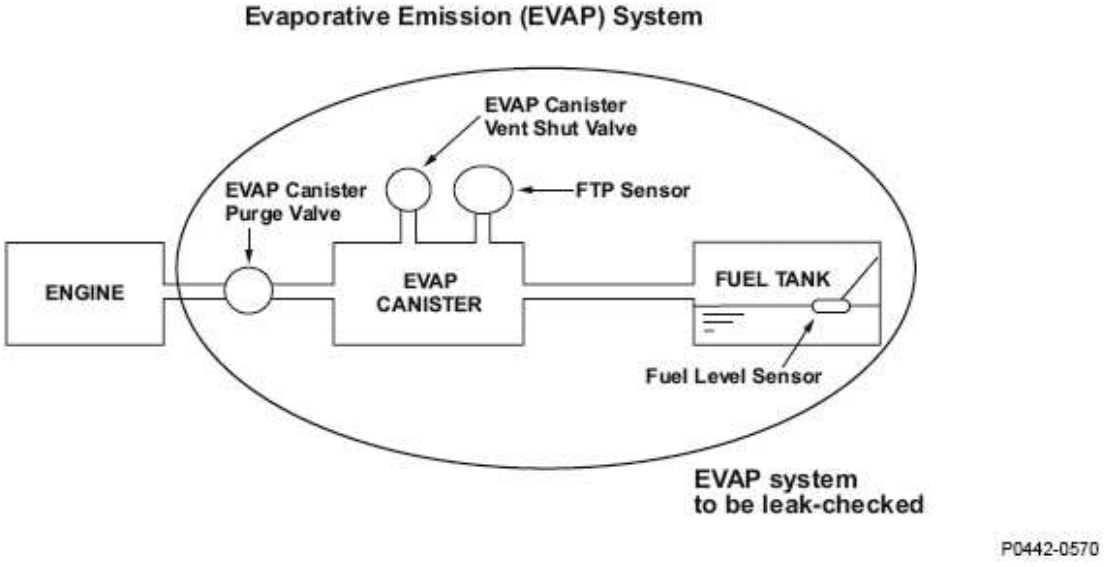



**Fig. 77: Evaporative Emission (EVAP) System Diagram**

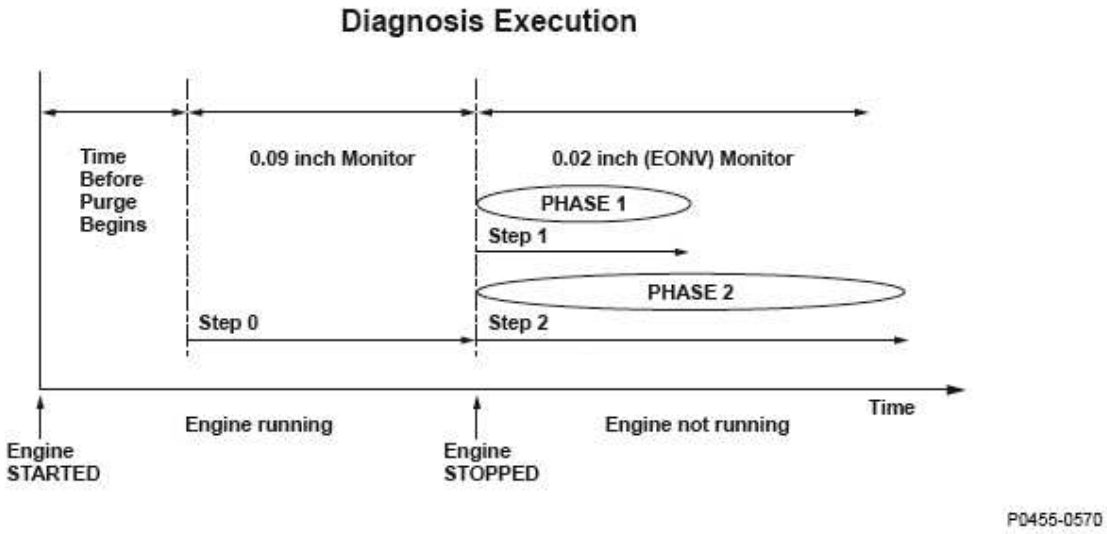



**Fig. 78: Evaporative Emission (EVAP) System - Diagnosis Execution**

**General Description**

The evaporative emission (EVAP) leak detection system uses a vacuum-retention (decompression) method and an engine off natural vacuum (EONV) method. This method detects leakage by monitoring the vacuum-retention ability of the EVAP system (from EVAP canister purge valve to fuel tank). The EONV method detects leakage from the change in fuel tank pressure via the fuel tank pressure (FTP) sensor with the engine off.

Here is an overview of the malfunction detection for the EONV method:

Step 0: Judgement of detection of 0.09 inch leak as normal operation < decompressing monitor >.

Step 1: Judgement of detection of 0.02 inch leak as normal operation < phase 1 >

Step 2: Detection of 0.02 inch leak < phase 2 >

Step 0:

Once required conditions for the monitor are met, the powertrain control module (PCM) applies vacuum to the EVAP system line from the purge control solenoid (PCS) valve through the fuel tank, and monitors the variation of the FTP sensor output to detect a "0.09 inch leak".

- If a "0.09 inch leak" is detected, it is identified as a malfunction; the diagnosis is complete.
- If "no 0.09 inch leak" is detected, the PCM goes to step 1, judgement of detection of a 0.02 inch leak as normal operation < phase 1 >.
- If sufficient vacuum cannot be drawn on the EVAP system line, it is identified as either "EVAP system low purge flow (P0497)" or "EVAP system leak detected fuel fill cap loose/off (P0457)" (refer to the applicable DTC detail).

Step 1:

After the engine has stopped, the PCM monitors the variation of the FTP sensor output to detect "no 0.02 inch leak" depending on the variation corresponding to the increasing pressure inside the fuel tank.

- If "no 0.02 inch leak" is detected, it is identified as normal; the diagnosis is complete.
- If "no 0.02 inch leak" is not detected, the PCM goes to step 2, detection of a 0.02 inch leak < phase 2 >.

Step 2:

The PCM continues to monitor the FTP sensor output to detect "no 0.02 inch leak" depending on the variation corresponding to the decreasing pressure inside the fuel tank.

- If a "0.02 inch leak" is detected, it is identified as a malfunction; the diagnosis is complete.
- If "no leakage" is detected, it is identified as normal; the diagnosis is complete.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | P0455, P0457, P0497 are judged as OK |
| Duration | At least 6 minutes, 27 seconds but not more than 31 minutes, 27 seconds |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time before starting the engine | 6 hours | - |
| Initial condition A (1) | - | 18°F (10°C) |
| Initial condition B (2) | - | 18°F (10°C) |
| Initial engine coolant temperature | 40°F (5°C) | 95°F (35°C) |
| Initial intake air temperature | 40°F (5°C) | 95°F (35°C) |
| Barometric pressure | 76 kPa (22.5 in.Hg, 569 mmHg) | - |
| Battery voltage | 10.5 V | - |
| No active DTCs | P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0443, P0451, P0452, P0453, P0455, P0457, P0496, P0497, P0498, P0499, P0641, P0651, P0657, P0685, P1109, P1116, P1454, P2227, P2228, P2229, P2422, P2610 | |
| | Other than when there is excessive vapor generation (fuel level is not full) | |

| | |
|---|---|
| Others | Avoid abrupt acceleration, deceleration, and turns |
| | Test-drive on a flat road to avoid misdetection |
| | Drive for 1 hour or more |
| | No refueling is required |
| (1) The initial intake air temperature minus the current intake air temperature<br>(2) The initial engine coolant temperature minus the initial intake air temperature | |

**Malfunction Threshold**

The variation of pressure inside the fuel tank after phase 1 is 0.3 kPa (0.1 in.Hg, 2.8 mmHg) or more (depending on fuel level and barometric pressure).

The sum of the variations of pressure inside the fuel tank after phase 1 and phase 2 is 10 kPa (3.1 in.Hg, 80 mmHg) or less (depending on fuel level and barometric pressure).

The barometric pressure is stable for at least 19 minutes, 55 seconds.

**Confirmation Procedure with the HDS**

Do the EVAP FUNCTION TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

1. After the vehicle has been left for an appropriate amount of time as specified, with the engine coolant temperature and intake air temperature within the specified range, start the engine.
2. Warm up the engine at idle until the radiator fan comes on.
3. Drive the vehicle immediately at a speed between 45 - 75 mph (72 - 120 km/h) for at least 20 minutes.
4. After stopping the engine, turn the ignition switch off, and leave the vehicle for 32 minutes or more (EONV executes).

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0457 (90): ADVANCED DIAGNOSTICS

### DTC P0457: EVAPORATIVE EMISSION (EVAP) SYSTEM LEAK DETECTED/FUEL FILL CAP LOOSE OR MISSING

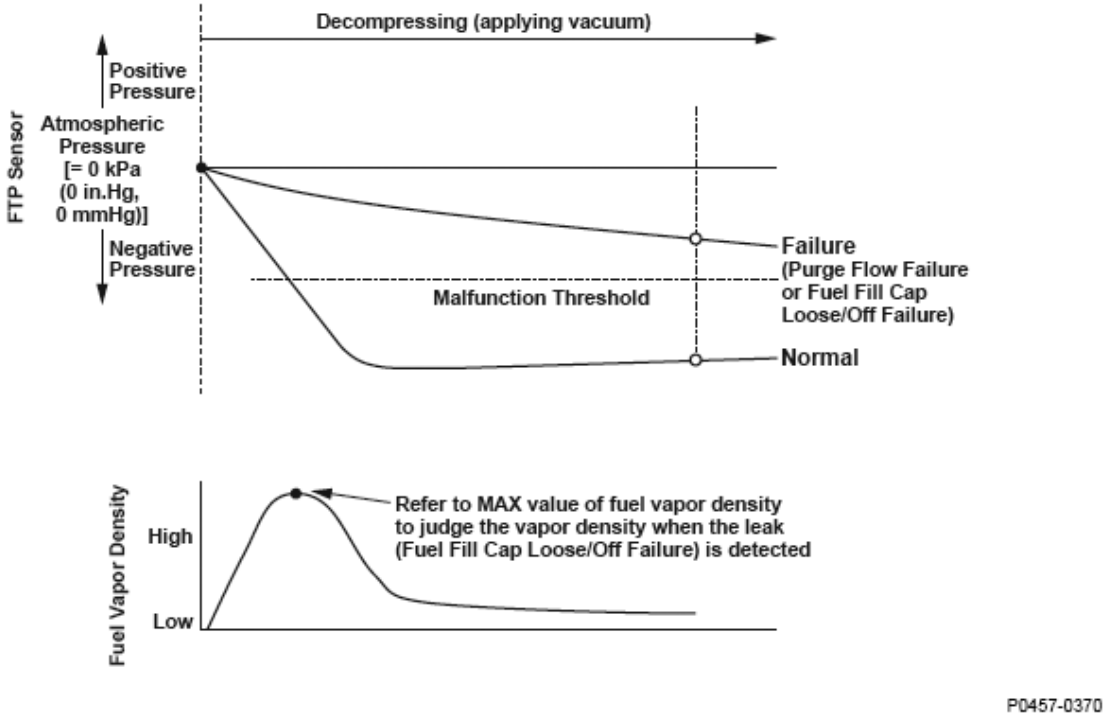



**Fig. 79: Evaporative Emission (EVAP) System - Graph**

#### General Description

There are two conditions when the evaporative emission (EVAP) system will not hold vacuum sufficiently, and the pressure in the fuel tank doesn't become negative.

1. EVAP system low purge flow.
2. EVAP system leakage or the fuel fill cap is loose/off.

Here is a description of condition 2:

The powertrain control module (PCM) monitors the fuel tank pressure (FTP) sensor output. If the FTP sensor output does not indicate the specified vacuum when leak checking when the fuel vapor density is high, the PCM detects a large leak (fuel fill cap loose/off) and a DTC is stored. [The malfunction detection is performed during EVAP system leak detection (P0442, P0455, P0456).]

#### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 22 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Initial engine coolant temperature | 40°F (5°C) | - |
| Initial intake air temperature | 40°F (5°C) | - |
| Engine coolant temperature | 156°F (69°C) | 212°F (100°C) |
| Engine coolant temperature before EVAP purge control starts | 140°F (60°C) | - |
| Vehicle speed | 7 mph (10 km/h) | - |
| Battery voltage | 10.5 V | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop at stoichiometric | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0134, P0135, P0154, P0155, P0335, P0339, P0443, P0451, P0452, P0453, P0496, P0498, P0499, P0641, P0651, P0657, P1109, P1116, P1128, P1129, P1172, P1174, P1454, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2422, P2627, P2628, P2630, P2631 | |
| Others | Other than when there is excessive vapor generation (fuel level is not full) | |
| | Avoid abrupt acceleration, deceleration, and turns | |
| | Test-drive on a flat road to avoid misdetection | |
| | No refueling is required | |

*: Initial engine coolant temperature minus initial intake air temperature

**: Initial intake air temperature minus current intake air temperature

**Malfunction Threshold**

- The output from the fuel tank pressure sensor is -0.5 kPa (-0.16 in.Hg, -4 mmHg) or more for at least 22 seconds.
- Fuel vapor density during leak-checking is at least 0.10 g (0.004 oz) for up to 45 seconds.

**Confirmation Procedure with the HDS**

Do the EVAP FUNCTION TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

1. After the vehicle has been left for an appropriate amount of time as specified, with the engine coolant temperature and intake air temperature within the specified range, start the engine.
2. Warm up the engine at idle until the radiator fan comes on.
3. Drive the vehicle at a speed between 45 - 75 mph (72 - 120 km/h) for at least 20 minutes.
4. After stopping the engine, turn the ignition switch off, and leave the vehicle for 32 minutes or more (EONV executes).

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle with the ECT at engine start-up within the specified temperature range, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle with the ECT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0461 (121): ADVANCED DIAGNOSTICS

## DTC P0461: FUEL LEVEL SENSOR (FUEL GAUGE SENDING UNIT) RANGE/PERFORMANCE PROBLEM

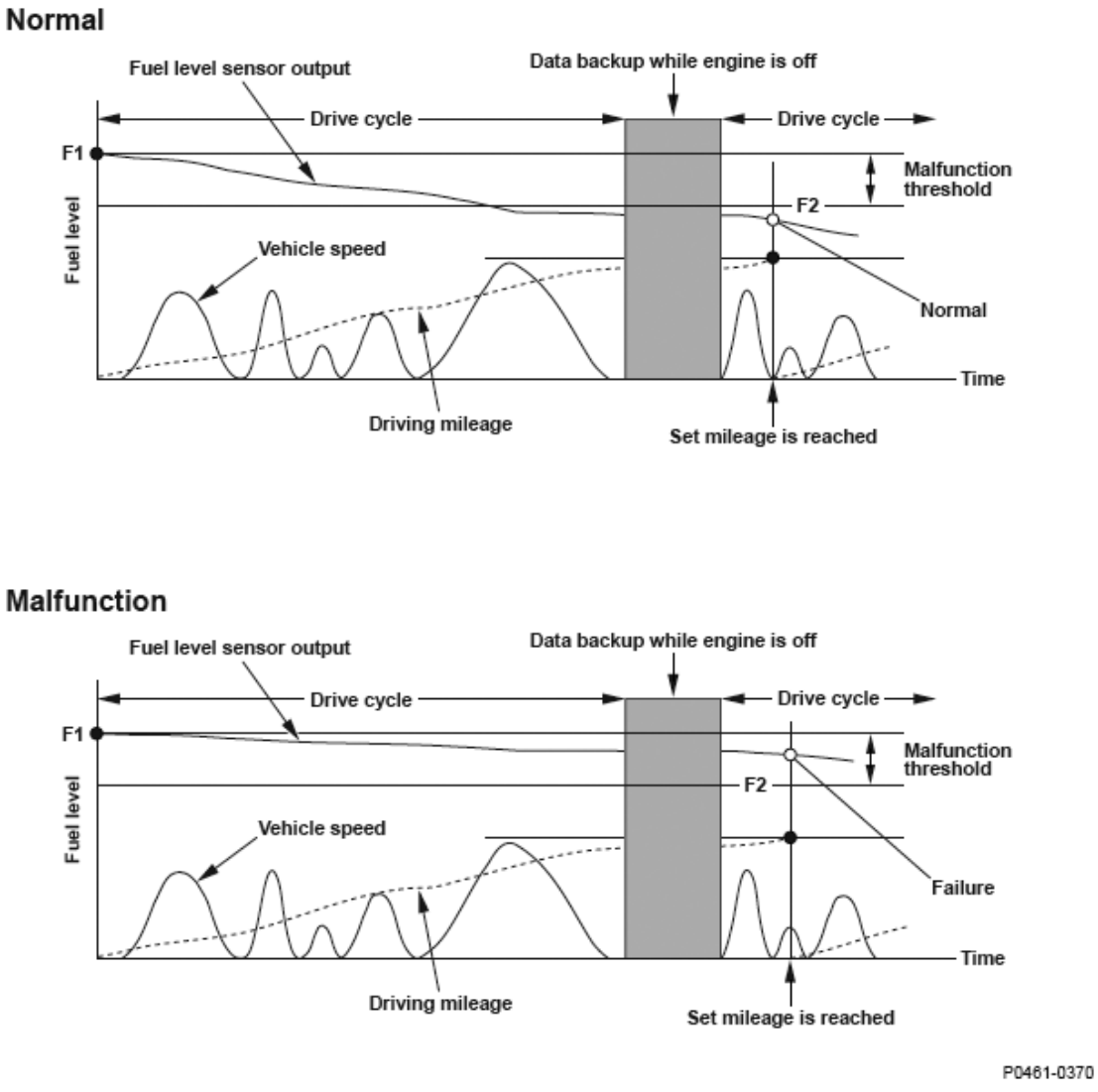



**Fig. 80: Fuel Level Sensor (Fuel Gauge Sending Unit) Circuit Range/ Performance Problem - Graph**

**General Description**

The fuel level sensor is incorporated with the fuel pump and installed in the fuel tank. Using a built-in potentiometer and float, it converts the movement of the float into electrical signals that correspond to the fuel level, and it indicates the amount of fuel in the fuel tank. If the powertrain control module (PCM) receives no change in the fuel level sensor output after driving for a specified number of miles, it detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| | |

| | |
|---|---|
| Duration | - |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Mileage | 125 miles (200 km) | - |
| No active DTCs | P0462, P0463, P0641, P0651, U0073 | |
| Others | Avoid driving and stopping on a steep road | |

**Malfunction Threshold**

The change in the fuel level sensor output is 3.5 % or less.

**Driving Pattern**

Drive for the specified mileage under Enable Conditions without refueling. (Turning the ignition switch off is acceptable.)

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0462 (121): ADVANCED DIAGNOSTICS

## DTC P0462: FUEL LEVEL SENSOR (FUEL GAUGE SENDING UNIT) CIRCUIT LOW VOLTAGE

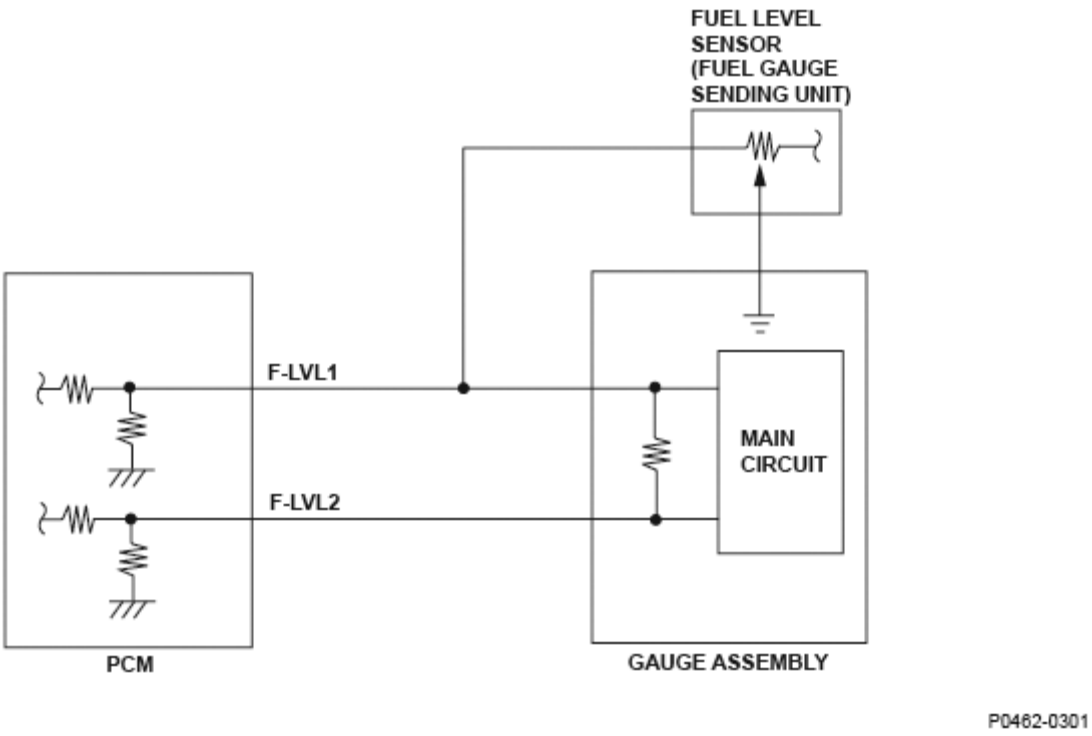



**Fig. 81: Fuel Level Sensor (Fuel Gauge Sending Unit) Circuit Diagram**

**General Description**

The fuel level sensor (fuel gauge sending unit) is incorporated with the fuel pump and installed in the fuel tank. Using a built-in potentiometer and float, it converts the movement of the float into electrical signals that correspond to fuel level, and it measures the remaining fuel in the fuel tank. If the powertrain control module (PCM) detects a signal voltage from the fuel level sensor (fuel gauge sending unit) below a predetermined value for a set time or more, it detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |
| | | |

| | |
|---|---|
| No active DTCs | P0463 |

**Malfunction Threshold**

The F-LVL1 terminal voltage is battery voltage times 0.05 V or less for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0463 (121): ADVANCED DIAGNOSTICS

## DTC P0463: FUEL LEVEL SENSOR (FUEL GAUGE SENDING UNIT) CIRCUIT HIGH VOLTAGE

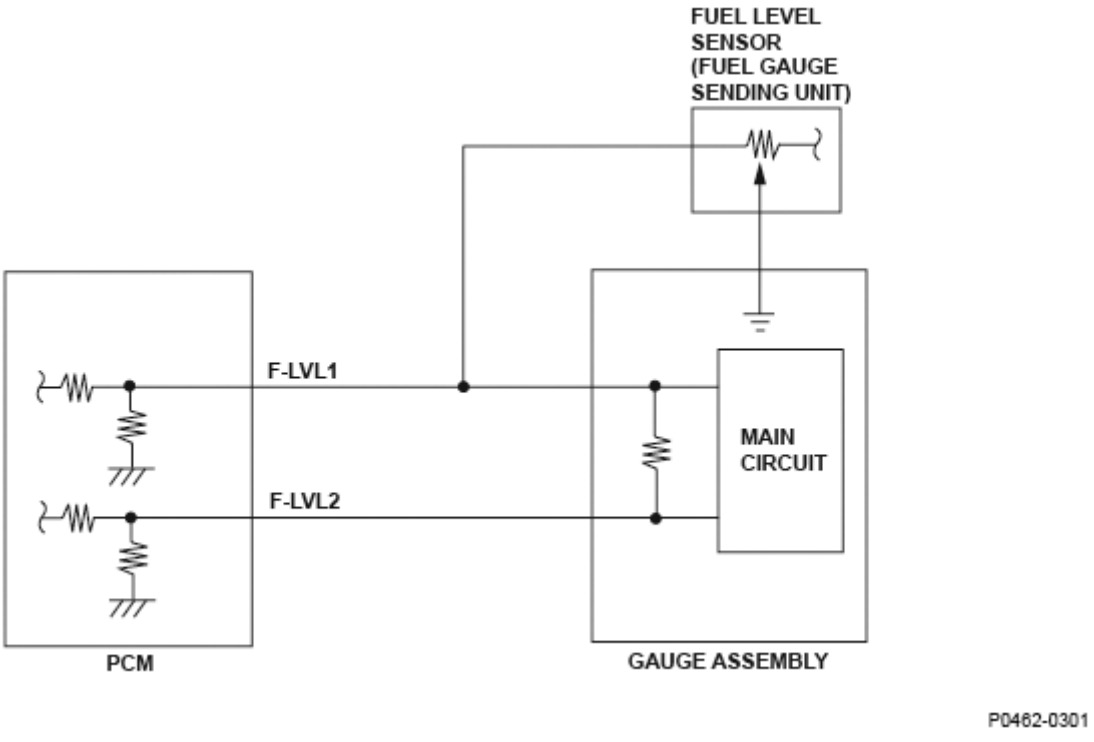



**Fig. 82: Fuel Level Sensor (Fuel Gauge Sending Unit) Circuit Diagram**

**General Description**

The fuel level sensor (fuel gauge sending unit) is incorporated with the fuel pump and installed in the fuel tank. Using a built-in potentiometer and float, it converts the movement of the float into electrical signals that correspond to fuel level, and it measures the remaining fuel in the fuel tank. If the powertrain control module (PCM) detects a signal voltage from the fuel level sensor (fuel gauge sending unit) above a predetermined value for a set time or more, it detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |
| No active DTCs | P0462 | |

**Malfunction Threshold**

The F-LVL1 terminal voltage is battery voltage times 0.88 V or more for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0496 (92): ADVANCED DIAGNOSTICS

## DTC P0496: EVAPORATIVE EMISSION (EVAP) SYSTEM HIGH PURGE FLOW

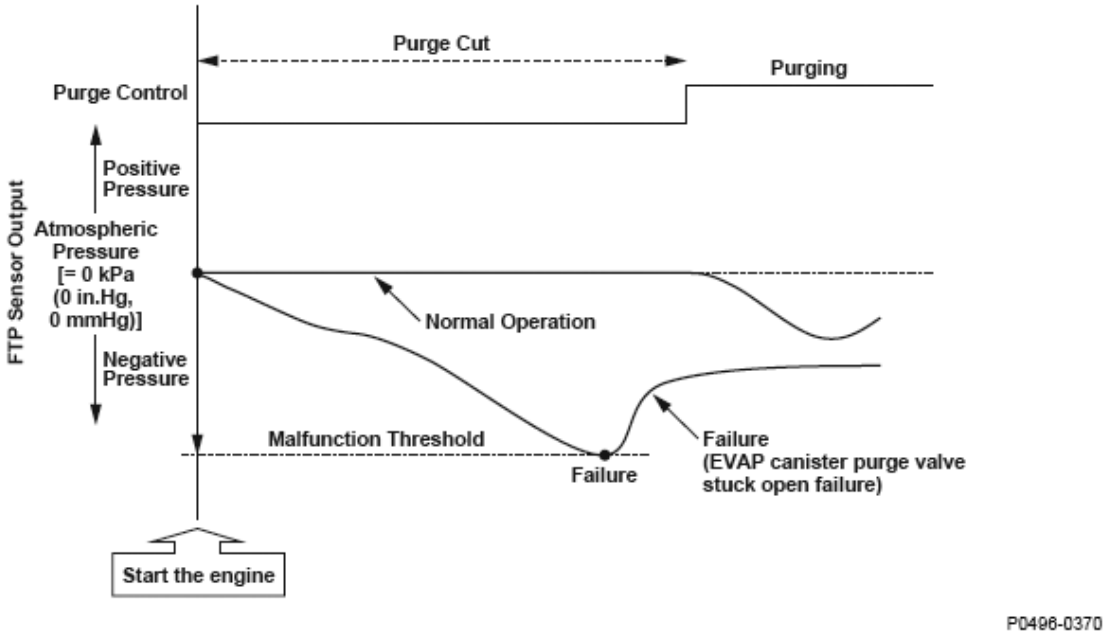



**Fig. 83: Evaporative Emission (EVAP) System - Graph**

**General Description**

The powertrain control module (PCM) adjusts the amount of fuel vapor sent to the engine by controlling the evaporative emission (EVAP) canister purge valve. If the EVAP canister purge valve is stuck open, engine vacuum flows into the purge line before purge control starts when starting the engine. The PCM monitors the fuel tank pressure (FTP) sensor output when purge control starts. If the FTP sensor output indicates negative pressure, the PCM detects a malfunction in the EVAP canister purge valve, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time before starting the engine | 10 seconds | - |
| Initial condition A(1) | - | 18°F (10°C) |
| Initial condition B(2) | - | 18°F (10°C) |

| | | |
|---|---|---|
| Initial engine coolant temperature | 40°F (5°C) | 95°F (35°C) |
| Initial intake air temperature | 40°F (5°C) | 95°F (35°C) |
| Engine coolant temperature before EVAP purge control starts | - | 140°F (60°C) |
| MAP value | - | 81 kPa (24.0 in.Hg, 610 mmHg) |
| Battery voltage | 10.5 V | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0443, P0451, P0452, P0453, P0498, P0499, P0641, P0651, P1109, P1116, P1128, P1129, P1454, P2227, P2228, P2229 | |
| (1) Initial engine coolant temperature minus initial intake air temperature<br>(2) Initial intake air temperature minus current intake air temperature | | |

**Malfunction Threshold**

The output from the fuel tank pressure sensor is -2 kPa (-0.6 in.Hg, -15 mmHg) or less for at least 10 seconds.

**Confirmation Procedure with the HDS**

Do the EVAP FUNCTION TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

Start the engine at an engine coolant temperature and intake air temperature as specified under Enable Conditions, and let it idle until the radiator fan comes on.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear

command or by disconnecting the battery.

# DTC P0497 (90): ADVANCED DIAGNOSTICS

### DTC P0497: EVAPORATIVE EMISSION (EVAP) SYSTEM LOW PURGE FLOW

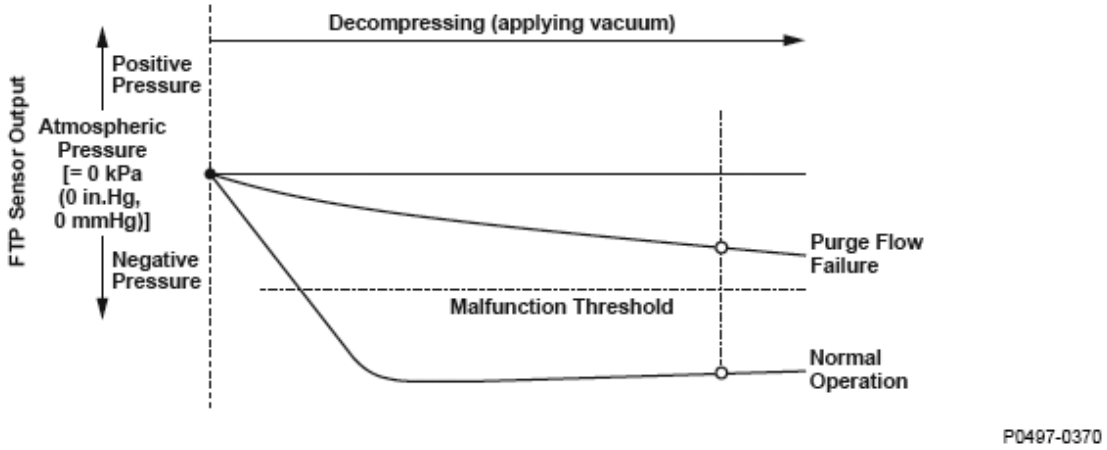



**Fig. 84: Evaporative Emission (EVAP) System - Graph**

#### General Description

There are two conditions when the evaporative emission (EVAP) system will not hold vacuum sufficiently, and the pressure in the fuel tank doesn't become negative.

1. EVAP system low purge flow.
2. EVAP system leakage or the fuel fill cap is loose/off.

Here is a description of condition 1:

The malfunction detection is done during EVAP system leak detection (P0442, P0455, P0456).

The powertrain control module (PCM) monitors the fuel tank pressure (FTP) sensor output. If the FTP sensor output does not indicate the prescribed negative pressure when purging, the PCM detects a malfunction and a DTC is stored.

#### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 22 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Initial engine coolant temperature | 40°F (5°C) | - |
| Initial intake air temperature | 40°F (5°C) | - |
| Engine coolant temperature | 156°F (69°C) | 212°F (100°C) |
| Engine coolant temperature before EVAP purge control starts | 140°F (60°C) | - |
| Vehicle speed | 7 mph (10 km/h) | - |
| Battery voltage | 10.5 V | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop at stoichiometric | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0134, P0135, P0154, P0155, P0335, P0339, P0443, P0451, P0452, P0453, P0496, P0498, P0499, P0641, P0651, P0657, P1109, P1116, P1128, P1129, P1172, P1174, P1454, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2422, P2627, P2628, P2630, P2631 | |
| Others | Other than when there is excessive vapor generation (fuel level is not full) | |
| | Avoid abrupt acceleration, deceleration, and turns | |
| | Test-drive on a flat road to avoid misdetection | |
| | No refueling is required | |

*: Initial engine coolant temperature minus initial intake air temperature

**: Initial intake air temperature minus current intake air temperature

**Malfunction Threshold**

The output from the fuel tank pressure sensor is at least -0.5 kPa (-0.16 in.Hg, -4 mmHg) for up to 22 seconds.

**Confirmation Procedure with the HDS**

Do the EVAP FUNCTION TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

1. After the vehicle has been left for an appropriate amount of time as specified, with the engine coolant temperature and intake air temperature within the specified range, start the engine.
2. Warm up the engine at idle until the radiator fan comes on.

3. Drive the vehicle at a speed between 45 - 75 mph (72 - 120 km/h) for at least 20 minutes.
4. After stopping the engine, turn the ignition switch off, and leave the vehicle for at least 32 minutes (EONV executes).

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0498 (117): ADVANCED DIAGNOSTICS

## DTC P0498: EVAPORATIVE EMISSION (EVAP) CANISTER VENT SHUT VALVE CONTROL CIRCUIT LOW VOLTAGE

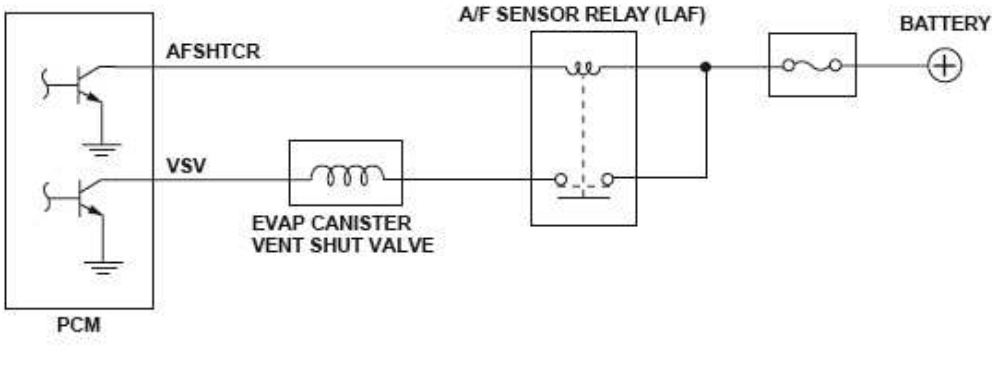



**Fig. 85: Evaporative Emission (EVAP) Canister Vent Shut Valve Control Circuit Diagram**

**General Description**

The evaporative emission (EVAP) canister vent shut valve is attached to the EVAP canister to control the ventilation of the EVAP canister to atmosphere.

The EVAP canister vent shut valve is open (open to atmosphere) when the VSV signal is OFF.

If the return signal is "Low" when the powertrain control module (PCM) outputs the "ON" signal to the EVAP canister vent shut valve, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0499 |

**Malfunction Threshold**

The return signal is "Low" for at least 1 second when the PCM outputs the "ON" signal to the EVAP canister vent shut valve.

**Confirmation Procedure with the HDS**

Do the EVAP CVS ON in the INSPECTION MENU with the HDS.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0499 (117): ADVANCED DIAGNOSTICS

## DTC P0499: EVAPORATIVE EMISSION (EVAP) CANISTER VENT SHUT VALVE CONTROL CIRCUIT HIGH VOLTAGE

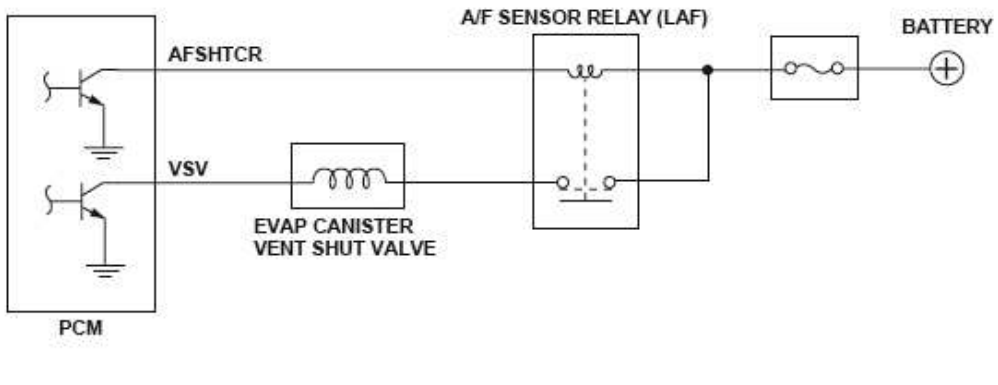



**Fig. 86: Evaporative Emission (EVAP) Canister Vent Shut Valve Control Circuit Diagram**

**General Description**

The evaporative emission (EVAP) canister vent shut valve is attached to the EVAP canister to control the ventilation of the EVAP canister to atmosphere.

The EVAP canister vent shut valve is open (open to atmosphere) when the VSV signal is OFF.

If the return signal is "ON" when the powertrain control module (PCM) outputs the "Low" signal to the EVAP canister vent shut valve, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0498 |

**Malfunction Threshold**

The return signal is "ON" for at least 1 second when the PCM outputs the "Low" signal to the EVAP canister

vent shut valve.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0506 (14): ADVANCED DIAGNOSTICS

## DTC P0506: IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED

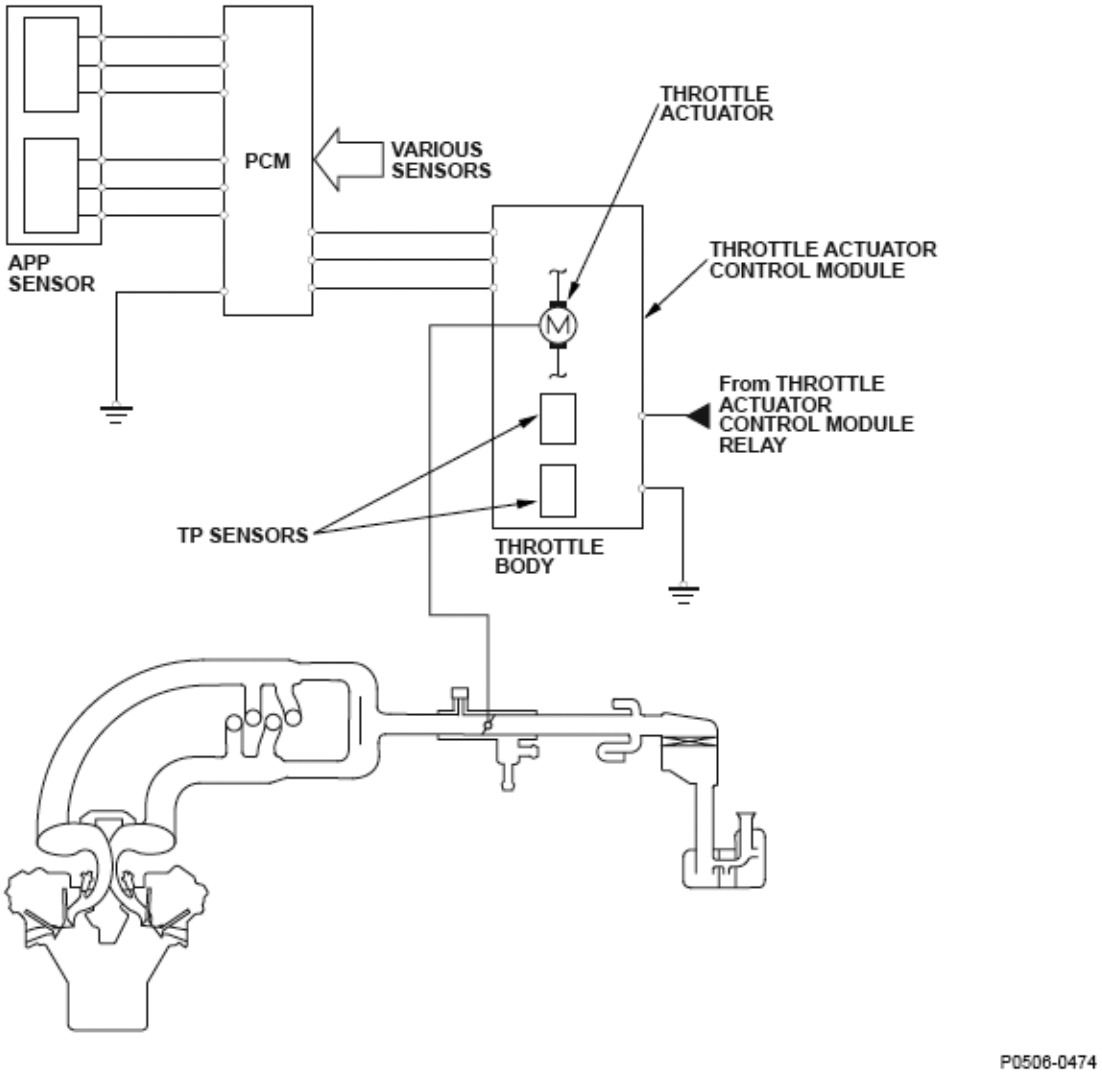



**Fig. 87: Idle Control System RPM Diagram**

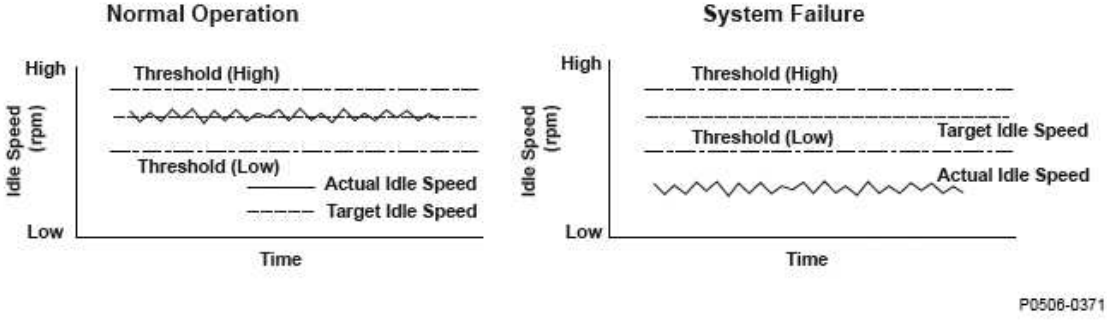



**Fig. 88: Idle Control System RPM - Graph**

**General Description**

A target idle speed that meets the engine operating conditions (coolant temperature, A/C ON or OFF, etc.) is

stored in the powertrain control module (PCM). The PCM monitors and controls the idle speed so that the actual idle speed is equal to the target idle speed. If the actual idle speed varies beyond a specified value from the target speed over a certain period of time, the PCM detects a malfunction in the idle speed control system and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 20 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 32°F (0°C) | - |
| Battery voltage | 10.5 V | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| Throttle position | Fully closed | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P0403, P0404, P0627, P0641, P1109, P1128, P1129, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2227, P2228, P2229, P2413, P2646, P2647, P2648, P2649, U0107 | |
| Other | The engine is under no load | |

**Malfunction Threshold**

The actual idle speed is at least 100 rpm less than the target idle speed for at least 20 seconds.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Let the engine idle for at least 20 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0507 (14): ADVANCED DIAGNOSTICS

## DTC P0507: IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED

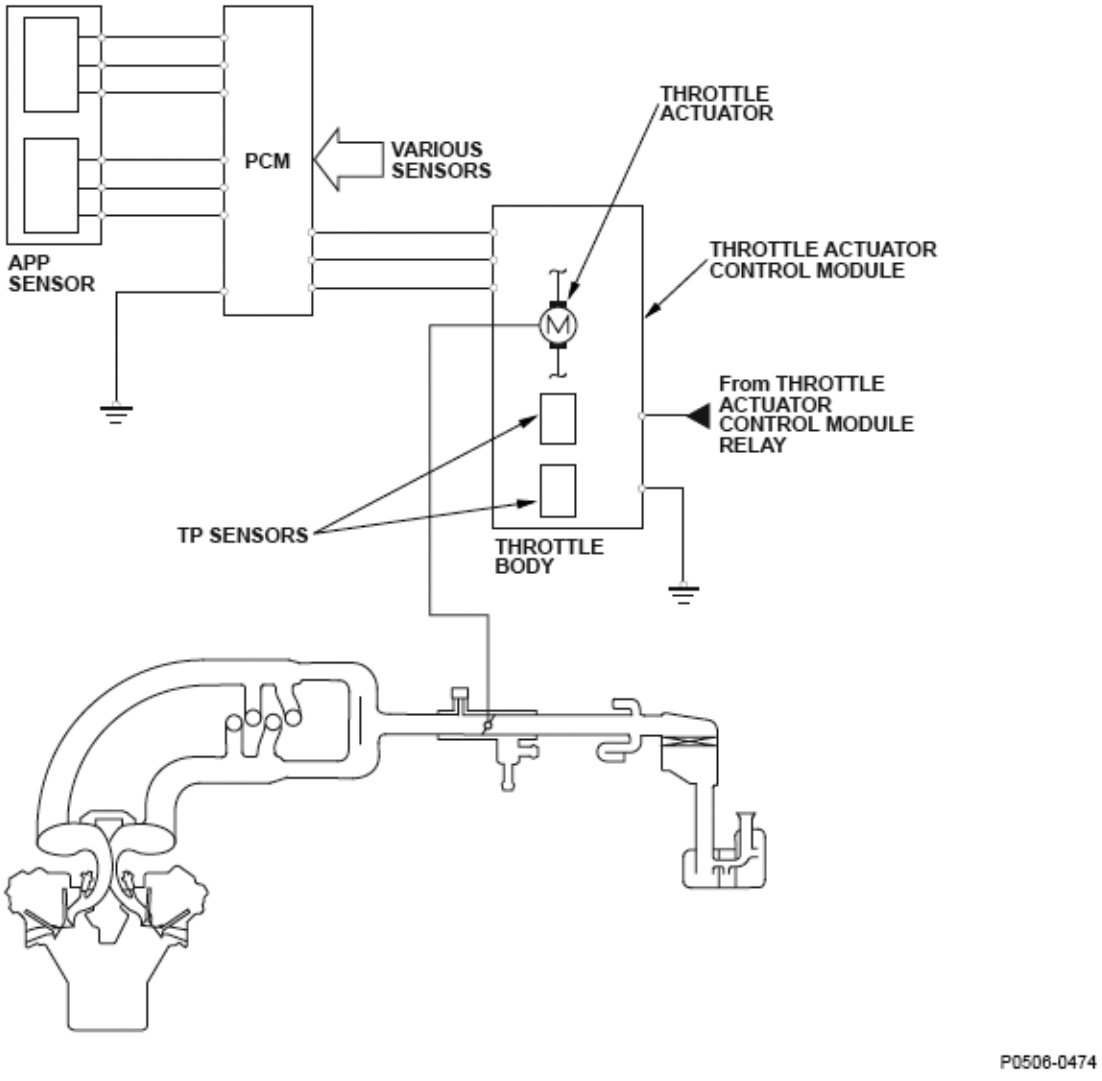



**Fig. 89: Idle Control System RPM Diagram**

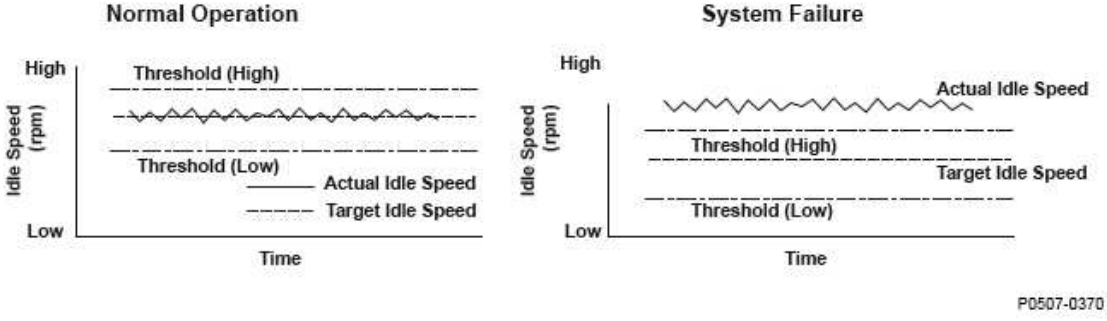



**Fig. 90: Idle Control System RPM - Graph**

**General Description**

A target idle speed that meets the engine operating conditions (coolant temperature, A/C ON or OFF, etc.) is

stored in the powertrain control module (PCM). The PCM monitors and controls the idle speed so that the actual idle speed is equal to the target idle speed. If the actual idle speed varies beyond a specified value from the target speed over a certain period of time, the PCM detects a malfunction in the idle speed control system and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 20 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 32°F (0°C) | - |
| Battery voltage | 10.5 V | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| Throttle position | Fully closed | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P0403, P0404, P0627, P0641, P1109, P1128, P1129, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2227, P2228, P2229, P2413, P2646, P2647, P2648, P2649, U0107 | |
| Other | The engine is under no load | |

**Malfunction Threshold**

The actual idle speed is at least 200 rpm greater than the target idle speed for at least 20 seconds.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Let the engine idle for at least 20 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0563 (34): ADVANCED DIAGNOSTICS

## DTC P0563: POWERTRAIN CONTROL MODULE (PCM) POWER SOURCE CIRCUIT UNEXPECTED VOLTAGE

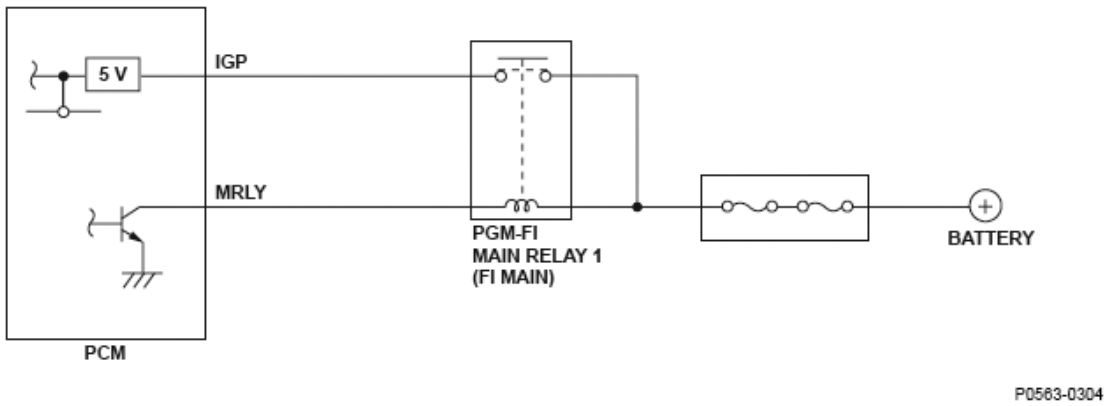



**Fig. 91: Powertrain Control Module (PCM) Power Source Circuit Diagram**

**General Description**

If there is a short to ground in the harness between the powertrain control module (PCM) and the PGM-FI main relay 1, the PGM-FI main relay 1 stays ON even though the ignition switch is OFF, and the PCM remains active. However, the engine is not running because the power for the gauges, the ignition, and the fuel pump is turned OFF by the ignition switch.

When the PCM operates for a set time after the ignition switch is turned OFF, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage (IGP terminal of PCM) | 10.1 V | - |

**Malfunction Threshold**

The PCM operates for at least 5 seconds after the ignition switch is turned OFF.

**Diagnosis Details**

**Conditions for illuminating the indicator**

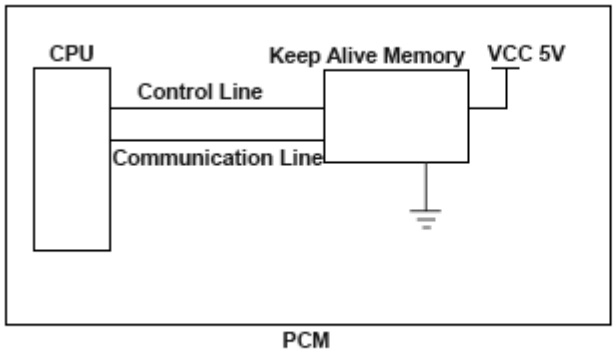
When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0603 (131): ADVANCED DIAGNOSTICS

## DTC P0603: POWERTRAIN CONTROL MODULE (PCM) INTERNAL CONTROL MODULE (KEEP ALIVE MEMORY (KAM) ERROR)




P0603-0571

## Fig. 92: Powertrain Control Module Internal Control Module (Keep Alive Memory (KAM) Error) Circuit Diagram

#### General Description

The powertrain control module (PCM) is equipped with a keep-alive memory. The data (control learn data etc.) for powertrain control and information (vehicle identification number (VIN), etc.) related to vehicle control is stored in the keep alive memory, so that it can be maintained even when power is not supplied to the PCM such as when the battery is disconnected. When power is restored to the PCM, the CPU retrieves the stored information from the keep-alive memory, but when the data retrieval process is not finished normally, a malfunction is detected and a DTC is stored.

The CPU writes data to the keep-alive memory from the CPU: Control related data is written when the ignition is turned on, and vehicle information when commanded from the HDS.

If the data writing process is not completed normally, a malfunction is detected and a DTC is stored.

#### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

#### Enable Conditions

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |

#### Malfunction Threshold

A malfunction is detected whenever the keep alive data retrieval and writing process is not completed normally.

#### Diagnosis Details

##### Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

##### Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic

runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0627 (127): ADVANCED DIAGNOSTICS

### DTC P0627: PGM-FI MAIN RELAY 2 (FUEL PUMP) CIRCUIT MALFUNCTION

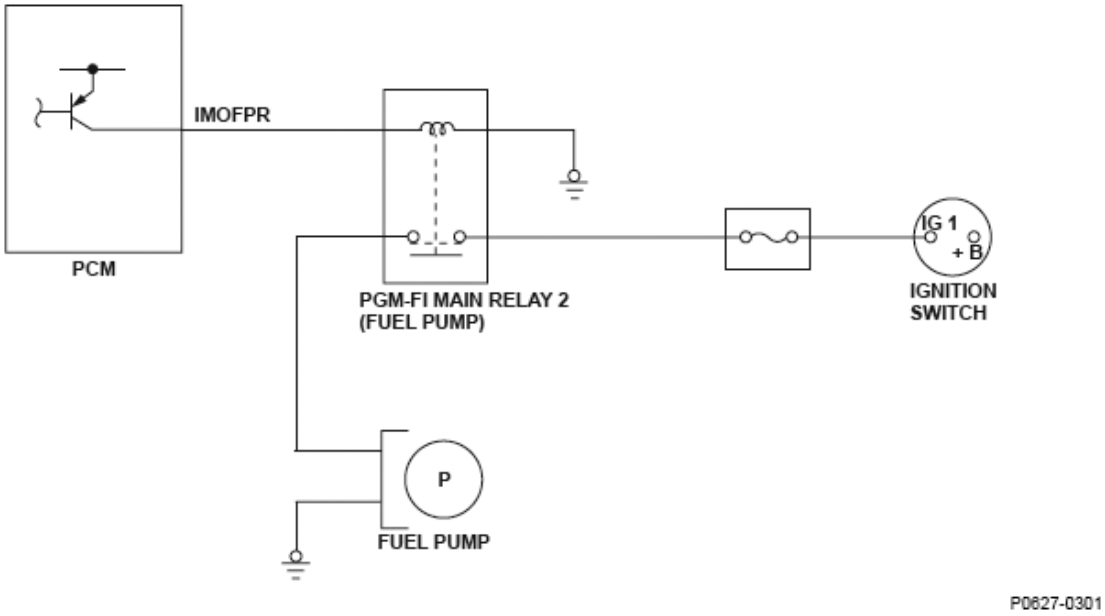



**Fig. 93: PGM-FI Main Relay 2 (Fuel Pump) Circuit Diagram**

#### General Description

A PGM-F1 main relay 2 (fuel pump) for the fuel pump power supply is equipped in the power line of the fuel pump and the powertrain control module (PCM) controls the fuel pump drive by controlling the fuel pump relay.

The PCM reads the return signal against the fuel pump relay drive signal.

When the fuel pump relay drive signal and the return signal do not match for a certain time, the PCM detects a malfunction and a DTC is stored.

#### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2.5 seconds or more |

| | |
|---|---|
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |

**Malfunction Threshold**

Either of the following conditions continues for at least 2.5 seconds.

- The return signal is OFF when the PCM outputs the ON signal to the fuel pump relay.
- The return signal is ON when the PCM outputs the OFF signal to the fuel pump relay.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0630 (139): ADVANCED DIAGNOSTICS

## DTC P0630: VIN NOT PROGRAMMED OR MISMATCH

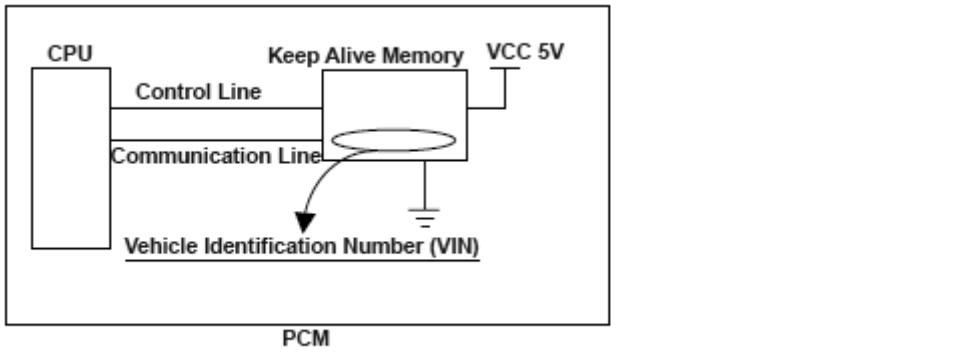



**Fig. 94: VIN Not Programmed Or Mismatch Circuit Diagram**

**General Description**

The powertrain control module (PCM) stores a vehicle identification number (VIN) in the keep-alive memory and outputs the VIN according to the command from the HDS.

The VIN for each vehicle is registered to the PCM using the HDS. The registered VIN is read by the CPU from the keep-alive memory after the ignition is turned on or after the Clear command is executed.

If the VIN is not registered in the keep-alive memory when the ignition is turned on or when the Clear command is executed, it is detected as a VIN unregistered condition and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or less |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0603 |

**Malfunction Threshold**

The VIN is not registered in the keep-alive memory in the PCM.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

When the VIN registration is completed, the MIL is cleared.

# DTC P0641 (133): ADVANCED DIAGNOSTICS

**DTC P0641: SENSOR REFERENCE VOLTAGE A MALFUNCTION**

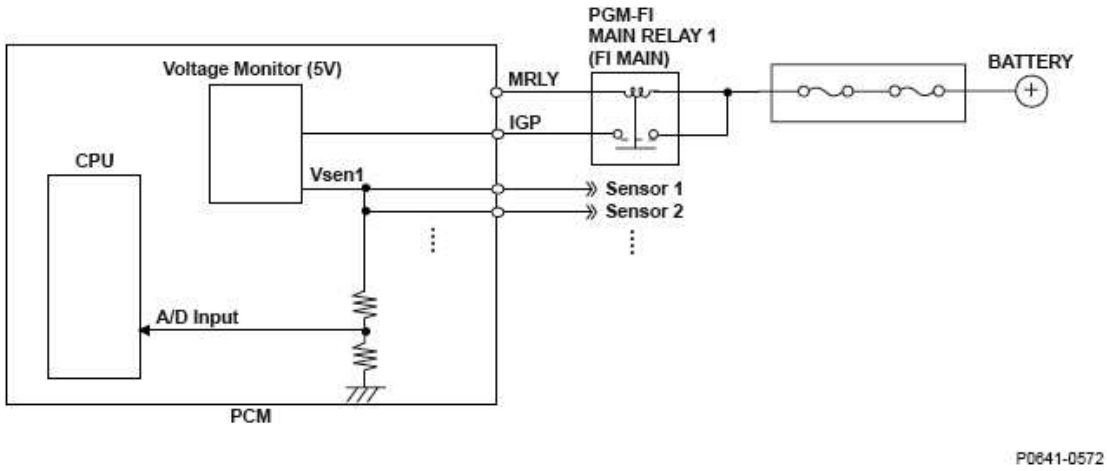



**Fig. 95: Sensor Reference Voltage A Malfunction Circuit Diagram**

**General Description**

The powertrain control module (PCM) is equipped with a voltage monitor (5 V power source for sensor) to supply 5 V to each sensor, and it supplies stable power to each sensor as a reference voltage.

The correct voltages for the sensors are loaded in the CPU of the PCM (A/D input), and when the condition that sensor power voltage is set value or more (high) or set value or less (low) continues for a certain time, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |

**Malfunction Threshold**

The sensor power voltage is 1.07 V or more, or 0.96 V or less, for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0651 (134): ADVANCED DIAGNOSTICS

## DTC P0651: SENSOR REFERENCE VOLTAGE B MALFUNCTION

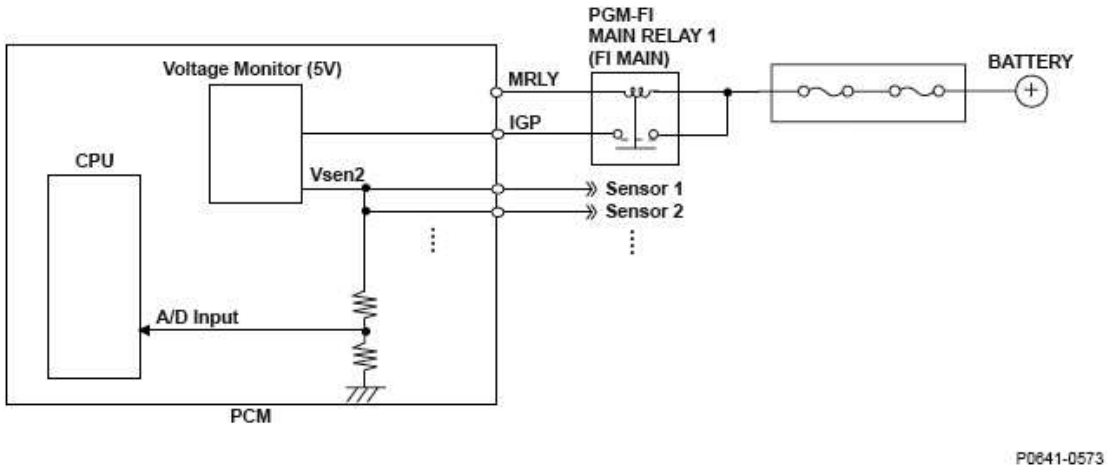



**Fig. 96: Sensor Reference Voltage B Malfunction Circuit Diagram**

**General Description**

The powertrain control module (PCM) is equipped with a voltage monitor (5 V power source for sensor) to supply 5 V to each sensor, and it supplies stable power to each sensor as reference voltage.

The correct voltage for the sensors are loaded in the CPU of the PCM (A/D input) and when the condition that sensor power voltage is set value or more (high) or set value or less (low) continues for a certain time, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |

| | |
|---|---|
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |

**Malfunction Threshold**

The sensor power voltage is 1.07 V or more, or 0.96 V or less, for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0657 (129): ADVANCED DIAGNOSTICS

## DTC P0657: AIR/FUEL RATIO (A/F) SENSOR RELAY CIRCUIT MALFUNCTION

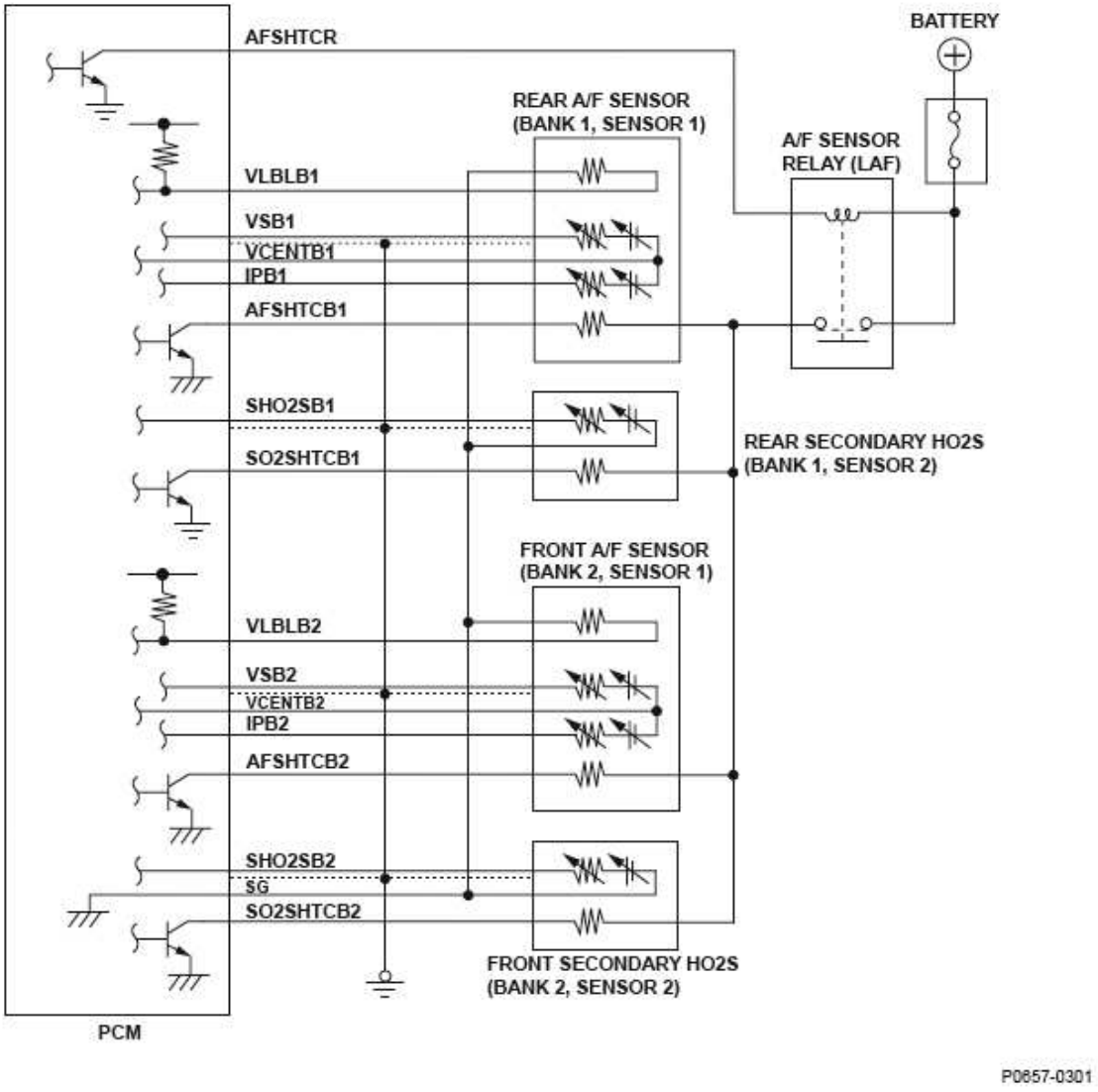



**Fig. 97: Air/Fuel Ratio (A/F) Sensor Relay Circuit Diagram**

**General Description**

The powertrain control module (PCM) controls the A/F sensor and secondary heated oxygen sensor (secondary HO2S) power supply by controlling the air fuel ratio (A/F) sensor relay.

The PCM reads the return signal against the A/F sensor relay drive signal.

When the A/F sensor relay drive signal and the return signal do not match for a certain time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |

**Malfunction Threshold**

Either of the following conditions continues for at least 1 second.

- The return signal is OFF when the PCM outputs the ON signal to the A/F sensor relay.
- The return signal is ON when the PCM outputs the OFF signal to the A/F sensor relay.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0685 (135): ADVANCED DIAGNOSTICS

### DTC P0685: POWERTRAIN CONTROL MODULE (PCM) POWER CONTROL CIRCUIT/INTERNAL CIRCUIT MALFUNCTION

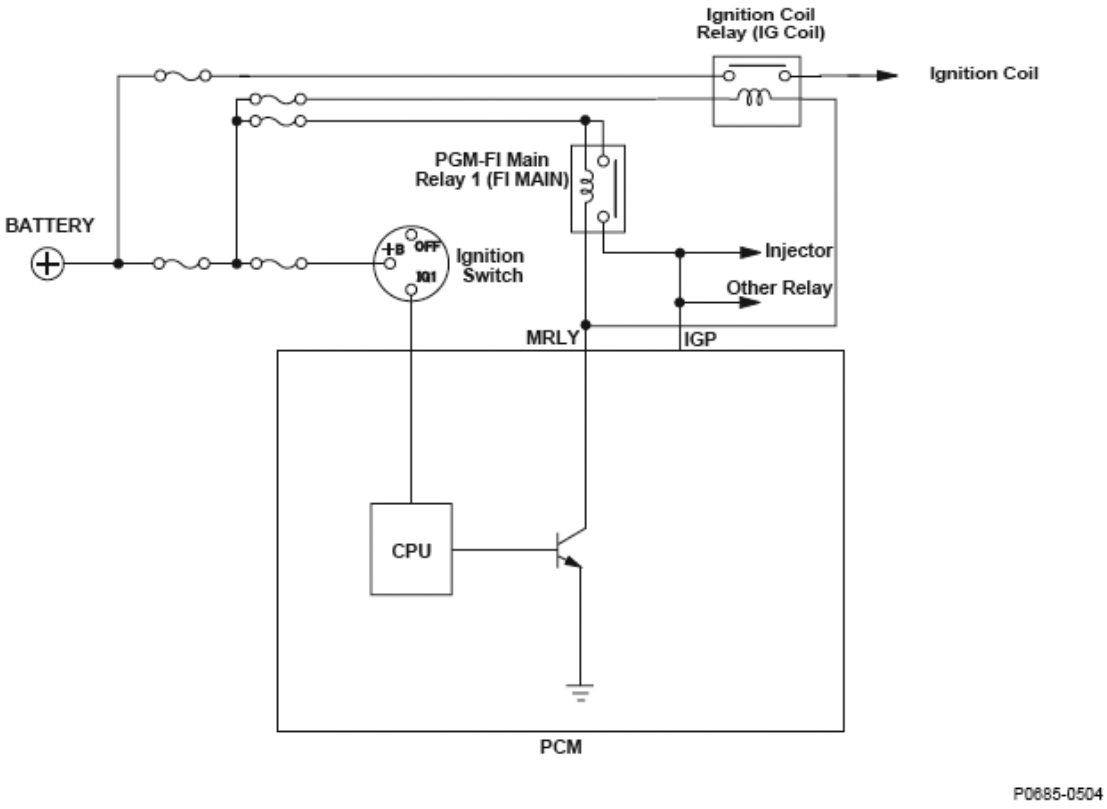



**Fig. 98: Powertrain Control Module (PCM) Power Control Circuit/Internal Circuit Diagram**

**General Description**

After the ignition switch is turned off, the powertrain control module (PCM) does not shut down immediately. After finishing a predetermined process according to the request of each device and system, the power supply is automatically disconnected (self shut-down function). The PCM power is disconnected by controlling PGM-FI main relay 1 (FI MAIN).

During a normal PCM shut down, the shut down process is executed by the CPU, PGM-FI main relay 1 (FI MAIN) is turned off, and the voltage to the PCM is turned off to shut down the PCM. When the voltage to the PCM is turned off and the PCM shuts down without the normal shut down procedure, a malfunction in the PGM-FI main relay 1 (FI MAIN) control circuit is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 400 rpm | - |

**Malfunction Threshold**

The PCM is shut down without the normal shut down procedure.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0705 (5): ADVANCED DIAGNOSTICS

## DTC P0705: SHORT IN TRANSMISSION RANGE SWITCH CIRCUIT (MULTIPLE SHIFT-POSITION INPUT)

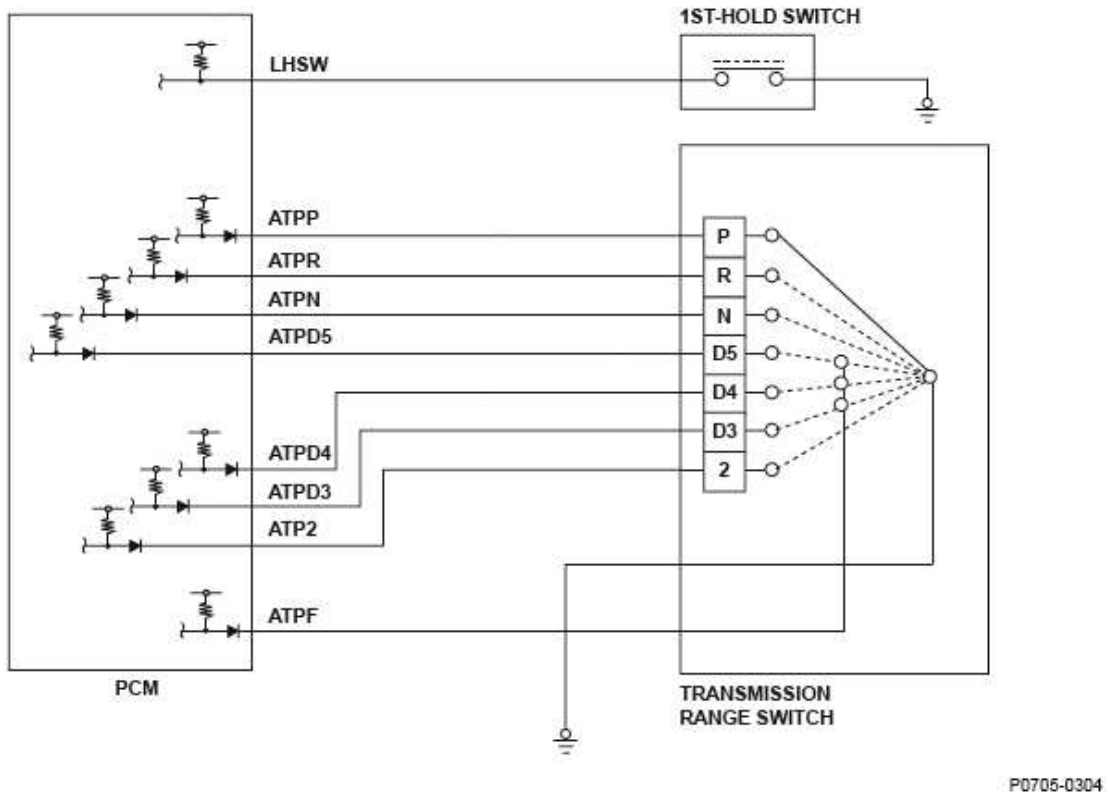



**Fig. 99: Transmission Range Switch Circuit Diagram (Multiple Shift-Position Input)**

**TRANSMISSION RANGE SWITCH CONTACT POINT INPUT MATRIX**

| Shift lever position | Input per switch | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | R | N | D5 | D4 | D3 | 2/1 | LHSW | FWD |
| P | O | X | X | X | X | X | X | X | X |
| R | X | O | X | X | X | X | X | X | X |
| N | X | X | O | X | X | X | X | X | X |
| D5 | X | X | X | O | X | X | X | X | O |
| D4 | X | X | X | X | O | X | X | X | O |
| D3 | X | X | X | X | X | O | X | X | O |
| 2 | X | X | X | X | X | X | O | X | X |
| 1 | X | X | X | X | X | X | O | O | X |
| O: Closed X: Open | | | | | | | | | |

**General Description**

The transmission range switch is attached to the control shaft. Operation of the shift lever makes the control shaft rotate via the shift cable. The A/T gear position indicator indicates which position is selected according to the signal Low/High combinations which vary based on shift lever position. The control shaft changes the position of the transmission range switch, activates the manual valve, and switches hydraulic pressure to shift the transmission through forward/neutral/reverse. The transmission range switch signal is used to determine the

shift schedule. The voltage is 12 V (High) at the powertrain control module (PCM) input terminal when each transmission range switch position is open, and it is 0 V (Low) when each switch is closed. If the PCM detects multiple switch inputs instead of the correct switch input for the selected range at that time, it detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P1710 | |

**Malfunction Threshold**

Case 1

The PCM detects the selected range switch input and another range switch (except FWD and 1st-hold switch) input simultaneously for at least 1 second.

Case 2

The PCM detects the P, R, N, 2, or 1 range switch input and the FWD switch input simultaneously for at least 1 second.

**Driving Pattern**

Start the engine, and then place the shift lever in each position for at least 1 second.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0706 (6): ADVANCED DIAGNOSTICS

### DTC P0706: OPEN IN TRANSMISSION RANGE SWITCH CIRCUIT

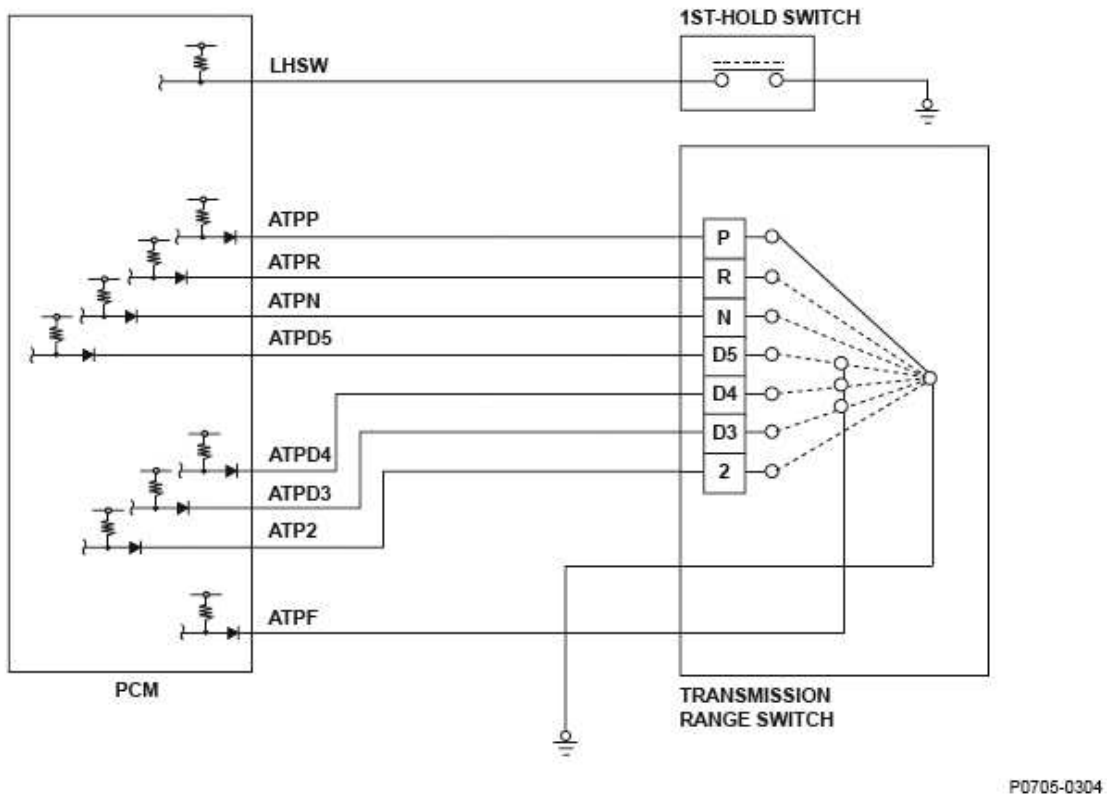



**Fig. 100: Transmission Range Switch Circuit Diagram**

**TRANSMISSION RANGE SWITCH CONTACT POINT INPUT MATRIX**

| Shift lever position | Input per switch | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | R | N | D5 | D4 | D3 | 2/1 | LHSW | FWD |
| P | O | X | X | X | X | X | X | X | X |
| R | X | O | X | X | X | X | X | X | X |
| N | X | X | O | X | X | X | X | X | X |
| D5 | X | X | X | O | X | X | X | X | O |
| D4 | X | X | X | X | O | X | X | X | O |
| D3 | X | X | X | X | X | O | X | X | O |
| 2 | X | X | X | X | X | X | O | X | X |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | X | X | X | X | X | X | O | O | X |
| O: Closed X: Open | | | | | | | | | |

**General Description**

The transmission range switch is attached to the control shaft. Operation of the shift lever makes the control shaft rotate via the shift cable. The A/T gear position indicator indicates which position is selected according to the signal Low/High combinations which vary based on the control shaft rotational angle. The control shaft changes the position of the transmission range switch, activates the manual valve, and switches hydraulic pressure to shift the transmission through forward/neutral/reverse. The transmission range switch signal is used to determine the shift schedule. The voltage is 12 V (High) at the powertrain control module (PCM) input terminal when each transmission range switch position is open, and it is 0 V (Low) when each switch is closed. If the FWD switch stays open while the vehicle repeatedly accelerates to a specified vehicle speed and then stops despite being in the D position, the PCM detects a malfunction in the transmission range switch (open) and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | Depending on the driving pattern |
| DTC Type | Two drive cycles, MIL ON, D5 indicator OFF |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0705, P0721, P0722, P1710 | |

**Malfunction Threshold**

No FWD position signal is detected when the vehicle speed changes from 6 mph (10 km/h) --> 30 mph (48 km/h) --> 6 mph (10 km/h) in the D5 or D4 position.

**Driving Pattern**

1. Start the engine, and accelerate to 30 mph (48 km/h) or more in D5 position, then slow down to 6 mph (10 km/h).
2. Stop the vehicle, turn the ignition switch OFF, and repeat step 1.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0711 (28): ADVANCED DIAGNOSTICS

## DTC P0711: PROBLEM IN ATF TEMPERATURE SENSOR CIRCUIT

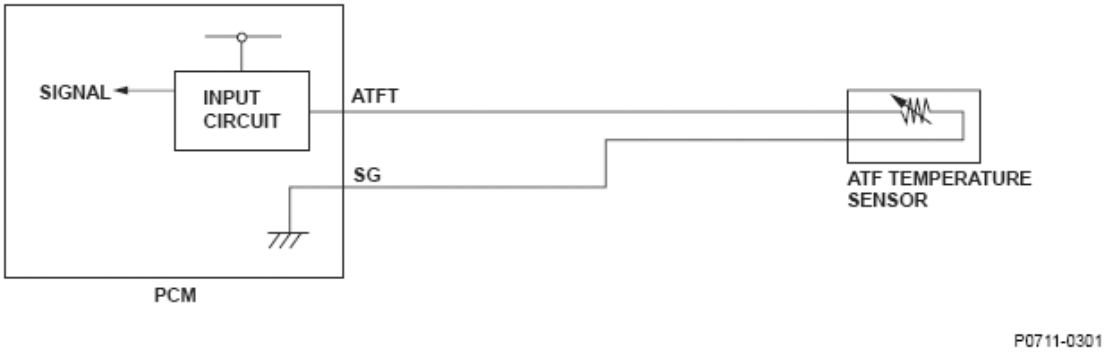



**Fig. 101: ATF Temperature Sensor Circuit Diagram**

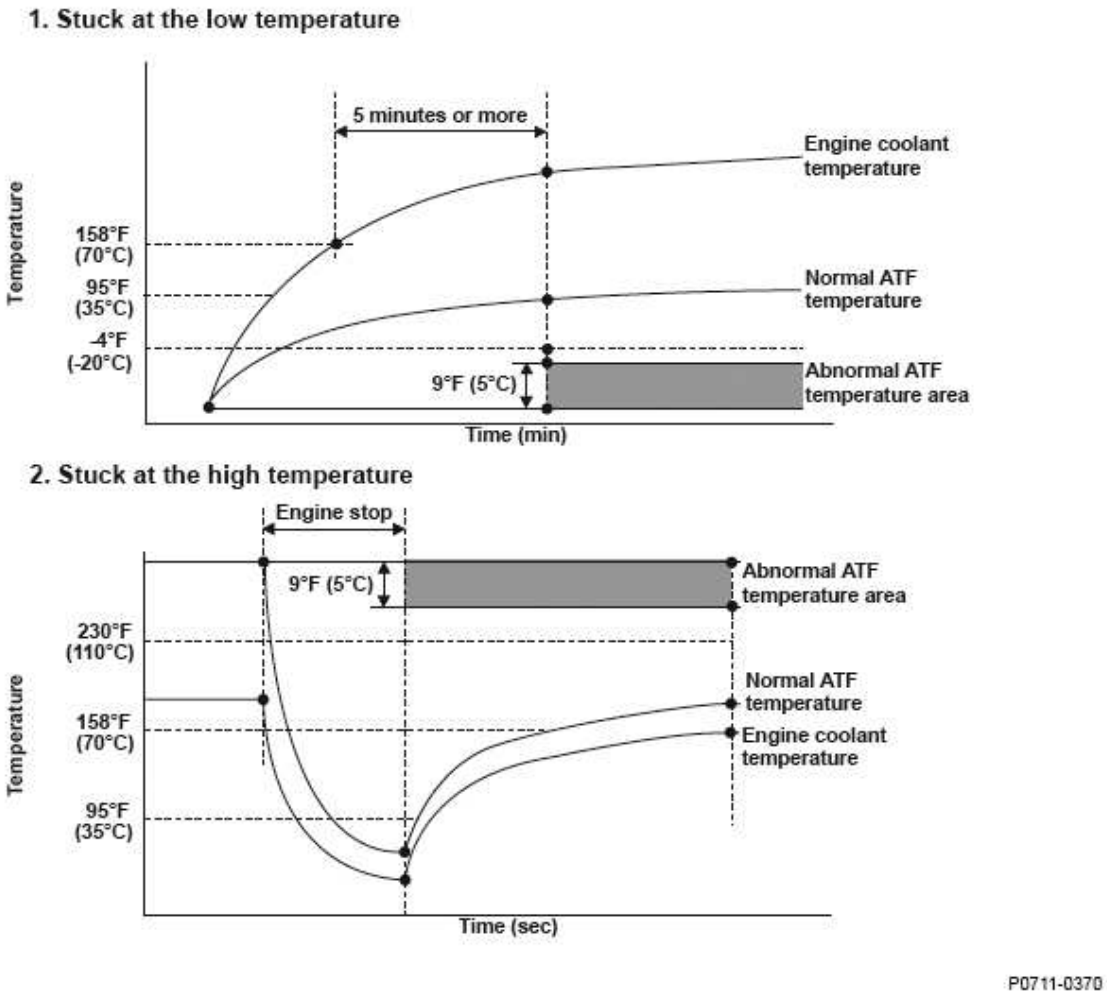



**Fig. 102: ATF Temperature Graph**

**General Description**

The ATF temperature sensor is a thermistor type sensor whose resistance changes according to the change in ATF temperature. The powertrain control module (PCM) sends a 5V reference voltage to the grounded sensor through a pull-up resistor. When the ATF temperature is low, the sensor resistance increases and the PCM detects a high signal voltage. As the ATF temperature rises, the sensor resistance decreases and the PCM detects a low signal voltage.

If the ATF temperature sensor signal doesn't change, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| | 5 minutes or more(1) |

| | |
|---|---|
| Duration | 20 seconds or more(2) |
| DTC Type | One drive cycle, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |
| (1) Stuck at low temperature<br>(2) Stuck at high temperature | |

**Enable Conditions**

1. Stuck at low temperature

**ENABLE CONDITIONS (LOW TEMPERATURE)**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 158°F (70°C) | - |
| Initial engine coolant temperature | - | 95°F (35°C) |
| Vehicle speed | 19 mph (30 km/h) | - |
| Battery voltage | 11.0 V | - |
| Throttle position | 4.0° | - |
| No active DTCs | P0116, P0117, P0118, P0712, P0713, P0721, P0722 | |
| Other | After the engine coolant temperature reaches the minimum value, both the vehicle speed and the throttle position meet the conditions for 5 minutes or more | |

2. Stuck at high temperature

**ENABLE CONDITIONS (HIGH TEMPERATURE)**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 158°F (70°C) | - |
| Previous engine coolant temperature when the ignition switch was turned OFF | 158°F (70°C) | - |
| Present engine coolant temperature when the ignition switch is turned ON | - | 95°F (35°C) |
| Battery voltage | 11.0 V | - |
| No active DTCs | P0116, P0117, P0118, P0712, P0713, P0721, P0722 | |

**Malfunction Threshold**

1. Stuck at low temperature

The ATF temperature rise is 9°F (5°C) or less after the ignition switch is turned ON, and the current ATF temperature is -4°F (-20°C) or less.

2. Stuck at high temperature

   The ATF temperature drop is -9°F (-5°C) or less after the ignition switch is turned ON, and the current ATF temperature is 230°F (110°C) or more for at least 20 seconds.

**Driving Pattern**

1. Stuck at low temperature

   Start the engine with engine coolant temperature at 95°F (35°C) or less, and warm up the engine until the engine coolant temperature reaches 158°F (70°C) or more. Then drive the vehicle at a speed of 19 mph (30 km/h) or more with the throttle position at 4.0° or more for at least 5 minutes.

2. Stuck at high temperature

   Turn off the engine with the engine coolant temperature at 158°F (70°C) or more. Restart the engine after the engine coolant temperature drops to 95°F (35°C) or less, and warm up the engine until the engine coolant temperature reaches 158°F (70°C).

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0712 (28): ADVANCED DIAGNOSTICS

## DTC P0712: SHORT IN ATF TEMPERATURE SENSOR CIRCUIT

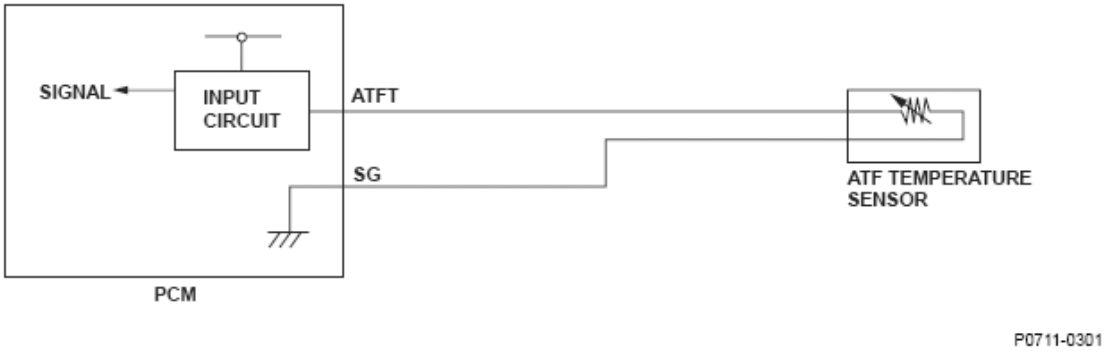



**Fig. 103: ATF Temperature Sensor Circuit Diagram**

**General Description**

The ATF temperature sensor is a thermistor type sensor whose resistance changes according to the change in ATF temperature. The powertrain control module (PCM) sends a 5V reference voltage to the grounded sensor through a pull-up resistor. When the ATF temperature is low, the sensor resistance increases and the PCM detects a high signal voltage. As the ATF temperature rises, the sensor resistance decreases and the PCM detects a low signal voltage.

When the ATF temperature sensor signal voltage to the PCM is under the specification, indicating that the temperature is above the specification (a short to ground), a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | One drive cycle, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0711, P0713 | |

**Malfunction Threshold**

The output voltage from the ATF temperature sensor is 0.07 V or less for at least 10 seconds.

**Driving Pattern**

Start the engine, shift to P position, and wait for at least 10 seconds.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0713 (28): ADVANCED DIAGNOSTICS

## DTC P0713: OPEN IN ATF TEMPERATURE SENSOR CIRCUIT

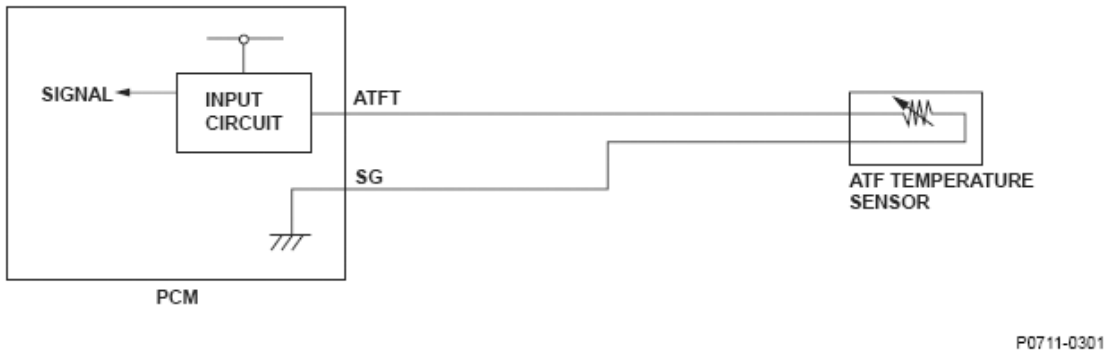



**Fig. 104: ATF Temperature Sensor Circuit Diagram**

**General Description**

The ATF temperature sensor is a thermistor type sensor whose resistance changes according to the change in ATF temperature. The powertrain control module (PCM) sends a 5V reference voltage to the grounded sensor through a pull-up resistor. When the ATF temperature is low, the sensor resistance increases and the PCM detects a high signal voltage. As the ATF temperature rises, the sensor resistance decreases and the PCM detects a low signal voltage.

When the ATF temperature sensor signal voltage to the PCM is above the specification, indicating that the temperature is under the specification (open), a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |

| | |
|---|---|
| Duration | 10 seconds or more |
| DTC Type | One drive cycle, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0711, P0712 | |

**Malfunction Threshold**

The output voltage from the ATF temperature sensor is 4.93 V or more for at least 10 seconds.

**Driving Pattern**

Start the engine, shift to P position, and wait for 10 seconds or more.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0716 (15): ADVANCED DIAGNOSTICS

## DTC P0716: PROBLEM IN INPUT SHAFT (MAINSHAFT) SPEED SENSOR CIRCUIT

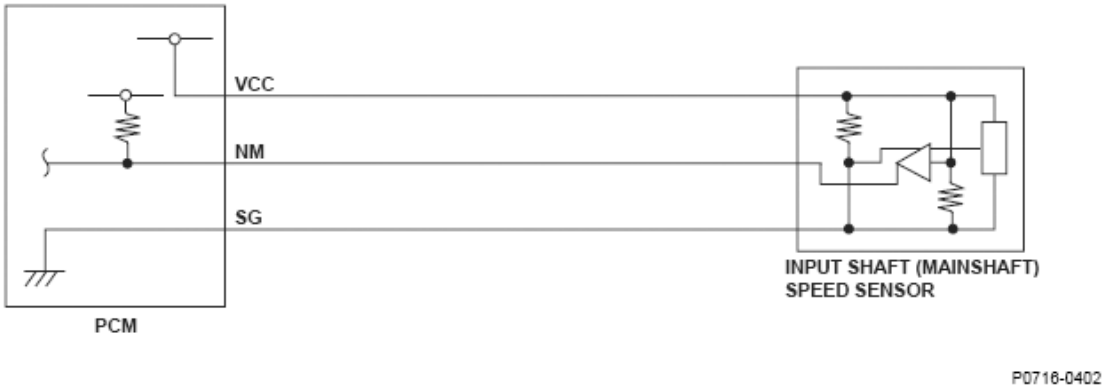



**Fig. 105: Input Shaft (Mainshaft) Speed Sensor Circuit Diagram**

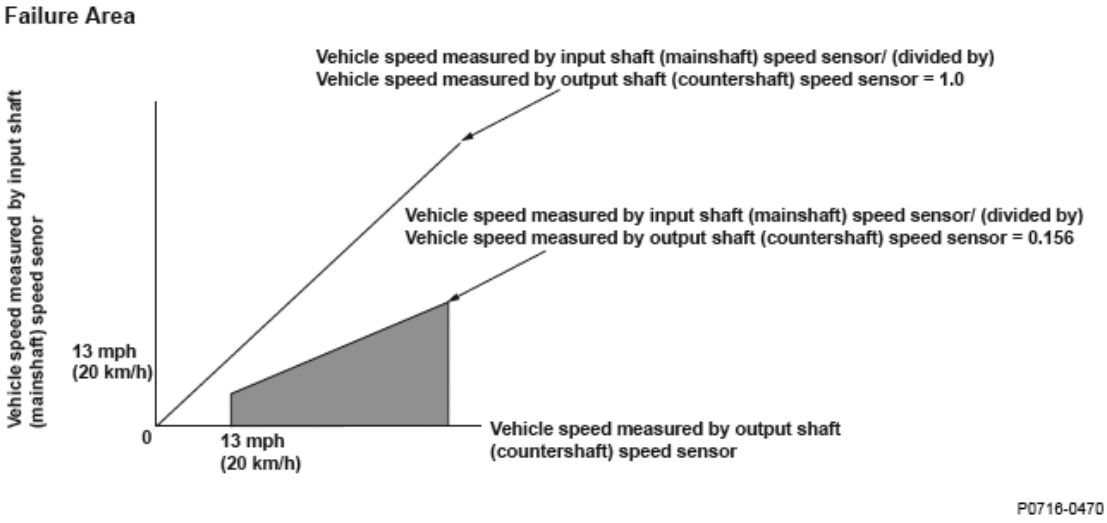



**Fig. 106: Vehicle Speed Sensor Failure Area Graph**

**General Description**

The input shaft (mainshaft) speed sensor is attached to the outside of the transmission housing. The input shaft (mainshaft) speed sensor generates a pulsing signal according to the speed of the mainshaft idler gear on the mainshaft. Using that signal, the powertrain control module (PCM) determines the speed of the mainshaft. If no pulses occur with the mainshaft rotating, the PCM detects a malfunction that may be caused by an open, a temporary open, or a short to ground. Based on the velocity ratio measured by the output shaft (countershaft) speed sensor and the input shaft (mainshaft) speed sensor, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |

| | |
|---|---|
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 500 rpm | - |
| Vehicle speed | 13 mph (20 km/h) | - |
| Battery voltage | 11.0 V | - |
| Shift lever position | D5, D4, D3, or 2 | |
| No active DTCs | P0705, P0706, P0717, P0721, P0722, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |
| Others | Not during shifting | |
| | Not when the shift lever is being shifted | |
| | No electrical noise in the output shaft (countershaft) speed sensor output circuit | |

**Malfunction Threshold**

The vehicle speed measured by the input shaft (mainshaft) speed sensor/(divided by) the vehicle speed measured by the output shaft (countershaft) speed sensor < 0.156 for at least 10 seconds.

**Driving Pattern**

Start the engine, and drive the vehicle at a speed of 13 mph (20 km/h) or more for at least 10 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0717 (15): ADVANCED DIAGNOSTICS

## DTC P0717: PROBLEM IN INPUT SHAFT (MAINSHAFT) SPEED SENSOR CIRCUIT (NO SIGNAL INPUT)

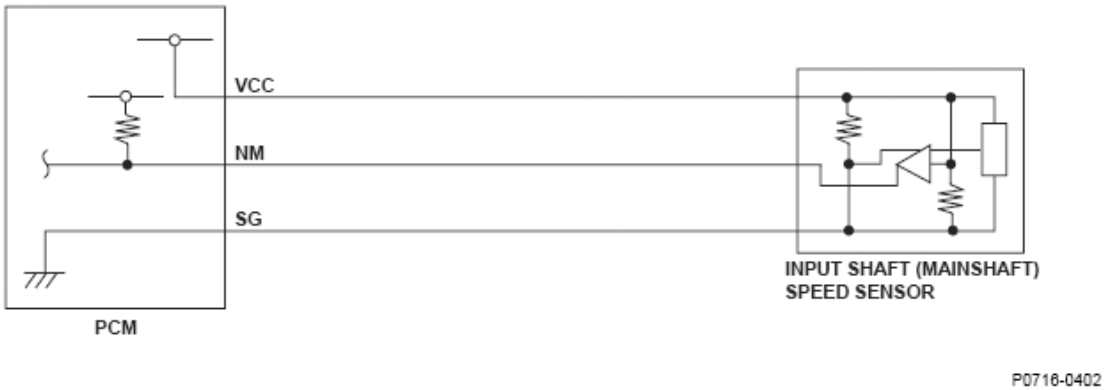



**Fig. 107: Input Shaft (Mainshaft) Speed Sensor Circuit Diagram**

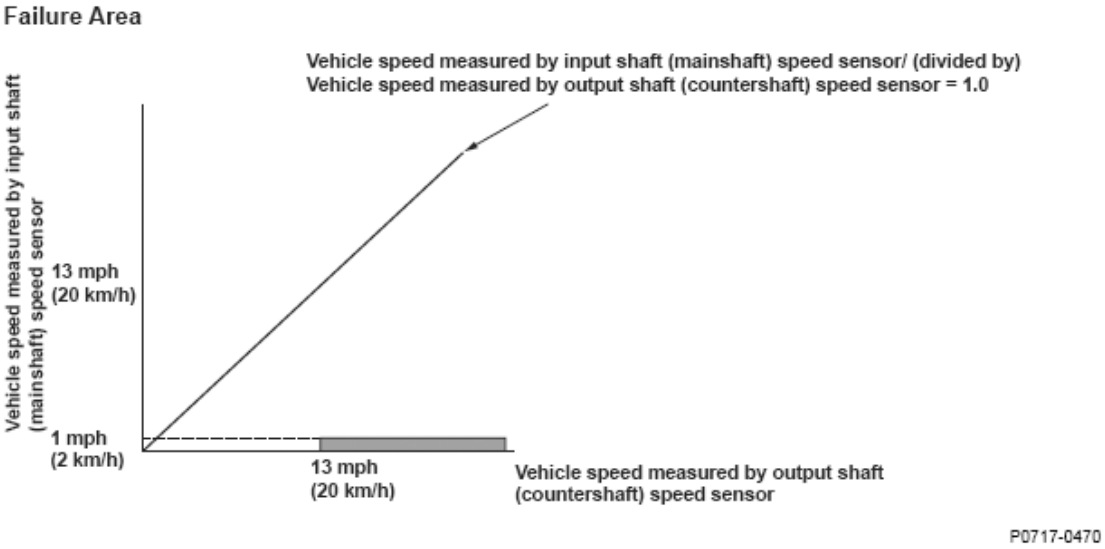



**Fig. 108: Vehicle Speed Sensor Failure Area Graph**

**General Description**

The input shaft (mainshaft) speed sensor is attached to the outside of the transmission housing. The input shaft (mainshaft) speed sensor generates a pulsing signal according to the speed of the mainshaft idler gear on the mainshaft. Using that signal, the powertrain control module (PCM) determines the speed of the mainshaft. If no pulses occur with the mainshaft rotating, the PCM detects a malfunction that may be caused by an open, a temporary open, or a short to ground. Based on the correlation between the vehicle speed measured by the output shaft (countershaft) speed sensor and the input shaft (mainshaft) speed sensor, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

#### Enable Conditions

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 500 rpm | - |
| Vehicle speed | 13 mph (20 km/h) | - |
| Battery voltage | 11.0 V | - |
| Shift lever position | D5, D4, D3, or 2 | |
| No active DTCs | P0705, P0706, P0716, P0721, P0722, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |
| Others | Not during shifting | |
| | Not when the shift lever is being shifted | |
| | No electrical noise in the output shaft (countershaft) speed sensor output circuit | |

#### Malfunction Threshold

When the vehicle speed measured by the output shaft (countershaft) speed sensor is 13 mph (20 km/h) or more, the vehicle speed measured by the input shaft (mainshaft) speed sensor is 1 mph (2 km/h) or less for at least 10 seconds.

#### Driving Pattern

Start the engine, and drive the vehicle at a speed of 13 mph (20 km/h) or more for at least 10 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

#### Diagnosis Details

##### Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

##### Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0721 (9): ADVANCED DIAGNOSTICS

### DTC P0721: PROBLEM IN OUTPUT SHAFT (COUNTERSHAFT) SPEED SENSOR CIRCUIT


**Fig. 109: Output Shaft (Countershaft) Speed Sensor Circuit Diagram**

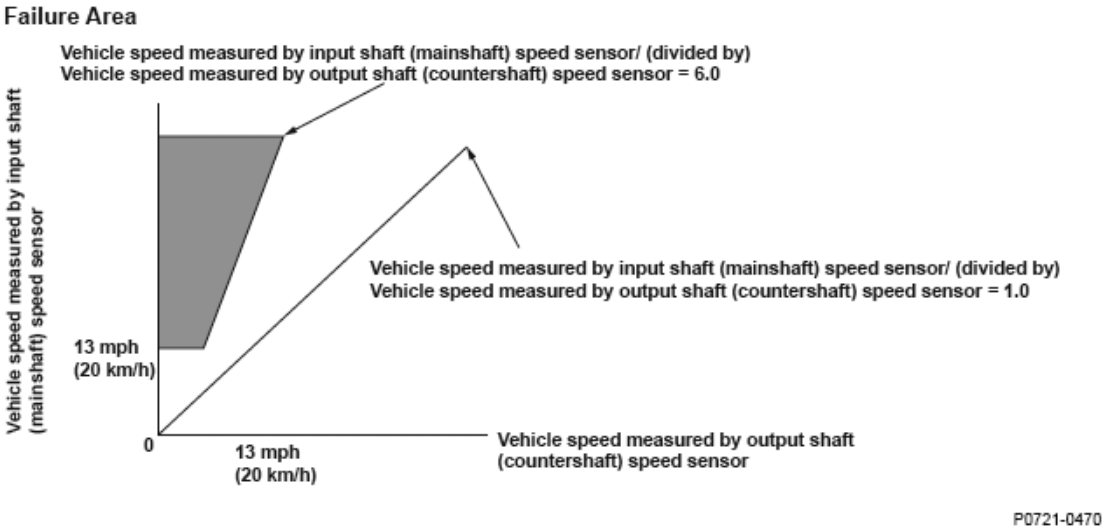



**Fig. 110: Vehicle Speed Sensor Failure Area Graph**

#### General Description

The output shaft (countershaft) speed sensor is attached to the outside of the transmission housing. The output shaft (countershaft) speed sensor generates a pulsing signal according to the speed of the park gear on the countershaft. Using that signal, the powertrain control module (PCM) determines the speed of the countershaft. If pulse dropouts occur with the countershaft rotating, the PCM detects a malfunction that may be caused by an open, a temporary open, or a short to ground. Based on the velocity ratio measured by the input shaft (mainshaft) speed sensor and the output shaft (countershaft) speed sensor, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 500 rpm | - |
| Vehicle speed | 13 mph (20 km/h) | - |
| Battery voltage | 11.0 V | - |
| Shift lever position | D5, D4, D3, or 2 | |
| No active DTCs | P0705, P0706, P0716, P0717, P0722, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |
| Others | Not during shifting | |
| | Not when the shift lever is being shifted | |
| | No electrical noise in the input shaft (mainshaft) speed sensor output circuit | |

**Malfunction Threshold**

The vehicle speed measured by the input shaft (mainshaft) speed sensor/(divided by) the vehicle speed measured by the output shaft (countershaft) speed sensor > 6.0 for at least 10 seconds.

**Driving Pattern**

Start the engine, and drive the vehicle at a speed of 13 mph (20 km/h) or more for at least 10 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic

runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0722 (9): ADVANCED DIAGNOSTICS

### DTC P0722: PROBLEM IN OUTPUT SHAFT (COUNTERSHAFT) SPEED SENSOR CIRCUIT (NO SIGNAL INPUT)

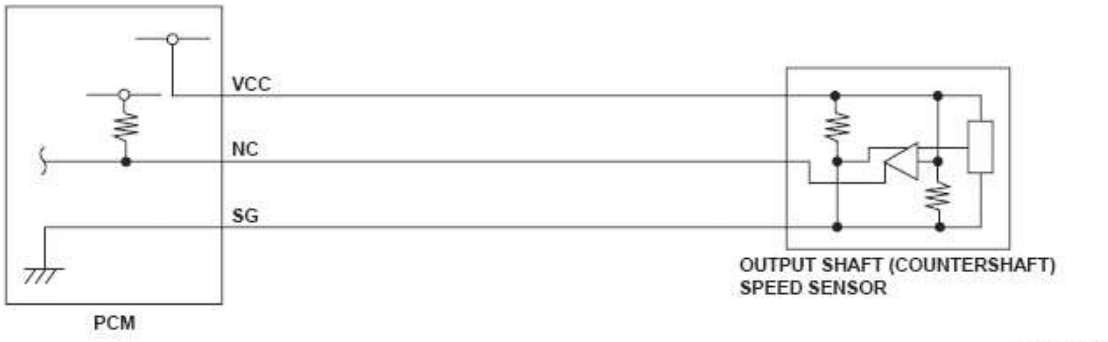



**Fig. 111: Output Shaft (Countershaft) Speed Sensor Circuit Diagram**

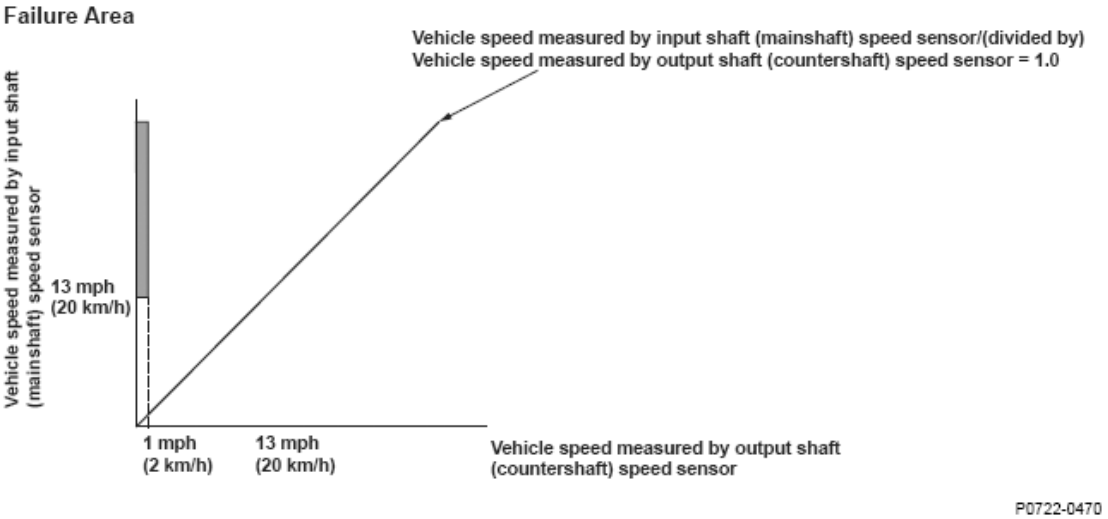



**Fig. 112: Vehicle Speed Sensor Failure Area Graph**

#### General Description

The output shaft (countershaft) speed sensor is attached to the outside of the transmission housing. The output shaft (countershaft) speed sensor generates a pulsing signal according to the speed of the park gear on the countershaft. Using that signal, the powertrain control module (PCM) determines the speed of the countershaft. If pulse dropouts occur with the countershaft rotating, the PCM detects a malfunction that may be caused by an open, a temporary open, or a short to ground. Based on the correlation between the vehicle speed measured by

the output shaft (countershaft) speed sensor and the input shaft (mainshaft) speed sensor, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 500 rpm | - |
| Vehicle speed | 13 mph (20 km/h) | - |
| Battery voltage | 11.0 V | - |
| Shift lever position | D5, D4, D3, or 2 | |
| No active DTCs | P0705, P0706, P0716, P0717, P0721, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |
| Others | Not during shifting | |
| | Not when the shift lever is being shifted | |
| | No electrical noise in the input shaft (mainshaft) speed sensor output circuit | |

**Malfunction Threshold**

When the vehicle speed measured by the input shaft (mainshaft) speed sensor is 13 mph (20 km/h) or more, the vehicle speed measured by the output shaft (countershaft) speed sensor is 1 mph (2 km/h) or less for at least 10 seconds.

**Driving Pattern**

Start the engine, and drive the vehicle at a speed of 13 mph (20 km/h) or more for at least 10 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0731 (64): ADVANCED DIAGNOSTICS

## DTC P0731: PROBLEM IN 1ST CLUTCH AND 1ST CLUTCH HYDRAULIC CIRCUIT

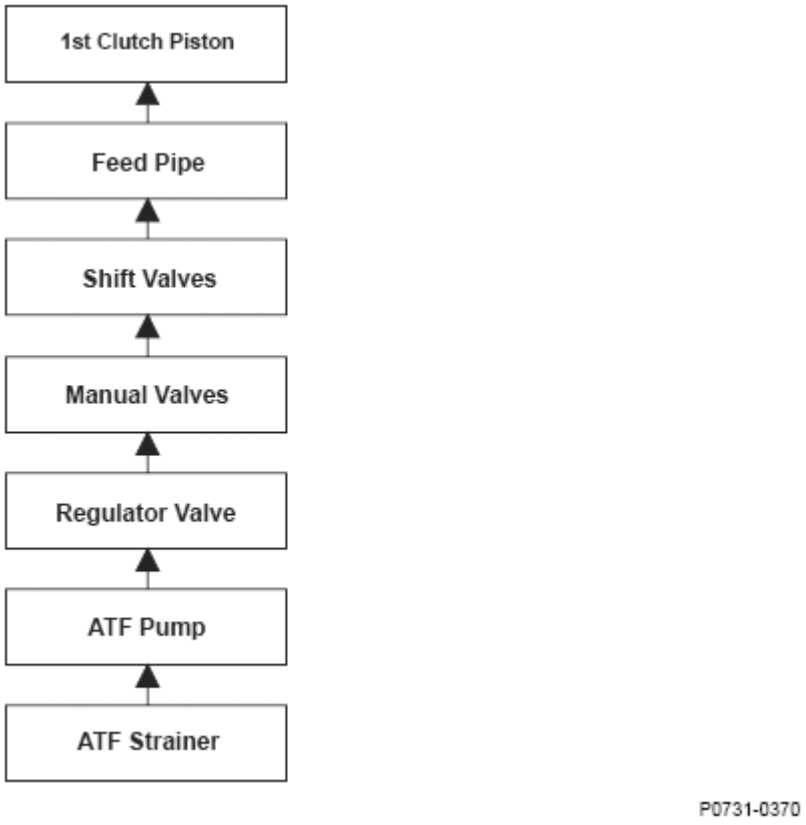



**Fig. 113: 1st Clutch And 1st Clutch Hydraulic Circuit Flow Chart**

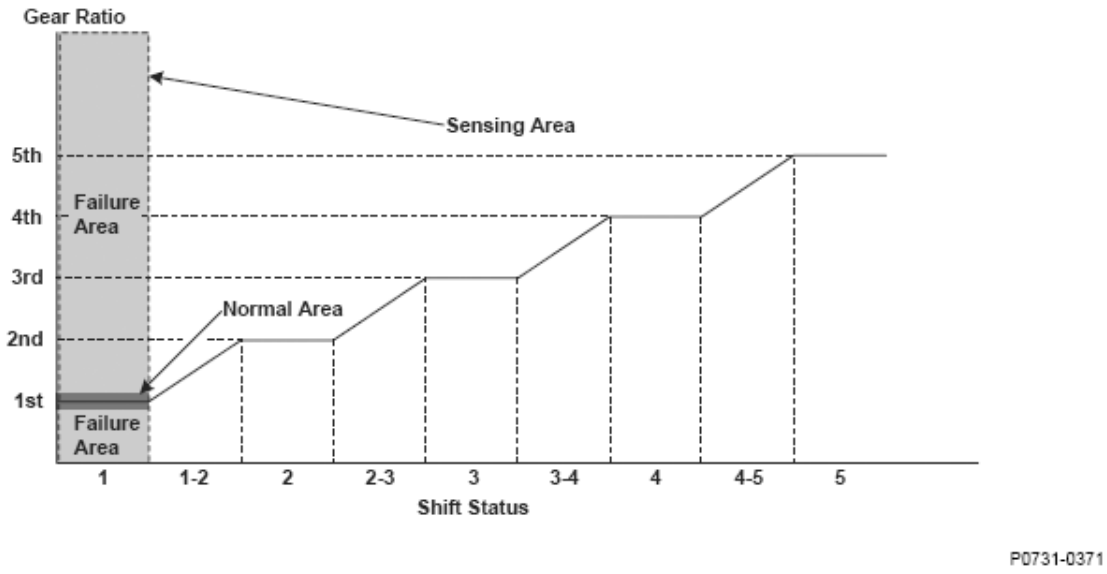



**Fig. 114: Gear Ratio To Shift Status Graph**

**General Description**

To engage 1st gear, line pressure is supplied to the 1st clutch piston, engaging the 1st clutch, and the secondary shaft and the secondary shaft 1st gear are connected and revolve together. Hydraulic pressure is supplied to the 1st clutch through the ATF strainer --> the ATF pump --> the regulator valve --> the manual valve --> the shift valves --> the feed pipe --> 1st clutch piston. (A shift valve failure in the supplying route above is detected by the malfunction detection of each shift solenoid valve.) The powertrain control module (PCM) computes the ratio of the mainshaft speed to the countershaft speed. When the ratio is not the 1st gear ratio, it is detected as a malfunction of the hydraulic circuit or the 1st clutch, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 12 seconds or more |
| DTC Type | Two drive cycles, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 1,000 rpm | - |
| Vehicle speed | 8 mph (12 km/h) | - |

| | | |
|---|---|---|
| Throttle position | 10.0% | - |
| Battery voltage | 11.0 V | - |
| Shift lever position | D5 | |
| No active DTCs | P0116, P0117, P0118, P0122, P0123, P0222, P0223, P0705, P0706, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The actual gear ratio must match one of these conditions for at least 12 seconds with the 1st gear command:

- Actual gear ratio > 1st gear ratio by a factor of 1.2
- Actual gear ratio < 1st gear ratio by a factor of 0.75

**Driving Pattern**

Start the engine, shift to D5 position, and drive the vehicle at a speed of 8 mph (12 km/h) or more for at least 12 seconds in 1st gear.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0732 (64): ADVANCED DIAGNOSTICS

## DTC P0732: PROBLEM IN 2ND CLUTCH AND 2ND CLUTCH HYDRAULIC CIRCUIT

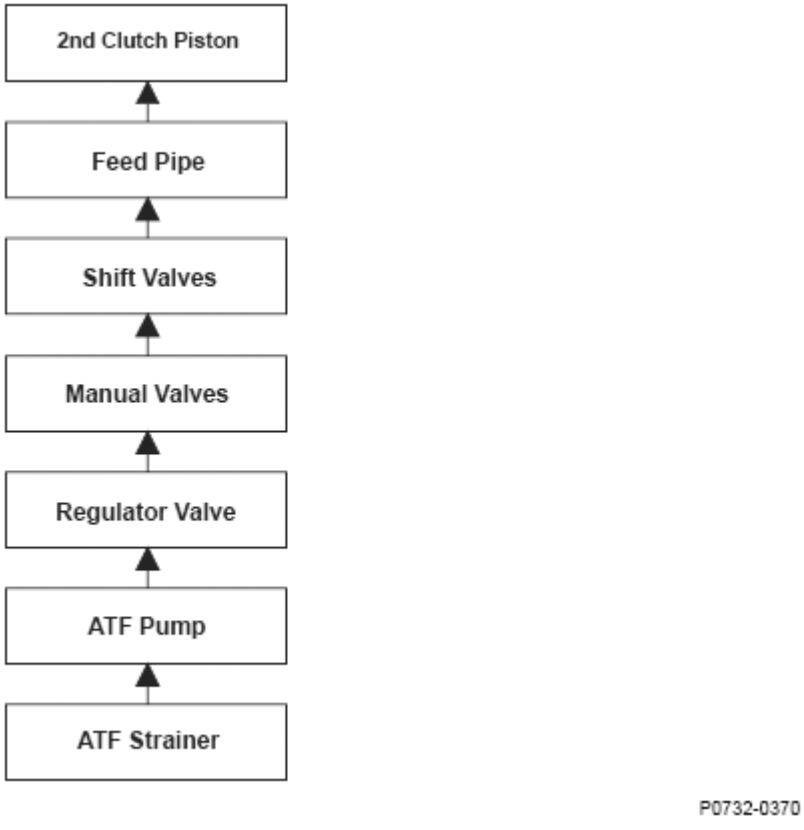



**Fig. 115: 2nd Clutch And 2nd Clutch Hydraulic Circuit Flow Chart**

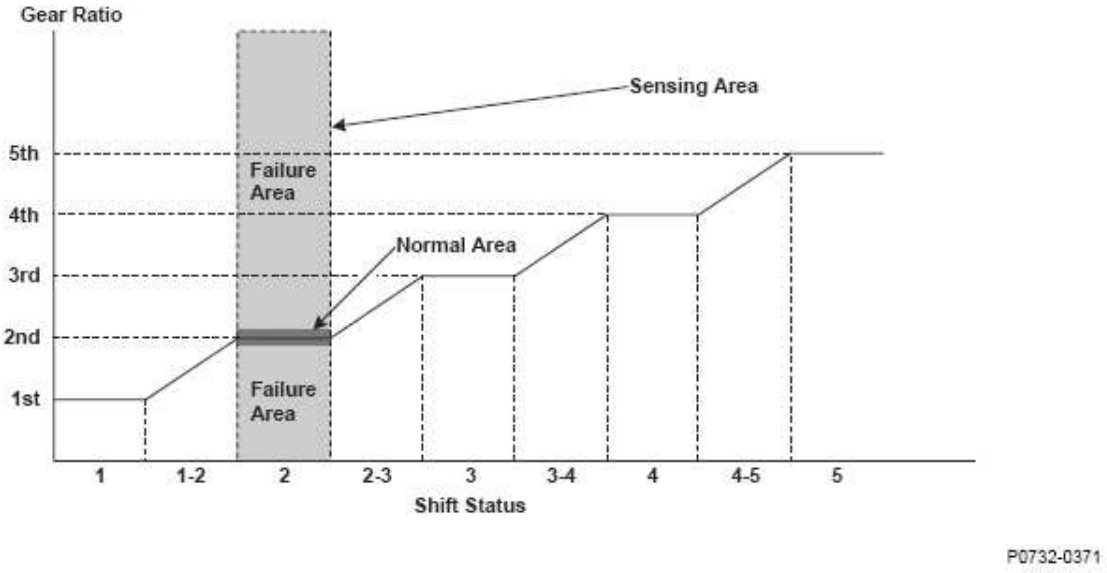



**Fig. 116: Gear Ratio To Shift Status Graph**

**General Description**

To engage 2nd gear, line pressure is supplied to the 2nd clutch piston, engaging the 2nd clutch, and the

secondary shaft and the secondary shaft 2nd gear are connected and revolve together. Hydraulic pressure is supplied to the 2nd clutch through the ATF strainer --> the ATF pump --> the regulator valve --> the manual valve --> the shift valves --> the feed pipe --> 2nd clutch piston. (A shift valve failure in the supplying route above is detected by the malfunction detection of each shift solenoid valve.) The powertrain control module (PCM) computes the ratio of the mainshaft speed to the countershaft speed. When the ratio is not the 2nd gear ratio, it is detected as a malfunction of the hydraulic circuit or the 2nd clutch, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 12 seconds or more |
| DTC Type | Two drive cycles, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 1,000 rpm | - |
| Vehicle speed | 8 mph (12 km/h) | - |
| Battery voltage | 11.0 V | - |
| Shift lever position | D5 | |
| No active DTCs | P0116, P0117, P0118, P0122, P0123, P0222, P0223, P0705, P0706, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The actual gear ratio must match one of these conditions for at least 12 seconds with the 2nd gear command:

- Actual gear ratio > 2nd gear ratio by a factor of 1.2
- Actual gear ratio < 2nd gear ratio by a factor of 0.75

**Driving Pattern**

Start the engine, shift to D5 position, and drive the vehicle at a speed of 8 mph (12 km/h) or more for at least 12 seconds in 2nd gear.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0733 (64): ADVANCED DIAGNOSTICS

## DTC P0733: PROBLEM IN 3RD CLUTCH AND 3RD CLUTCH HYDRAULIC CIRCUIT

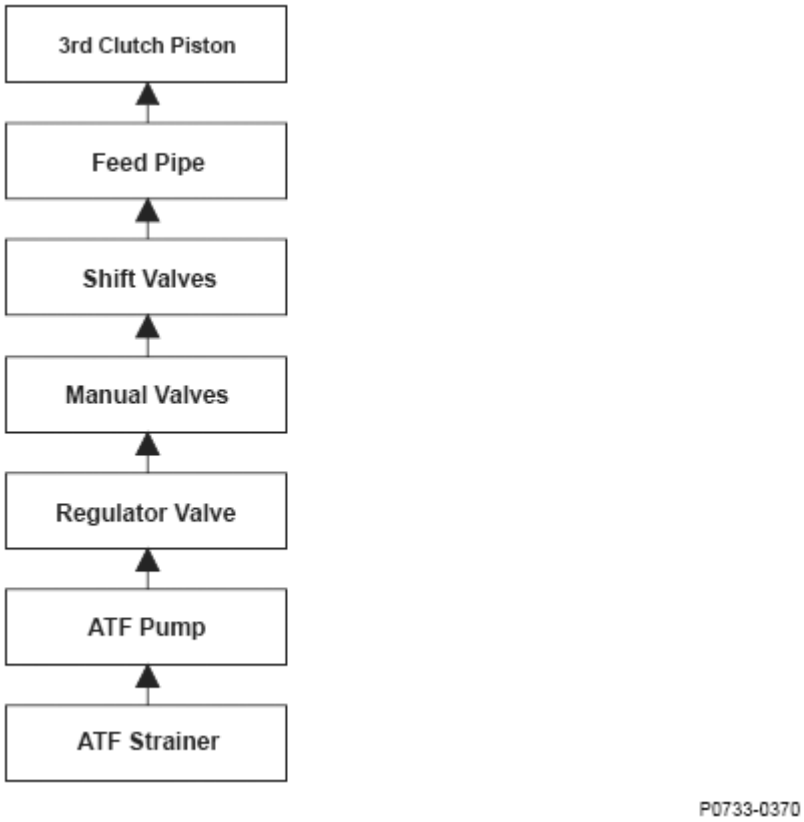



**Fig. 117: 3rd Clutch And 3rd Clutch Hydraulic Circuit Flow Chart**

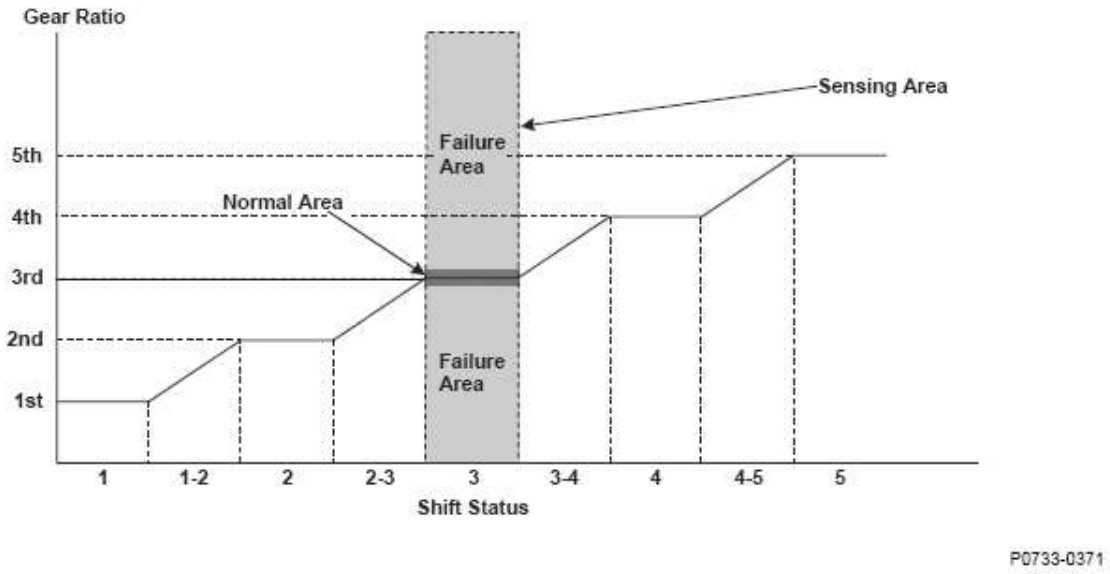



**Fig. 118: Gear Ratio To Shift Status Graph**

**General Description**

To engage 3rd gear, line pressure is supplied to the 3rd clutch piston, engaging the 3rd clutch, and the intermediary shaft and the intermediary shaft 3rd gear are connected and revolve together. Hydraulic pressure is supplied to the 3rd clutch through the ATF strainer --> the ATF pump --> the regulator valve --> the manual valve --> the shift valves --> the feed pipe --> 3rd clutch piston. (A shift valve failure in the supplying route above is detected by the malfunction detection of each shift solenoid valve.) The powertrain control module (PCM) computes the ratio of the mainshaft speed to the countershaft speed. When the ratio is not the 3rd gear ratio, it is detected as a malfunction of the hydraulic circuit or the 3rd clutch, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 12 seconds or more |
| DTC Type | Two drive cycles, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 1,000 rpm | - |
| Vehicle speed | 8 mph (12 km/h) | - |

| | | |
|---|---|---|
| Battery voltage | 11.0 V | - |
| Shift lever position | D5 | |
| No active DTCs | P0116, P0117, P0118, P0122, P0123, P0222, P0223, P0705, P0706, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The actual gear ratio must match one of these conditions for at least 12 seconds with the 3rd gear command:

- Actual gear ratio > 3rd gear ratio by a factor of 1.2
- Actual gear ratio < 3rd gear ratio by a factor of 0.75

**Driving Pattern**

Start the engine, shift to D5 position, and drive the vehicle at a speed of 8 mph (12 km/h) or more for at least 12 seconds in 3rd gear.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0734 (64): ADVANCED DIAGNOSTICS

### DTC P0734: PROBLEM IN 4TH CLUTCH AND 4TH CLUTCH HYDRAULIC CIRCUIT

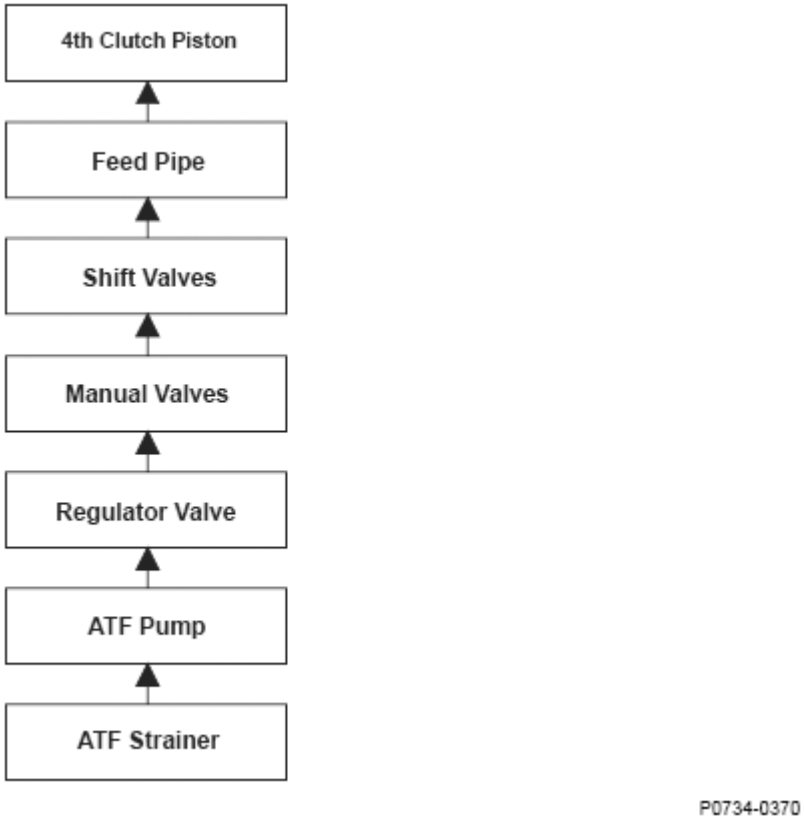



**Fig. 119: 4th Clutch And 4th Clutch Hydraulic Circuit Flow Chart**

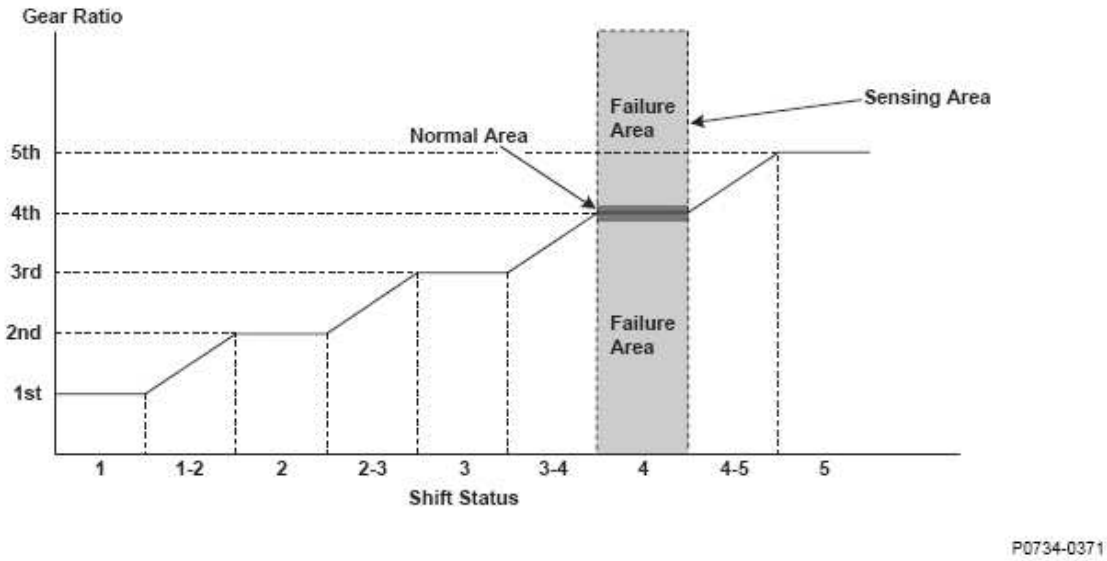



**Fig. 120: Gear Ratio To Shift Status Graph**

**General Description**

To engage 4th gear, line pressure is supplied to the 4th clutch piston, engaging the 4th clutch, and the mainshaft

and the mainshaft 4th gear are connected and revolve together. Hydraulic pressure is supplied to the 4th clutch through the ATF strainer --> the ATF pump --> the regulator valve --> the manual valve --> the shift valves --> the feed pipe --> 4th clutch piston. (A shift valve failure in the supplying route above is detected by the malfunction detection of each shift solenoid valve.) The powertrain control module (PCM) computes the ratio of the mainshaft speed to the countershaft speed. When the ratio is not the 4th gear ratio, it is detected as a malfunction of the hydraulic circuit or the 4th clutch, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 12 seconds or more |
| DTC Type | Two drive cycles, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 1,000 rpm | - |
| Vehicle speed | 8 mph (12 km/h) | - |
| Battery voltage | 11.0 V | - |
| Shift lever position | D5 | |
| No active DTCs | P0116, P0117, P0118, P0122, P0123, P0222, P0223, P0705, P0706, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The actual gear ratio must match one of these conditions for at least 12 seconds with the 4th gear command:

- Actual gear ratio > 4th gear ratio by a factor of 1.2
- Actual gear ratio < 4th gear ratio by a factor of 0.75

**Driving Pattern**

Start the engine, shift to D5 position, and drive the vehicle at a speed of 8 mph (12 km/h) or more for at least 12 seconds in 4th gear.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0735 (64): ADVANCED DIAGNOSTICS

## DTC P0735: PROBLEM IN 5TH CLUTCH AND 5TH CLUTCH HYDRAULIC CIRCUIT

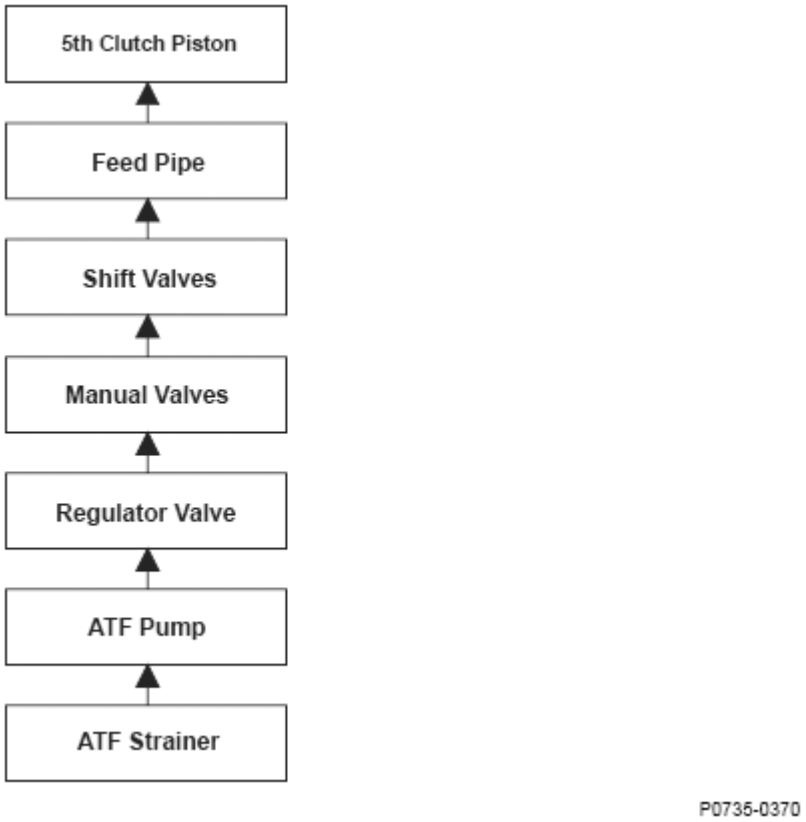



**Fig. 121: 5th Clutch And 5th Clutch Hydraulic Circuit Flow Chart**

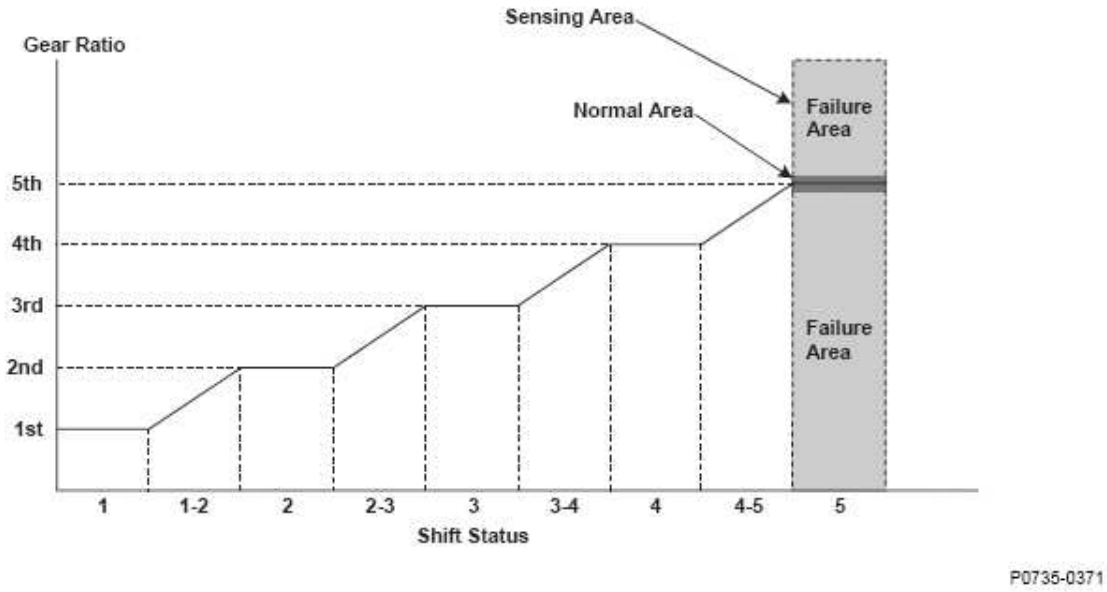



**Fig. 122: Gear Ratio To Shift Status Graph**

**General Description**

To engage 5th gear, line pressure is supplied to the 5th clutch piston, engaging the 5th clutch, and the mainshaft and the mainshaft 5th gear are connected and revolve together. Hydraulic pressure is supplied to the 5th clutch through the ATF strainer --> the ATF pump --> the regulator valve --> the manual valve --> the shift valves --> the feed pipe --> 5th clutch piston. (A shift valve failure in the supplying route above is detected by the malfunction detection of each shift solenoid valve.) The powertrain control module (PCM) computes the ratio of the mainshaft speed to the countershaft speed. When the ratio is not the 5th gear ratio, it is detected as a malfunction of the hydraulic circuit or the 5th clutch, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 12 seconds or more |
| DTC Type | Two drive cycles, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | 1,000 rpm | - |
| Vehicle speed | 8 mph (12 km/h) | - |

| | | |
|---|---|---|
| Battery voltage | 11.0 V | - |
| Shift lever position | D5 | |
| No active DTCs | P0116, P0117, P0118, P0122, P0123, P0222, P0223, P0705, P0706, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The actual gear ratio must match one of these conditions for at least 12 seconds with the 5th gear command:

- Actual gear ratio > 5th gear ratio by a factor of 1.2
- Actual gear ratio < 5th gear ratio by a factor of 0.75

**Driving Pattern**

Start the engine, shift to D5 position, and drive the vehicle at a speed of 8 mph (12 km/h) or more for at least 12 seconds in 5th gear.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0741 (40): ADVANCED DIAGNOSTICS

### DTC P0741: TORQUE CONVERTER CLUTCH CIRCUIT STUCK OFF

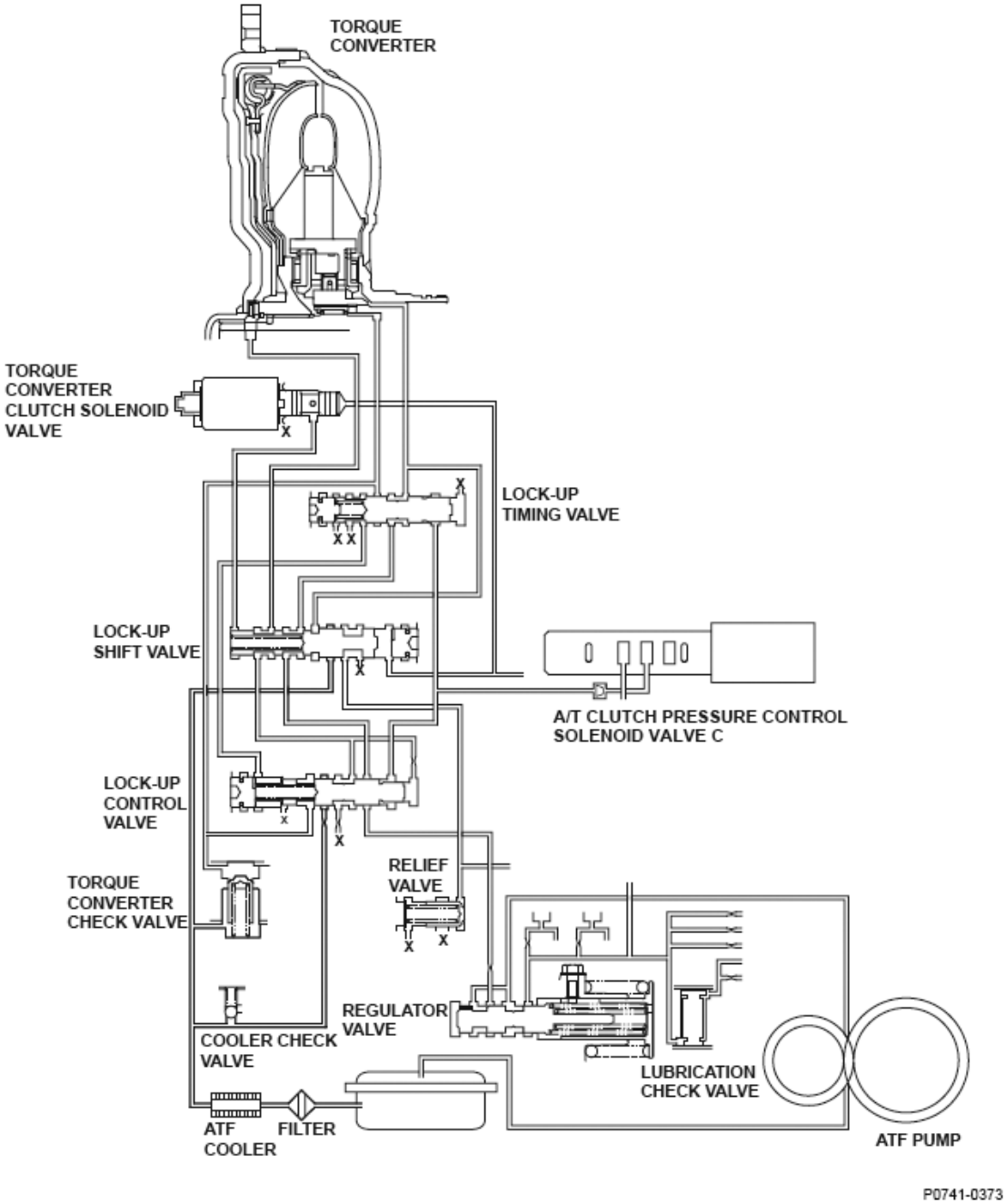



**Fig. 123: Torque Converter Clutch Circuit Diagram**

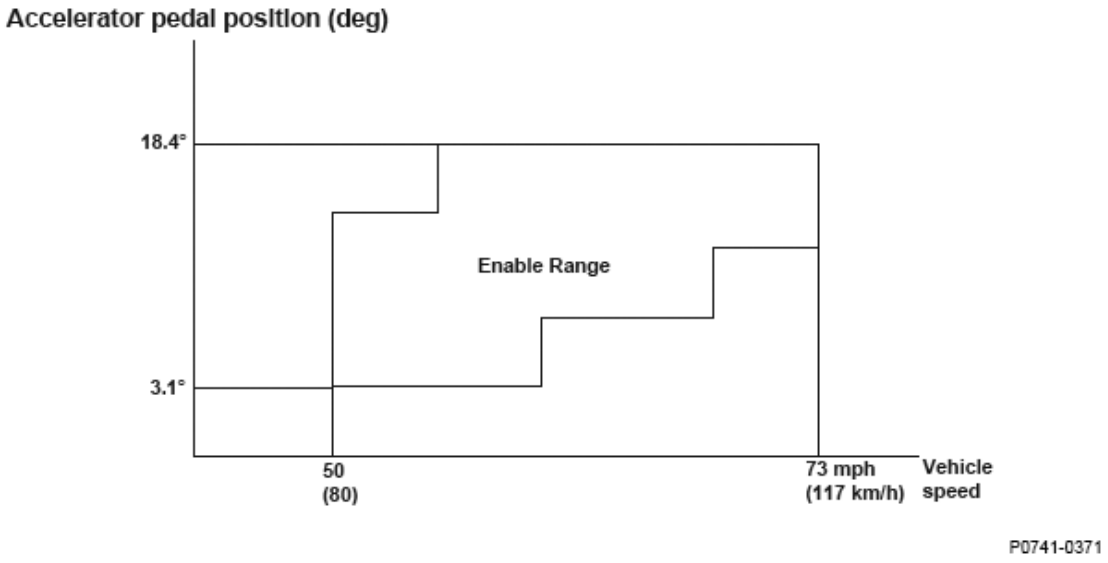



**Fig. 124: Accelerator Pedal Position Graph**

**TORQUE CONVERTER CLUTCH OPERATION CHART**

| Torque converter clutch operation | | A/T clutch pressure control solenoid valve C | |
|---|---|---|---|
| | | ON (100%) | OFF (0%) |
| Torque converter clutch solenoid valve | ON (12 V) | Torque converter clutch: maximum duty | Torque converter clutch OFF |
| | OFF (0 V) | Torque converter clutch OFF | Torque converter clutch OFF |

**General Description**

The power transfer capacity of the torque converter clutch is controlled by the balance of automatic transmission fluid (ATF) supply to and discharge from the torque converter. When hydraulic pressure is applied internally, the torque converter clutch turns ON, and when hydraulic pressure is applied from the back pressure side, the torque converter clutch turns OFF. As the hydraulic pressure from the internal pressure side increases, the power transfer capacity of the torque converter clutch increases. The direction of hydraulic pressure supply is switched by the torque converter clutch solenoid valve and the lockup shift valve. ATF is supplied from the internal pressure side to the torque converter clutch solenoid valve when the signal from the powertrain control module (PCM) is ON (12 V), and ATF is supplied from the back pressure side when it is OFF (0 V). The balance of internal pressure and back pressure is controlled by A/T clutch pressure control solenoid valve C, the lock-up control valve, and the lock-up timing valve. A/T clutch pressure control solenoid valve C maximizes the power transfer capacity of the torque converter clutch when the signal from the PCM is ON (1 A), and it minimizes the power transfer capacity of the torque converter clutch when the signal from the PCM is OFF (0 A). If the ratio of engine speed and mainshaft speed is not about 1:1 while the PCM is issuing the command to turn the torque converter clutch solenoid valve and A/T clutch pressure control solenoid valve C ON, the PCM detects a faulty lock-up control system and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 20 seconds or more |
| DTC Type | Two drive cycles, MIL ON, D5 indicator OFF |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 158°F (70°C) | 212°F (100°C) |
| Battery voltage | 11.0 V | - |
| ATF temperature | - | 275°F (135°C) |
| Shift status | 5th | |
| Torque converter clutch | During controlling operation | |
| No active DTCs | P0116, P0117, P0118, P0122, P0123, P0222, P0223, P0705, P0706, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |
| Other | When both the vehicle speed and the throttle position are in Enable Range | |

**Malfunction Threshold**

The ratio of the engine revolution to the transmission input pulse does not reach about 100% for at least 20 seconds.

**Driving Pattern**

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a constant speed of 60 mph (97 km/h) for at least 20 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0746 (76): ADVANCED DIAGNOSTICS

### DTC P0746: A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE A STUCK OFF

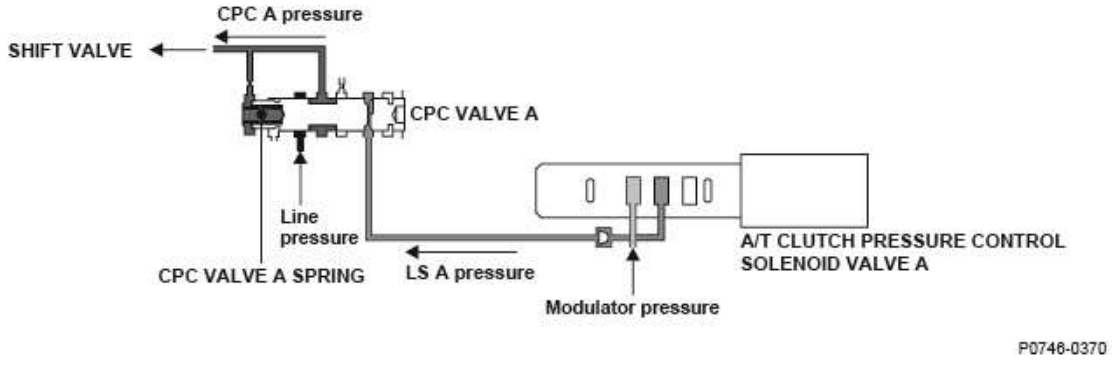



**Fig. 125: A/T Clutch Pressure Control Solenoid Valve A Operation Diagram**

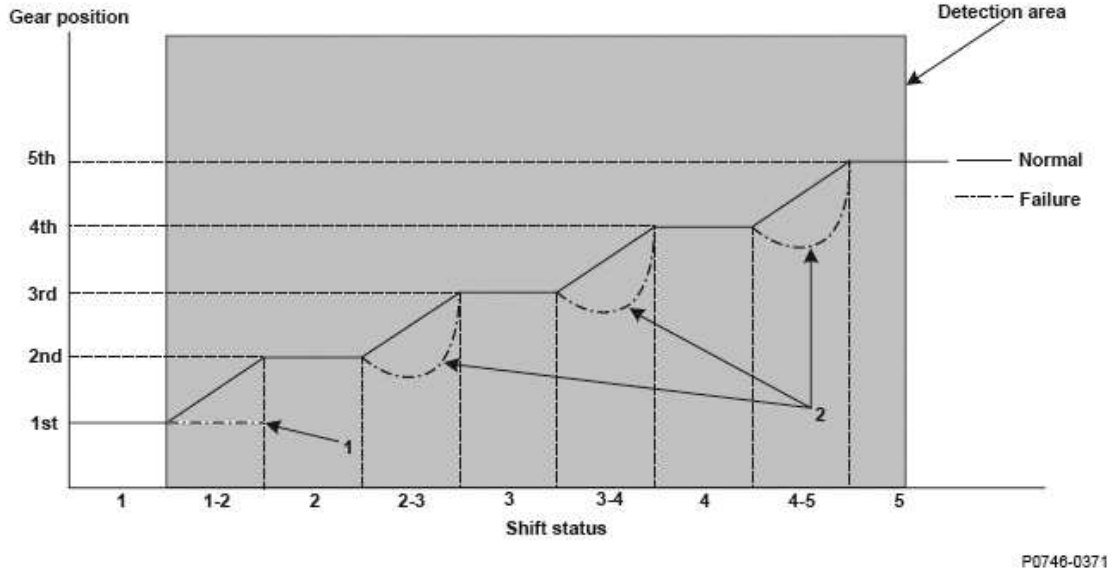



**Fig. 126: Gear Position To Shift Status Graph**

## A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE COMBINATION TABLE

| Gear position | A/T Clutch Pressure Control Solenoid Valve A | | | A/T Clutch Pressure Control Solenoid Valve B | | |
|---|---|---|---|---|---|---|
| | Operation | Pressure | Clutch | Operation | Pressure | Clutch |
| 1st | OFF | Minimum | 2nd | OFF | Maximum | - |
| 1st - 2nd | OFF - ON | Minimum - Maximum | 2nd | OFF - ON | Maximum - Minimum | - |
| 2nd | ON | Maximum | - | ON | Minimum | - |
| 2nd - 3rd | ON - OFF | Maximum - Minimum | 2nd | ON - OFF | Minimum - Maximum | 3rd |
| 3rd | OFF | Minimum | - | OFF | Maximum | - |
| 3rd - 4th | OFF - ON | Minimum - Maximum | 4th | OFF - ON | Maximum - Minimum | 3rd |
| 4th | ON | Maximum | - | ON | Minimum | - |
| 4th - 5th | ON - OFF | Maximum - Minimum | 4th | ON - OFF | Minimum - Maximum | 5th |
| 5th | OFF | Minimum | - | OFF | Maximum | - |

**General Description**

A/T clutch pressure control solenoid valve A is installed in the transmission housing. A/T clutch pressure control solenoid A is operated by the powertrain control module (PCM) and converts the modulated pressure to A/T clutch pressure control solenoid A pressure, which operates CPC valve A. Line pressure is modulated to clutch pressure control A pressure (CPC A pressure) by CPC valve A and the CPC valve A spring. A signal from the PCM is output to the proper gear clutch, determined by the gear schedule, to supply the proper CPC pressure according to the driving conditions. When the current from the PCM is high (ON), A/T clutch pressure control solenoid valve A operates and the CPC valve A pressure increases. When the current from the PCM is low (OFF), A/T clutch pressure control solenoid valve A turns off and CPC valve A pressure decreases. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear ratio, an A/T clutch pressure control solenoid valve A OFF failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | Depending on the driving pattern |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 50°F (10°C) | - |
| Battery voltage | 11.0 V | - |

| | | |
|---|---|---|
| ATF temperature | -13°F (-25°C) | - |
| Accelerator pedal position variation | - | 6.0%/20 msec |
| Accelerator pedal position | Other than fully closed | |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

One of these conditions occurs.

1. The transmission is held in 1st gear against the 1st --> 2nd gear upshift command.
2. The engine speed flares when upshifting to 2nd - 3rd, 3rd - 4th, and 4th - 5th.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0747 (76): ADVANCED DIAGNOSTICS

**DTC P0747: A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE A STUCK ON**

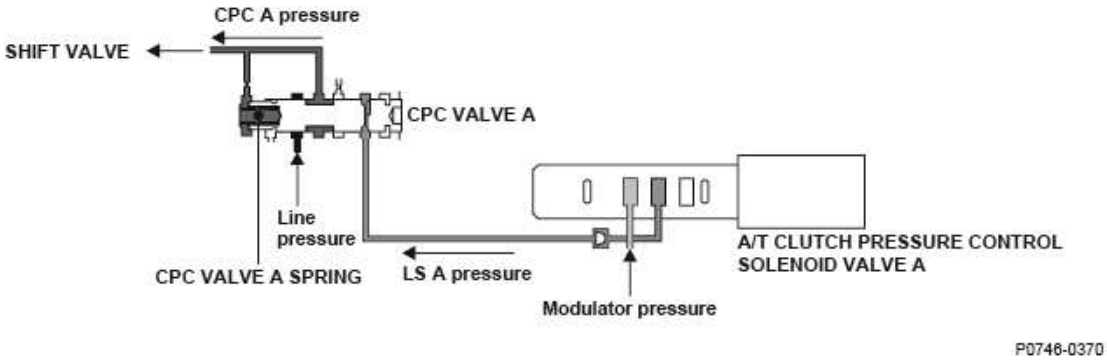



**Fig. 127: A/T Clutch Pressure Control Solenoid Valve A Operation Diagram**

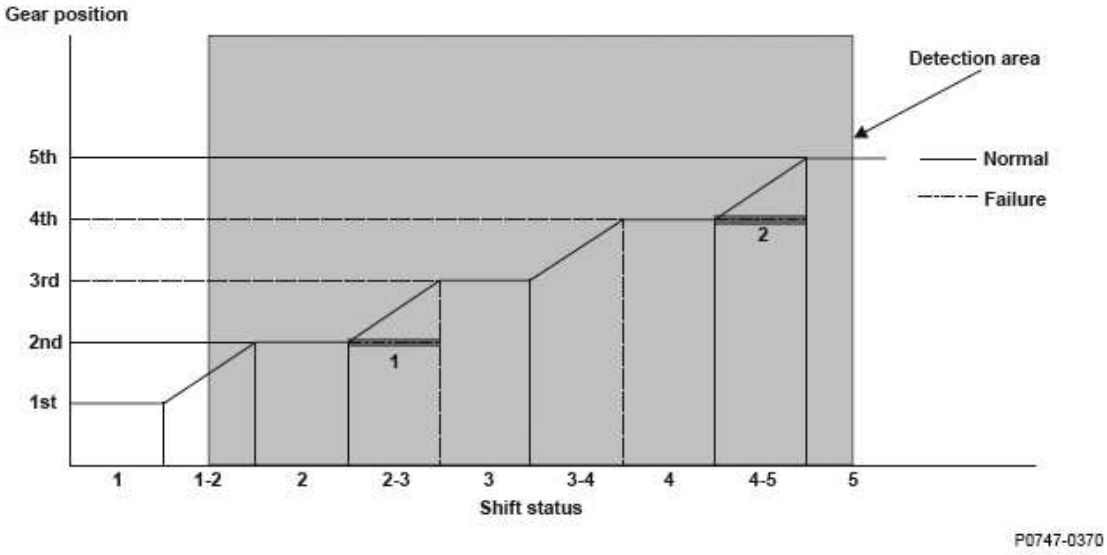



**Fig. 128: Gear Position To Shift Status Graph**

**A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE COMBINATION TABLE**

| Gear position | A/T Clutch Pressure Control Solenoid Valve A | | | A/T Clutch Pressure Control Solenoid Valve B | | |
|---|---|---|---|---|---|---|
| | Operation | Pressure | Clutch | Operation | Pressure | Clutch |
| 1st | OFF | Minimum | 2nd | OFF | Maximum | - |
| 1st - 2nd | OFF - ON | Minimum - Maximum | 2nd | OFF - ON | Maximum - Minimum | - |
| 2nd | ON | Maximum | - | ON | Minimum | - |
| 2nd - 3rd | ON - OFF | Maximum - Minimum | 2nd | ON - OFF | Minimum - Maximum | 3rd |
| 3rd | OFF | Minimum | - | OFF | Maximum | - |
| 3rd - 4th | OFF - ON | Minimum - Maximum | 4th | OFF - ON | Maximum - Minimum | 3rd |
| 4th | ON | Maximum | - | ON | Minimum | - |
| 4th - 5th | ON - OFF | Maximum - Minimum | 4th | ON - OFF | Minimum - Maximum | 5th |
| 5th | OFF | Minimum | - | OFF | Maximum | - |

**General Description**

A/T clutch pressure control solenoid valve A is installed in the transmission housing. A/T clutch pressure control solenoid A is operated by the powertrain control module (PCM) and converts the modulated pressure to A/T clutch pressure control solenoid A pressure, which operates CPC valve A. Line pressure is modulated to clutch pressure control A pressure (CPC A pressure) by CPC valve A and the CPC valve A spring. A signal from the PCM is output to the proper gear clutch, determined by the gear schedule, to supply the proper CPC pressure according to the driving conditions. When the current from the PCM is high (ON), A/T clutch pressure control solenoid valve A operates and the CPC valve A pressure increases. When the current from the PCM is low (OFF), A/T clutch pressure control solenoid valve A turns off and CPC valve A pressure decreases. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear ratio, an A/T clutch pressure control solenoid valve A ON failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 20 seconds or less |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| ATF temperature | -13°F (-25°C) | - |
| Battery voltage | 11.0 V | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

One of these conditions occurs.

1. The transmission is held in 2nd gear against the 2nd --> 3rd gear upshift command.
2. The transmission is held in 4th gear against the 4th --> 5th gear upshift command.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0751 (70): ADVANCED DIAGNOSTICS

### DTC P0751: SHIFT SOLENOID VALVE A STUCK OFF

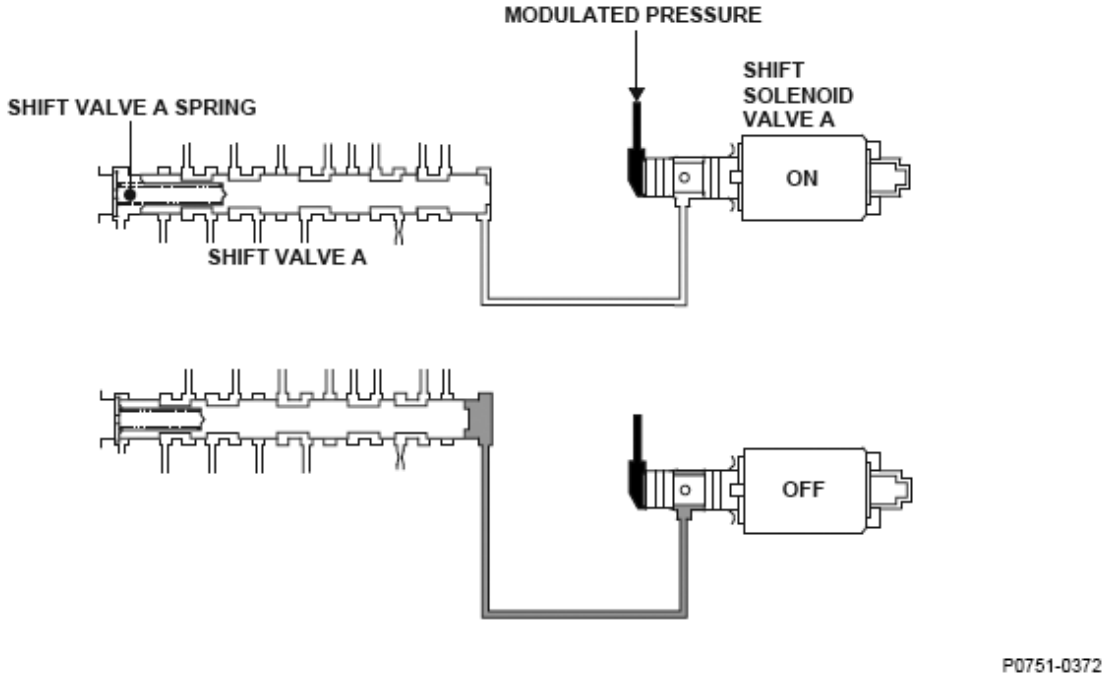



**Fig. 129: Shift Solenoid Valve A Operation Diagram**

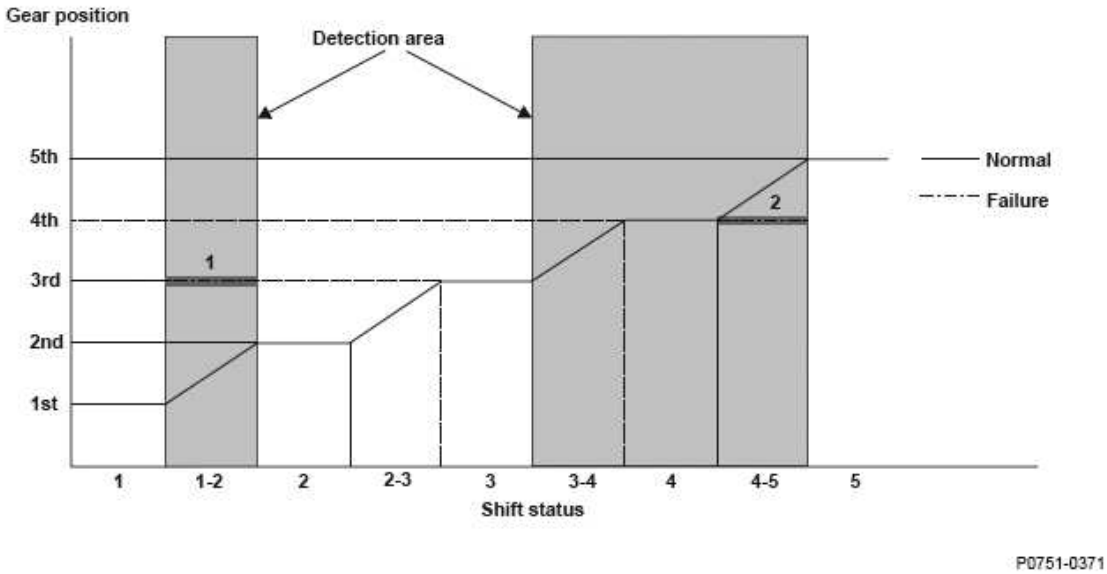



**Fig. 130: Gear Position To Shift Status Graph**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 131: Gear Position To Shift Solenoid Valve Table**

**General Description**

Shift solenoid valve A is installed in the transmission housing. It is controlled by the ON/OFF signal from the powertrain control module (PCM), to apply modulated pressure to shift valve A. The signal from the PCM is output to apply clutch pressure control pressure to the proper gear change clutch according to the gear change schedule. When the signal to shift solenoid valve A from the PCM is ON, and modulated pressure is discharged, shift valve A is inactive. When the signal to shift solenoid valve A from the PCM is OFF, and modulated pressure is applied to shift valve A, it operates against the shift valve A spring. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear change mode, a shift solenoid valve A OFF

failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 20 seconds or less |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| ATF temperature | -13°F (-25°C) | - |
| Battery voltage | 11.0 V | - |
| Accelerator pedal position | 5% | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

One of these conditions occurs.

1. The transmission is held in 3rd gear against the 1st --> 2nd gear upshift command for 20 seconds or less.
2. The transmission is held in 4th gear against the 4th --> 5th gear upshift command for 20 seconds or less without a record that the gear change time was short when the 3rd --> 4th gear upshift was commanded.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0752 (70): ADVANCED DIAGNOSTICS

### DTC P0752: SHIFT SOLENOID VALVE A STUCK ON

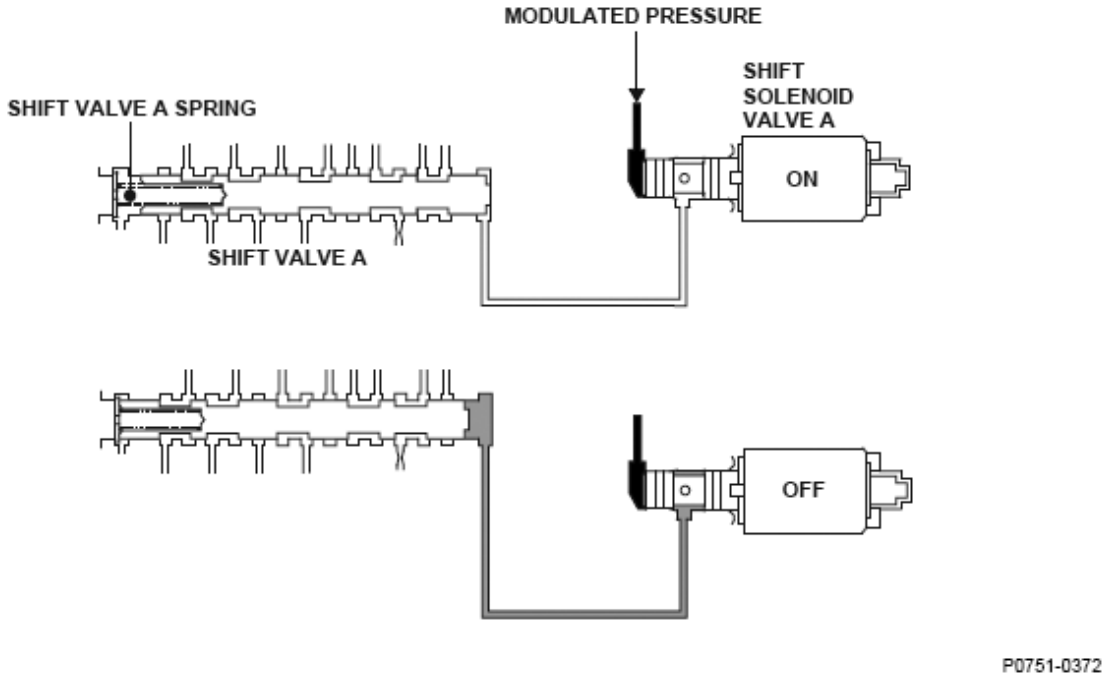



**Fig. 132: Shift Solenoid Valve A Operation Diagram**

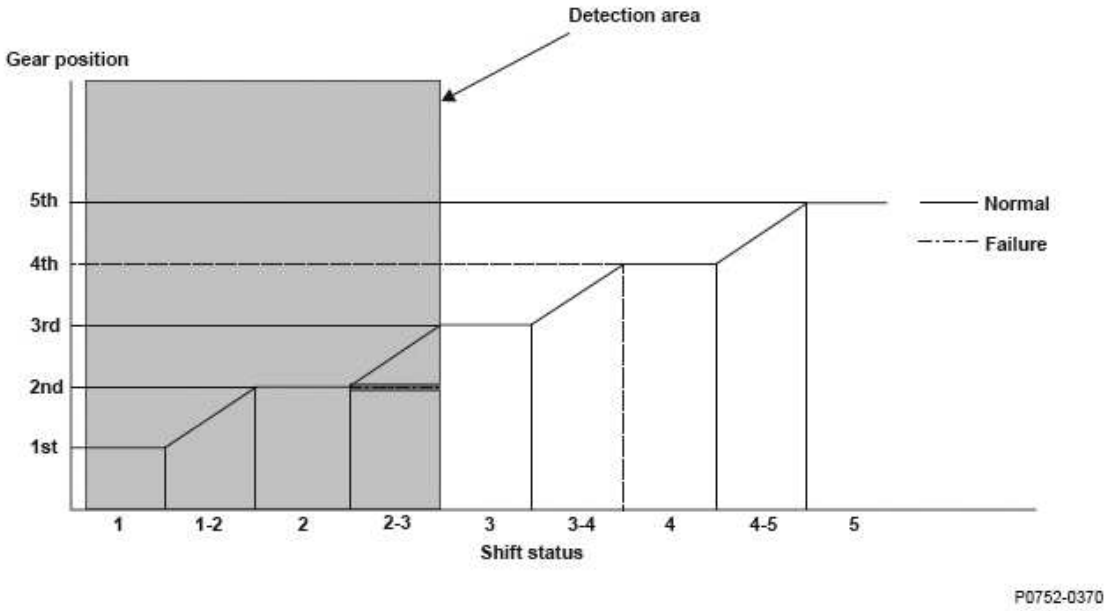



**Fig. 133: Gear Position To Shift Status Graph**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 134: Gear Position To Shift Solenoid Valve Table**

**General Description**

Shift solenoid valve A is installed in the transmission housing. It is controlled by the ON/OFF signal from the powertrain control module (PCM), to apply modulated pressure to shift valve A. The signal from the PCM is output to apply clutch pressure control pressure to the proper gear change clutch according to the gear change schedule. When the signal to shift solenoid valve A from the PCM is ON, and modulated pressure is discharged, shift valve A is inactive. When the signal to shift solenoid valve A from the PCM is OFF, and modulated pressure is applied to shift valve A, it operates against the shift valve A spring. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an

improper gear ratio is output compared to the predetermined gear change mode, a shift solenoid valve A ON failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 20 seconds or less |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| ATF temperature | -13°F (-25°C) | - |
| Vehicle speed | 5 mph (9 km/h) | - |
| Battery voltage | 11.0 V | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The transmission is held in 2nd gear against the 2nd --> 3rd gear upshift command for 20 seconds or less without a record that the transmission was held in 2nd gear against the 1st gear command.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0756 (71): ADVANCED DIAGNOSTICS

## DTC P0756: SHIFT SOLENOID VALVE B STUCK OFF

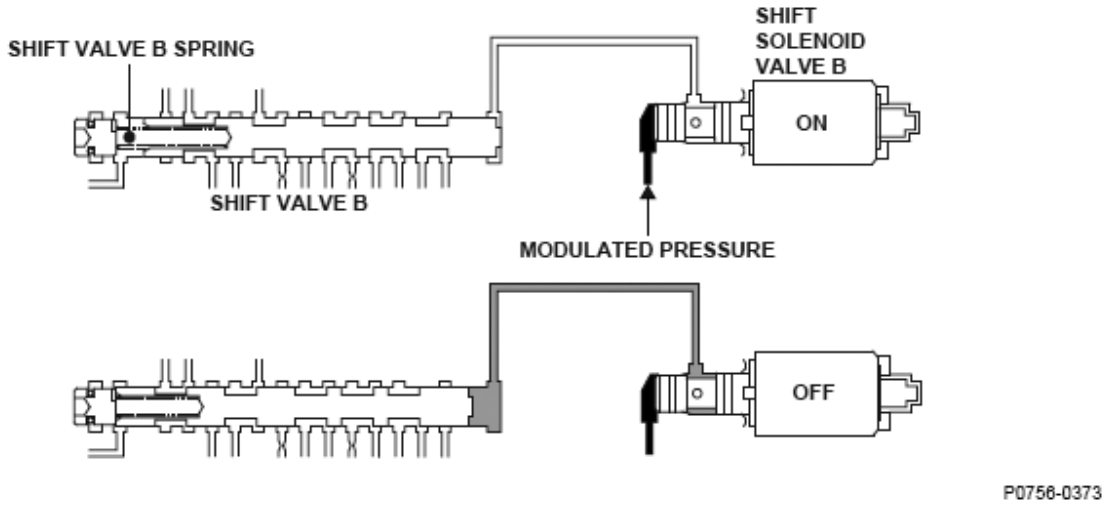



**Fig. 135: Shift Solenoid Valve B Operation Diagram**

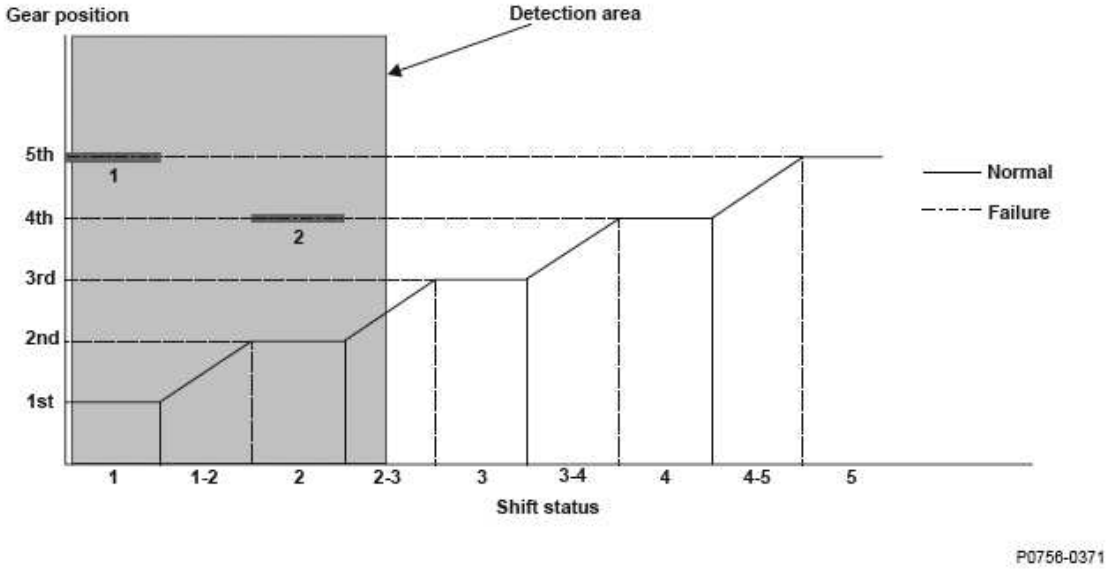



**Fig. 136: Gear Position To Shift Status Graph**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 137: Gear Position To Shift Solenoid Valve Table**

**General Description**

Shift solenoid valve B is installed in the transmission housing. It is controlled by the ON/OFF signal from the powertrain control module (PCM), to apply modulated pressure to shift valve B. The signal from the PCM is output to apply clutch pressure control pressure to the proper gear change clutch according to the gear change schedule. When the signal to shift solenoid valve B from the PCM is ON, and modulated pressure is discharged, shift valve B is inactive. When the signal to shift solenoid valve B from the PCM is OFF, and modulated pressure is applied to shift valve B, it operates against the shift valve B spring. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear change mode, a shift solenoid valve B OFF failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | Depending on the driving pattern |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Vehicle speed | 5 mph (9 km/h) | - |

| | | |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0757, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

Both of these conditions occur.

1. The transmission is held in 5th gear against the 1st gear hold command.
2. The transmission is held in 4th gear against the 2nd gear hold command.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0757 (71): ADVANCED DIAGNOSTICS

### DTC P0757: SHIFT SOLENOID VALVE B STUCK ON

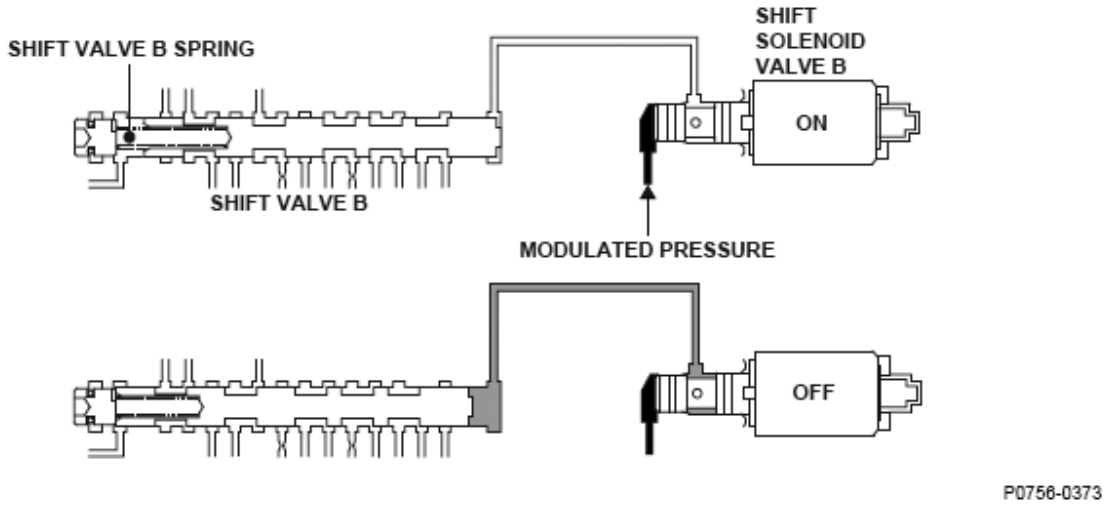



**Fig. 138: Shift Solenoid Valve B Operation Diagram**

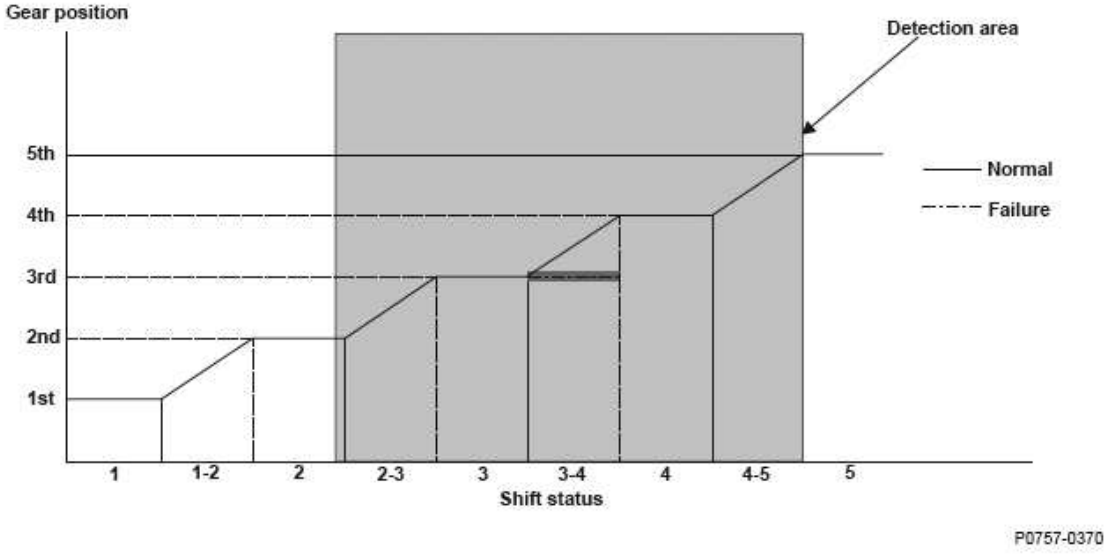



**Fig. 139: Gear Position To Shift Status Graph**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 140: Gear Position To Shift Solenoid Valve Table**

**General Description**

Shift solenoid valve B is installed in the transmission housing. It is controlled by the ON/OFF signal from the powertrain control module (PCM), to apply modulated pressure to shift valve B. The signal from the PCM is output to apply clutch pressure control pressure to the proper gear change clutch according to the gear change schedule. When the signal to shift solenoid valve B from the PCM is ON, and modulated pressure is discharged, shift valve B is inactive. When the signal to shift solenoid valve B from the PCM is OFF, and modulated pressure is applied to shift valve B, it operates against the shift valve B spring. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear change mode, a shift solenoid valve B ON failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 20 seconds or less |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| ATF temperature | -13°F (-25°C) | - |

| | | |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0761, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The transmission is held in 3rd gear against the 3rd --> 4th gear upshift command for 20 seconds or less, without records that the gear change time was short when the 2nd --> 3rd gear upshift and the 4th --> 5th gear upshift were commanded.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0761 (72): ADVANCED DIAGNOSTICS

### DTC P0761: SHIFT SOLENOID VALVE C STUCK OFF

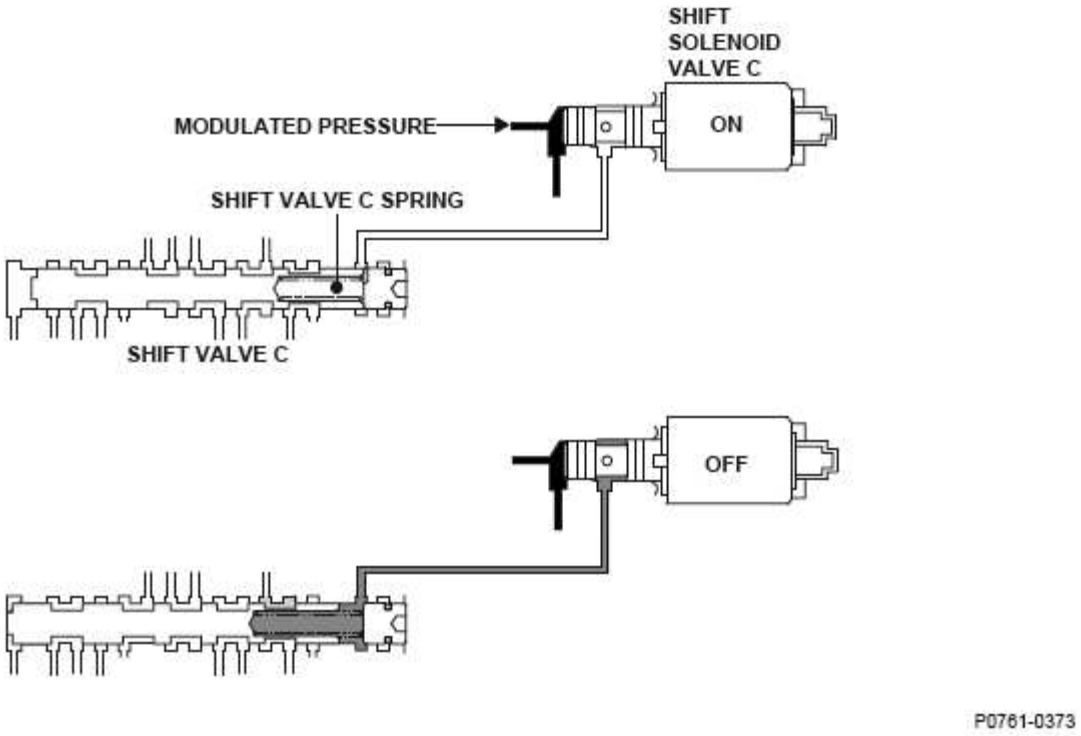



**Fig. 141: Shift Solenoid Valve C Operation Diagram**

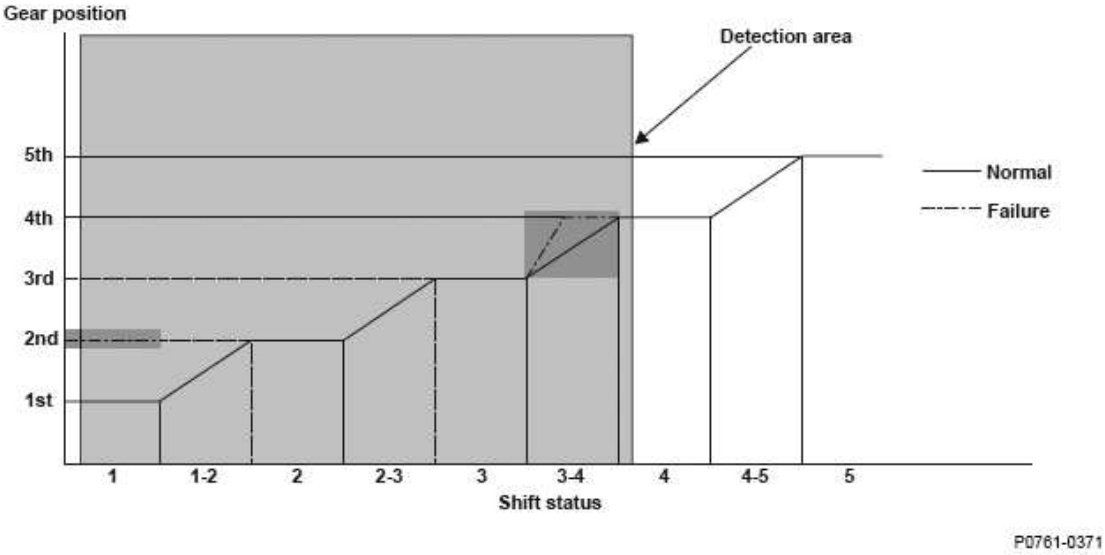



**Fig. 142: Gear Position To Shift Status Graph**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 143: Gear Position To Shift Solenoid Valve Table**

**General Description**

Shift solenoid valve C is installed in the transmission housing. It is controlled by the ON/OFF signal from the powertrain control module (PCM), to apply modulated pressure to shift valve C. The signal from the PCM is output to apply clutch pressure control pressure to the proper gear change clutch according to the gear change schedule. When the signal to shift solenoid valve C from the PCM is ON, and modulated pressure is discharged, shift valve C is inactive. When the signal to shift solenoid valve C from the PCM is OFF, and modulated pressure is applied to shift valve C, it operates against the shift valve C spring. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear change mode, a shift solenoid valve C OFF failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | Depending on the driving pattern |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Vehicle speed | 5 mph (9 km/h) | - |

| | | |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0762, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

At first, the transmission is held in 2nd gear against the 1st gear command, and then the 3rd --> 4th gear change time is short (less than 0.8 second) when the 3rd --> 4th gear upshift is commanded.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0762 (72): ADVANCED DIAGNOSTICS

### DTC P0762: SHIFT SOLENOID VALVE C STUCK ON

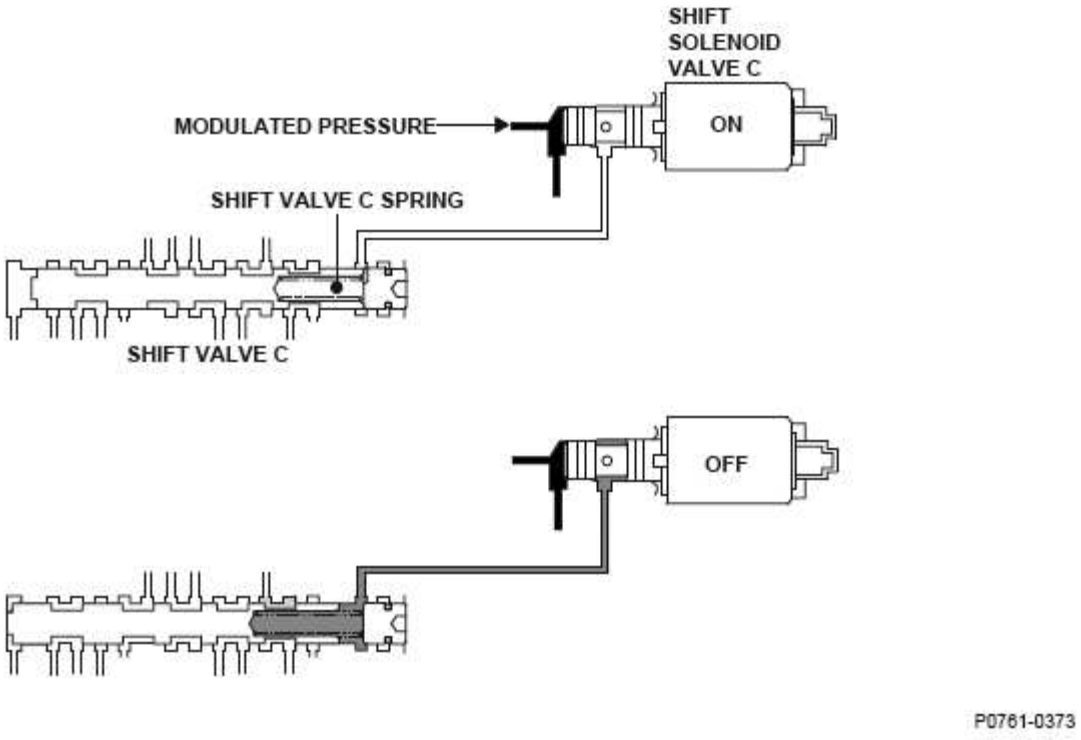



**Fig. 144: Shift Solenoid Valve C Operation Diagram**

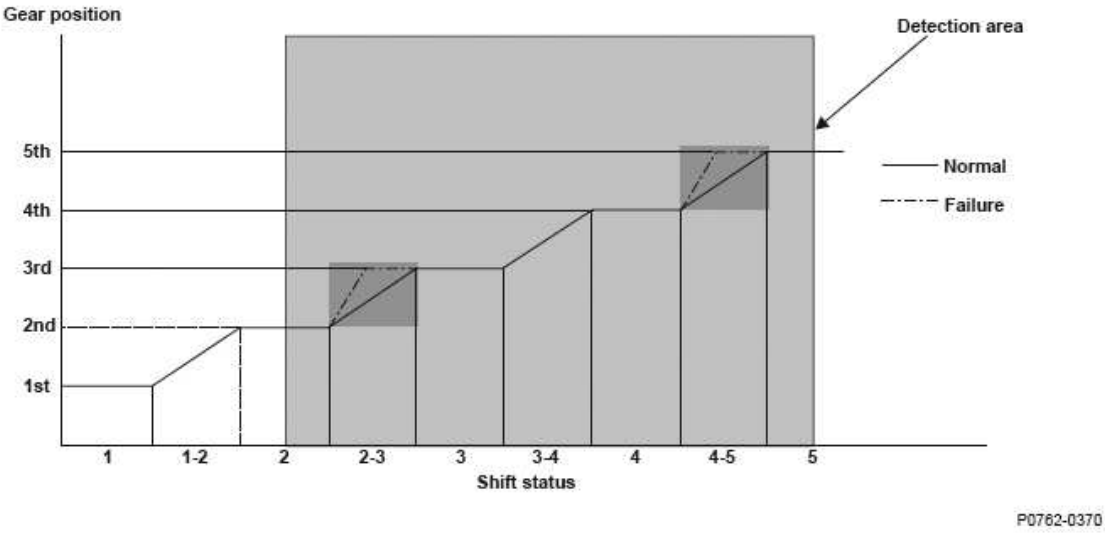



**Fig. 145: Gear Position To Shift Status Graph**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 146: Gear Position To Shift Solenoid Valve Table**

**General Description**

Shift solenoid valve C is installed in the transmission housing. It is controlled by the ON/OFF signal from the powertrain control module (PCM), to apply modulated pressure to shift valve C. The signal from the PCM is output to apply clutch pressure control pressure to the proper gear change clutch according to the gear change schedule. When the signal to shift solenoid valve C from the PCM is ON, and modulated pressure is discharged, shift valve C is inactive. When the signal to shift solenoid valve C from the PCM is OFF, and modulated pressure is applied to shift valve C, it operates against the shift valve C spring. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear change mode, a shift solenoid valve C ON failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | Depending on the driving pattern |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Accelerator pedal position | 5% | - |

| | | |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0776, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

First, the 2nd --> 3rd gear change time is short (less than 0.8 second) when the 2nd --> 3rd gear upshift is commanded, and then the 4th --> 5th gear change time is short (less than 0.8 second) when the 4th --> 5th gear upshift is commanded.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0776 (77): ADVANCED DIAGNOSTICS

### DTC P0776: A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE B STUCK OFF

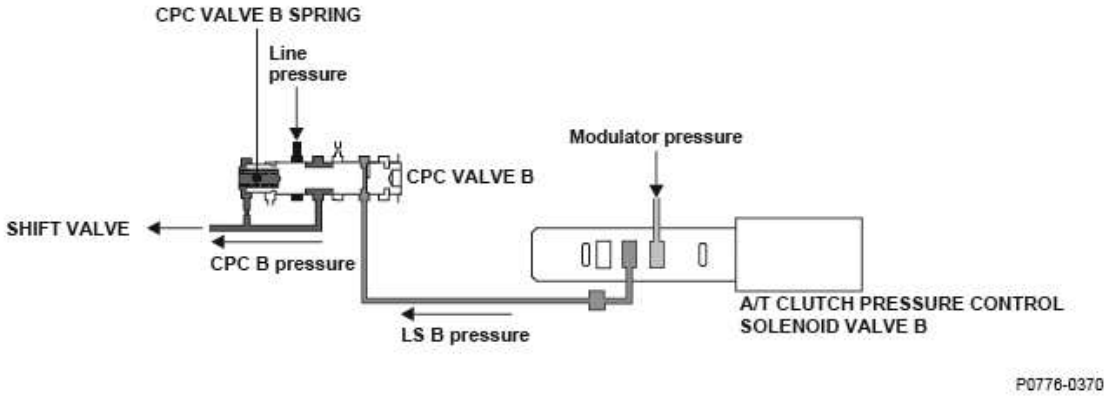



**Fig. 147: A/T Clutch Pressure Control Solenoid Valve B Operation Diagram**

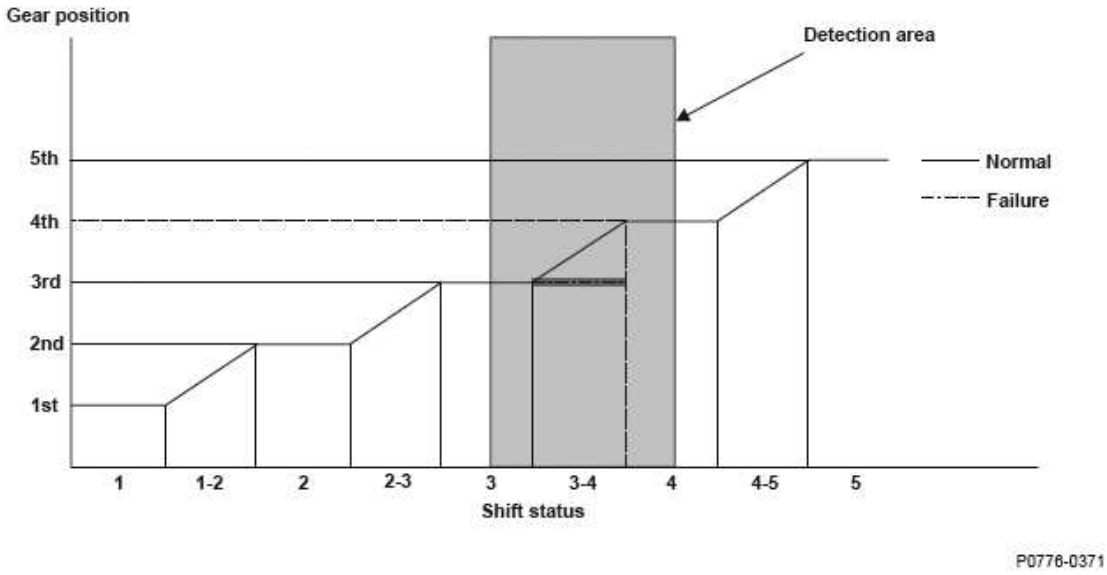



**Fig. 148: Gear Position To Shift Status Graph**

**A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE COMBINATION TABLE**

| Gear position | A/T Clutch Pressure Control Solenoid Valve A | | | A/T Clutch Pressure Control Solenoid Valve B | | |
|---|---|---|---|---|---|---|
| | Operation | Pressure | Clutch | Operation | Pressure | Clutch |
| 1st | OFF | Minimum | 2nd | OFF | Maximum | - |
| 1st - 2nd | OFF - ON | Minimum - Maximum | 2nd | OFF - ON | Maximum - Minimum | - |
| 2nd | ON | Maximum | - | ON | Minimum | - |
| 2nd - 3rd | ON - OFF | Maximum - Minimum | 2nd | ON - OFF | Minimum - Maximum | 3rd |
| 3rd | OFF | Minimum | - | OFF | Maximum | - |
| 3rd - 4th | OFF - ON | Minimum - Maximum | 4th | OFF - ON | Maximum - Minimum | 3rd |
| 4th | ON | Maximum | - | ON | Minimum | - |
| 4th - 5th | ON - OFF | Maximum - Minimum | 4th | ON - OFF | Minimum - Maximum | 5th |
| 5th | OFF | Minimum | - | OFF | Maximum | - |

**General Description**

A/T clutch pressure control solenoid valve B is installed in the transmission housing. A/T clutch pressure control solenoid B is operated by the powertrain control module (PCM) and converts modulated pressure to A/T clutch pressure control solenoid B pressure, which operates CPC valve B. Line pressure is modulated to clutch pressure control B pressure (CPC B pressure) by CPC valve B and the CPC valve B spring. A signal from the PCM is output to the proper gear clutch, determined by the gear schedule, to supply the proper CPC pressure according to the driving conditions. When the current from the PCM is low (OFF), A/T clutch pressure control solenoid valve B operates and the CPC valve B pressure increases. When the current from the PCM is high (ON), A/T clutch pressure control solenoid valve B turns off and the CPC valve B pressure decreases. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear change mode, an A/T clutch pressure control solenoid valve B OFF failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 20 seconds or less |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| ATF temperature | -13°F (-25°C) | - |
| Battery voltage | 11.0 V | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0777, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The transmission is held in 3rd gear against the 3rd --> 4th gear upshift command.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0777 (77): ADVANCED DIAGNOSTICS

## DTC P0777: A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE B STUCK ON

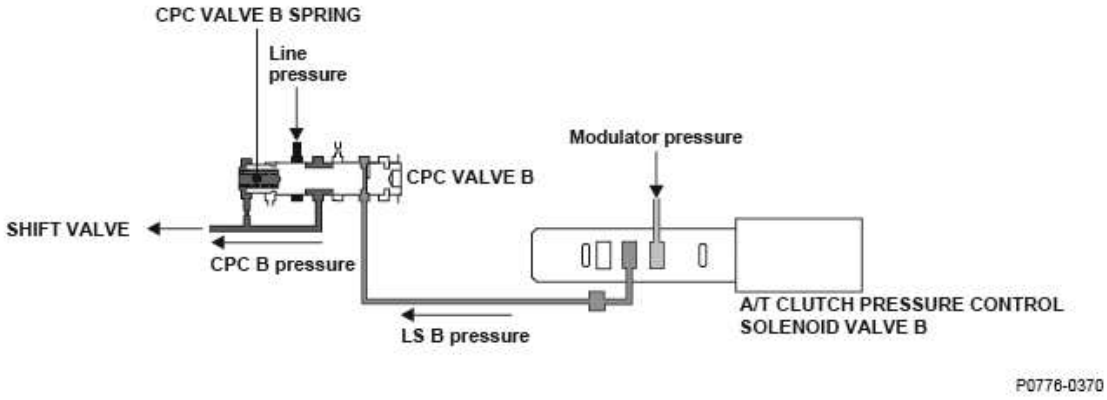



**Fig. 149: A/T Clutch Pressure Control Solenoid Valve B Operation Diagram**

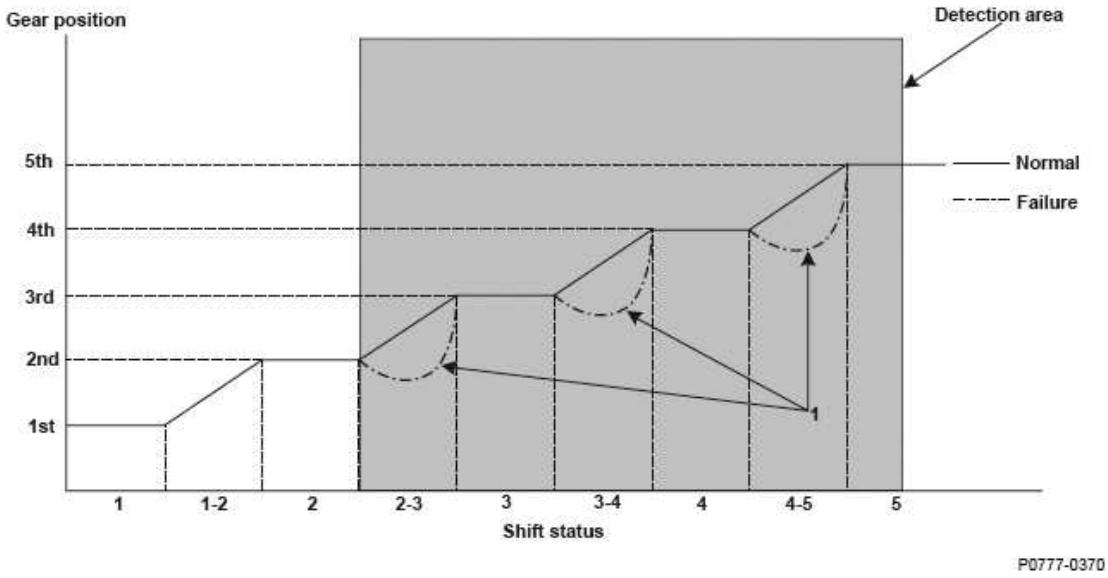



**Fig. 150: Gear Position To Shift Status Graph**

**A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE COMBINATION TABLE**

| Gear position | A/T Clutch Pressure Control Solenoid Valve A | | | A/T Clutch Pressure Control Solenoid Valve B | | |
|---|---|---|---|---|---|---|
| | Operation | Pressure | Clutch | Operation | Pressure | Clutch |
| 1st | OFF | Minimum | 2nd | OFF | Maximum | - |
| 1st - 2nd | OFF - ON | Minimum - Maximum | 2nd | OFF - ON | Maximum - Minimum | - |
| 2nd | ON | Maximum | - | ON | Minimum | - |
| 2nd - 3rd | ON - OFF | Maximum - Minimum | 2nd | ON - OFF | Minimum - Maximum | 3rd |
| 3rd | OFF | Minimum | - | OFF | Maximum | - |
| 3rd - 4th | OFF - ON | Minimum - Maximum | 4th | OFF - ON | Maximum - Minimum | 3rd |
| 4th | ON | Maximum | - | ON | Minimum | - |
| 4th - 5th | ON - OFF | Maximum - Minimum | 4th | ON - OFF | Minimum - Maximum | 5th |
| 5th | OFF | Minimum | - | OFF | Maximum | - |

**General Description**

A/T clutch pressure control solenoid valve B is installed in the transmission housing. A/T clutch pressure control solenoid B is operated by the powertrain control module (PCM) and converts modulated pressure to A/T clutch pressure control solenoid B pressure, which operates CPC valve B. Line pressure is modulated to clutch pressure control B pressure (CPC B pressure) by CPC valve B and the CPC valve B spring. A signal from the PCM is output to the proper gear clutch, determined by the gear schedule, to supply the proper CPC pressure according to the driving conditions. When the current from the PCM is low (OFF), A/T clutch pressure control solenoid valve B operates and the CPC valve B pressure increases. When the current from the PCM is high (ON), A/T clutch pressure control solenoid valve B turns off and the CPC valve B pressure decreases. The PCM monitors the mainshaft speed and the countershaft speed at the gear change determined by the shift schedule. When an improper gear ratio is output compared to the predetermined gear change mode, an A/T clutch pressure control solenoid valve B ON failure is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | Depending on the driving pattern |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 50°F (10°C) | - |
| ATF temperature | -13°F (-25°C) | - |
| Battery voltage | 11.0 V | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0780, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The engine speed flares when upshifting from 2nd - 3rd, 3rd - 4th, and 4th - 5th.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0780 (45): ADVANCED DIAGNOSTICS

### DTC P0780: PROBLEM IN SHIFT CONTROL SYSTEM

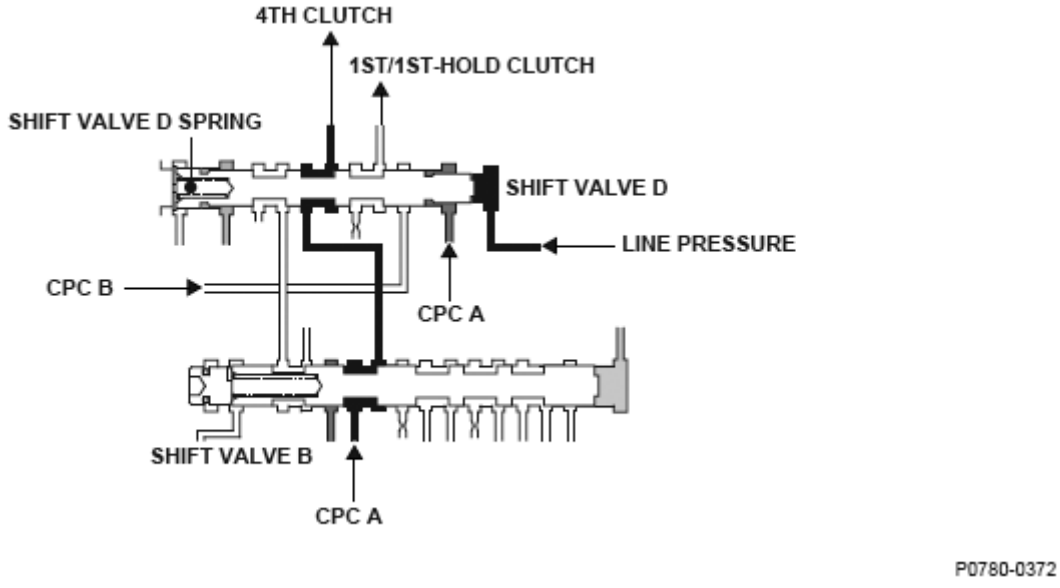



**Fig. 151: Shift Control System Diagram**

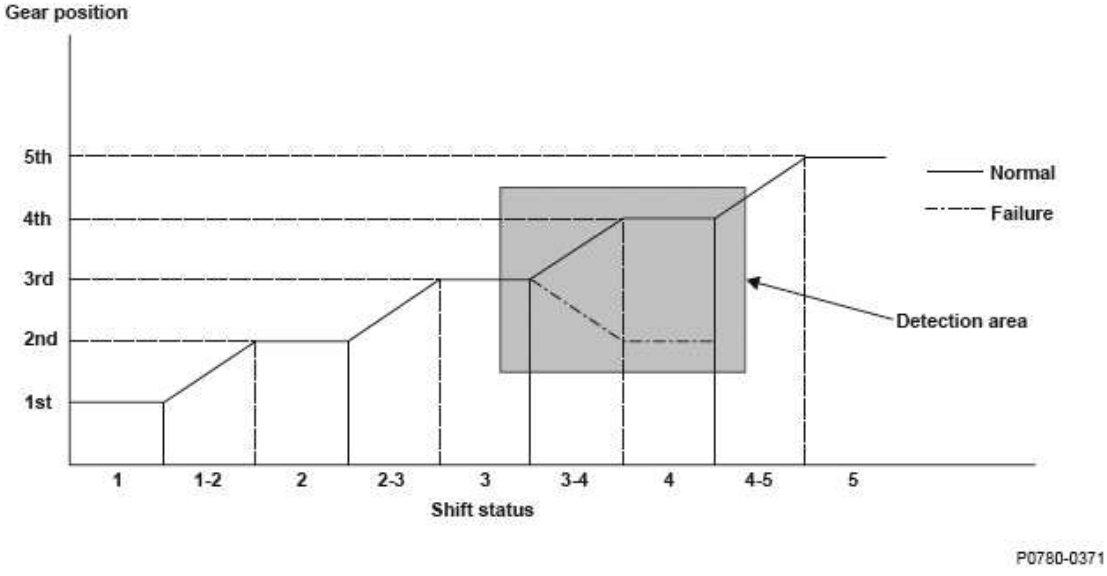



**Fig. 152: Gear Position To Shift Status Graph**

**General Description**

Shift valve D is installed in the control circuit in the transmission. When the shift lever is in D5, shift valve D supplies clutch pressure control A pressure (CPC A pressure) to the 4th clutch. When the shift lever is in 1st, shift valve D supplies clutch pressure control B pressure (CPC B pressure) to the 1st/1st-hold clutch. Shift valve D supplies CPC A pressure to the 4th clutch by increasing the line pressure and CPC A pressure. Shift valve D supplies clutch pressure control B pressure (CPC B pressure) to the 1st/1st-hold clutch. Shift valve D is regulated by the shift valve D spring which decreases the line pressure and CPC A pressure. The powertrain control module (PCM) monitors the mainshaft speed and countershaft speed at the gear change determined by the shift schedule. When an improper ratio is output versus the predetermined gear change mode, shift valve D is stuck closed, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 4.5 seconds or less |
| DTC Type | Two drive cycles, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| ATF temperature | -13°F (-25°C) | - |
| No active DTCs | P0122, P0123, P0222, P0223, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P1683, P1684, P2101, P2108, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2552, P2769, P2770, U0107 | |

**Malfunction Threshold**

The transmission is downshifted from 3rd gear to 2nd gear against the 3rd --> 4th gear upshift command.

**Driving Pattern**

Start the engine, and accelerate the vehicle until the transmission shifts into 5th gear in D5 position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0847 (26): ADVANCED DIAGNOSTICS

## DTC P0847: SHORT IN 3RD CLUTCH TRANSMISSION FLUID PRESSURE SWITCH CIRCUIT, OR 3RD CLUTCH TRANSMISSION FLUID PRESSURE SWITCH STUCK ON

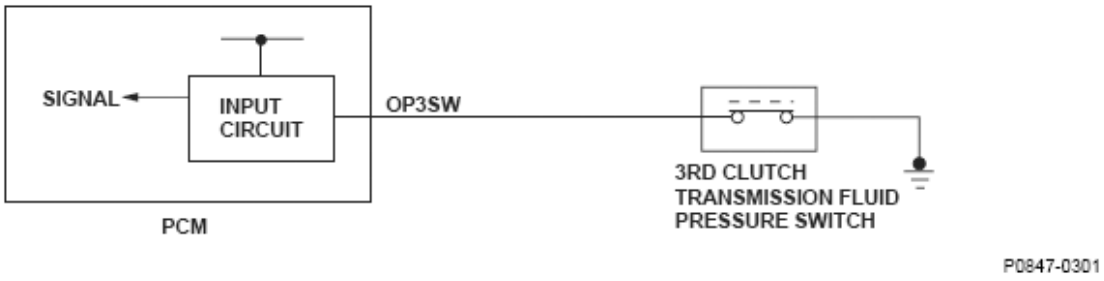



**Fig. 153: 3rd Clutch Transmission Fluid Pressure Switch Or 3rd Clutch Transmission Fluid Pressure Switch Circuit Diagram**

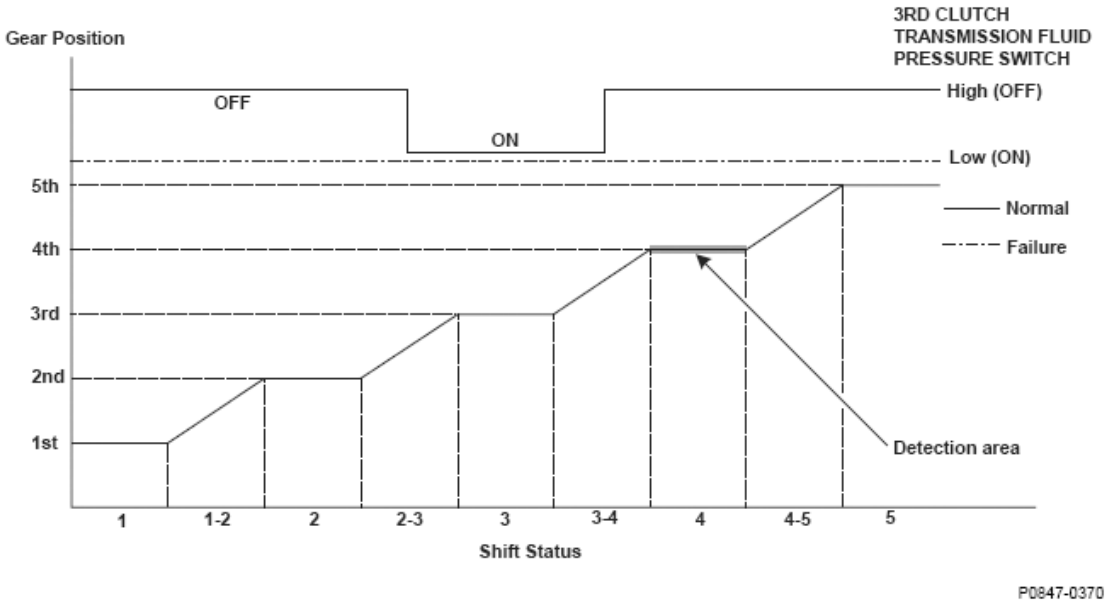



**Fig. 154: Gear Position To Shift Status Graph**

**General Description**

The 3rd clutch transmission fluid pressure switch is installed in the hydraulic pressure circuit to the 3rd clutch. When hydraulic pressure is supplied to the 3rd clutch, the switch is turned ON. When hydraulic pressure is not supplied to the 3rd clutch, the switch is turned OFF. The signal from the 3rd clutch transmission fluid pressure switch is input to the powertrain control module (PCM). The PCM detects the hydraulic pressure supply conditions at the gear change to 3rd gear (2nd --> 3rd, 4th --> 3rd) to reduce the shock that occurs at the gear change.

If the 3rd clutch transmission fluid pressure switch is ON while driving, and the speed ratio of the countershaft to the mainshaft other than the 3rd ratio (the ratio is Neutral or 4th), the PCM detects a 3rd clutch transmission fluid pressure switch failure, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| | | |

| | | |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0116, P0117, P0118, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0848, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The input signal from the 3rd clutch transmission fluid pressure switch to the PCM is low when driving in 4th gear.

**Driving Pattern**

Start the engine, and drive the vehicle in D5 position and 4th gear for at least 2 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0848 (26): ADVANCED DIAGNOSTICS

### DTC P0848: OPEN IN 3RD CLUTCH TRANSMISSION FLUID PRESSURE SWITCH CIRCUIT, OR 3RD CLUTCH TRANSMISSION FLUID PRESSURE SWITCH STUCK OFF

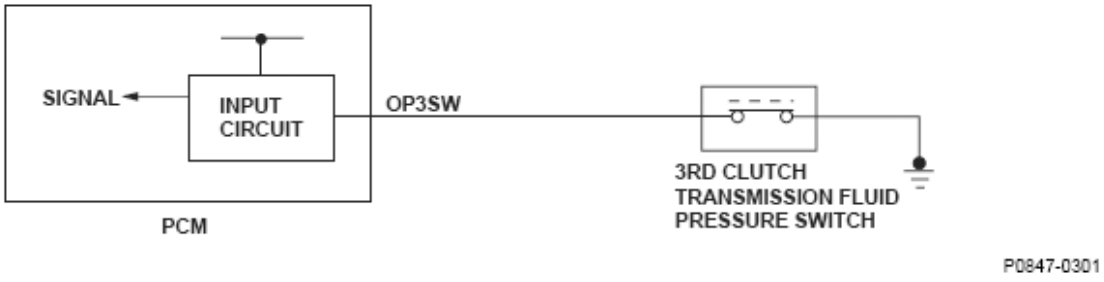



**Fig. 155: 3rd Clutch Transmission Fluid Pressure Switch Circuit Or 3rd Clutch Transmission Fluid Pressure Switch Circuit Diagram**

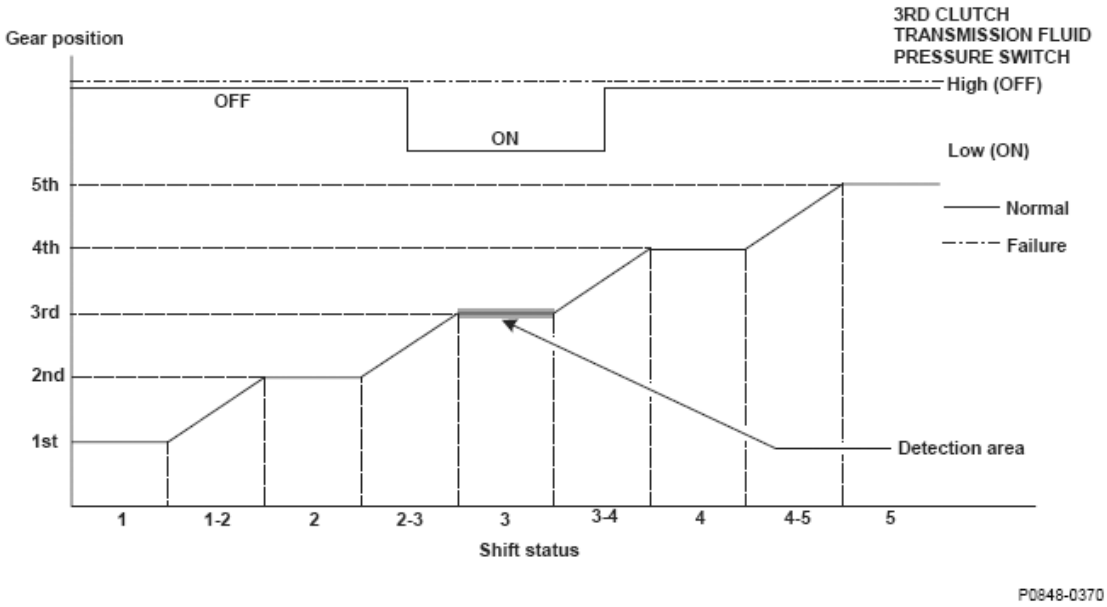



**Fig. 156: Gear Position To Shift Status Graph**

**General Description**

The 3rd clutch transmission fluid pressure switch is installed in the hydraulic pressure circuit to the 3rd clutch. When hydraulic pressure is supplied to the 3rd clutch, the switch is turned ON. When hydraulic pressure is not supplied to the 3rd clutch, the switch is turned OFF. The signal from the 3rd clutch transmission fluid pressure switch is input to the powertrain control module (PCM). The PCM detects the hydraulic pressure supply conditions at the gear change to 3rd gear (2nd --> 3rd, 4th --> 3rd) to reduce the shock that occurs at the gear change. If the 3rd clutch transmission fluid pressure switch is OFF while the rotation speed ratio of the input/output pulses is that of 3rd gear, the PCM detects a malfunction in the 3rd clutch transmission fluid pressure switch and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| | | |

| | |
|---|---|
| No active DTCs | P0116, P0117, P0118, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0847, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 |

**Malfunction Threshold**

The input signal from the 3rd clutch transmission fluid pressure switch to the PCM is high when driving in 3rd gear.

**Driving Pattern**

Start the engine, and drive the vehicle in D5 position and 3rd gear for at least 2 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0872 (27): ADVANCED DIAGNOSTICS

## DTC P0872: SHORT IN 4TH CLUTCH TRANSMISSION FLUID PRESSURE SWITCH CIRCUIT, OR 4TH CLUTCH TRANSMISSION FLUID PRESSURE SWITCH STUCK ON

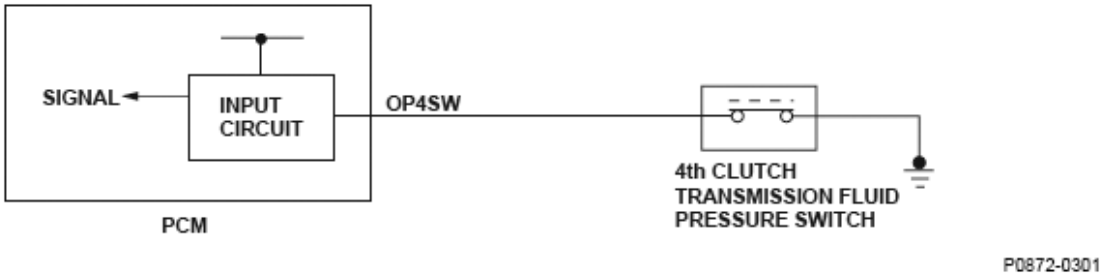



**Fig. 157: 4th Clutch Transmission Fluid Pressure Switch Circuit Or 4th Clutch Transmission Fluid Pressure Switch Circuit Diagram**

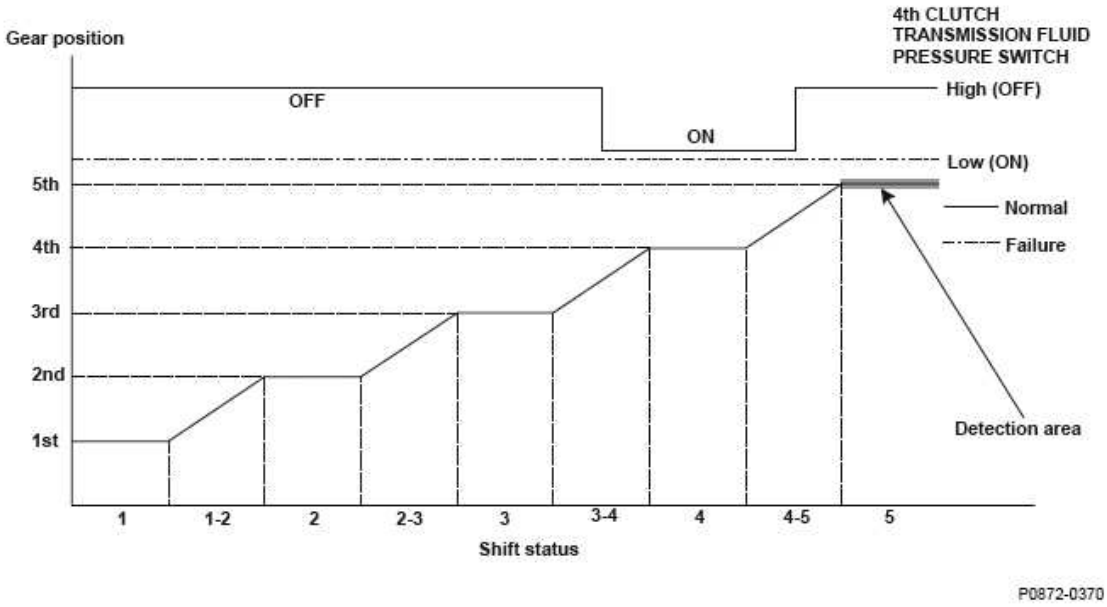



**Fig. 158: Gear Position To Shift Status Graph**

**General Description**

The 4th clutch transmission fluid pressure switch is installed in the hydraulic pressure circuit to the 4th clutch. When hydraulic pressure is supplied to the 4th clutch, the switch is turned ON. When hydraulic pressure is not supplied to the 4th clutch, the switch is turned OFF. The signal from the 4th clutch transmission fluid pressure switch is input to the powertrain control module (PCM). The PCM detects the hydraulic pressure supply conditions at the gear change to 4th gear (3rd --> 4th, 5th --> 4th) to reduce the shock that occurs at the gear change.

If the 4th clutch transmission fluid pressure switch is ON while driving, and the speed ratio of the countershaft to mainshaft is other than 4th gear (the ratio is Neutral or 5th), the PCM detects a 4th clutch transmission fluid pressure switch failure, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| | | |

| | | |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0116, P0117, P0118, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0873, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The input signal from the 4th clutch transmission fluid pressure switch to the PCM is low when driving in 5th gear.

**Driving Pattern**

Start the engine, and drive the vehicle in D5 position and 5th gear for at least 2 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0873 (27): ADVANCED DIAGNOSTICS

## DTC P0873: OPEN IN 4TH CLUTCH TRANSMISSION FLUID PRESSURE SWITCH CIRCUIT, OR 4TH CLUTCH TRANSMISSION FLUID PRESSURE SWITCH STUCK OFF

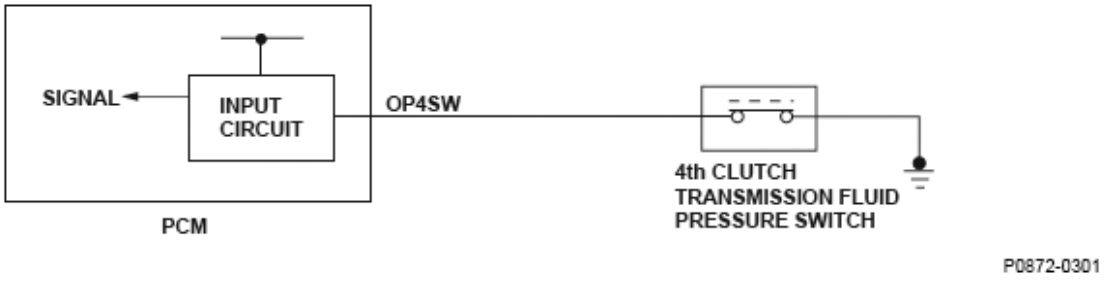



**Fig. 159: 4th Clutch Transmission Fluid Pressure Switch Circuit Or 4th Clutch Transmission Fluid Pressure Circuit Diagram**

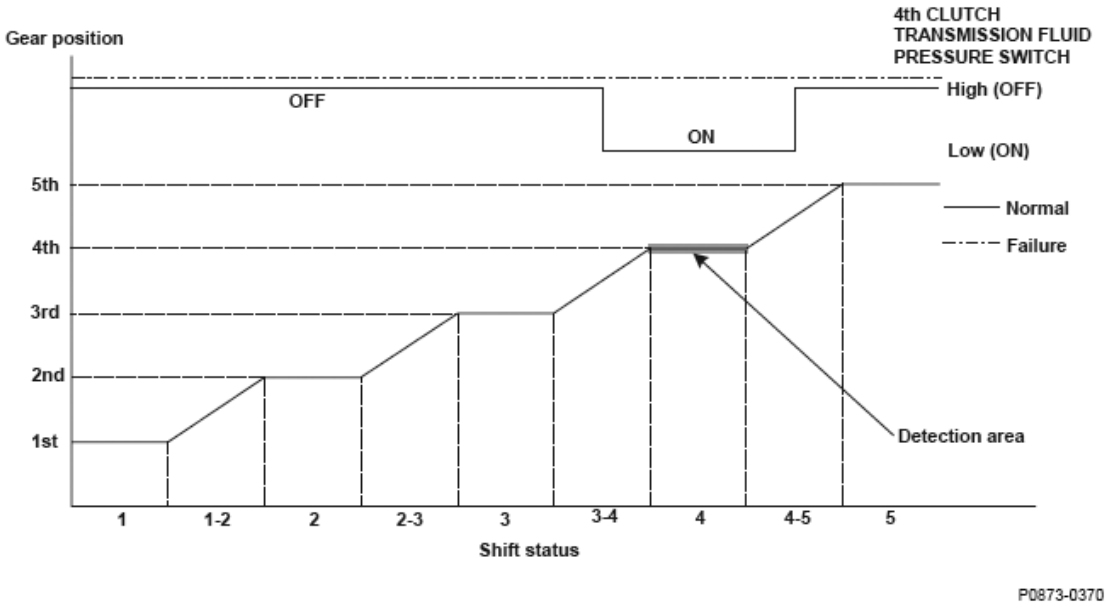



**Fig. 160: Gear Position To Shift Status Graph**

**General Description**

The 4th clutch transmission fluid pressure switch is installed in the hydraulic pressure circuit to the 4th clutch. When hydraulic pressure is supplied to the 4th clutch, the switch is turned ON. When hydraulic pressure is not supplied to the 4th clutch, the switch is turned OFF. The signal from the 4th clutch transmission fluid pressure switch is input to the powertrain control module (PCM). The PCM detects the hydraulic pressure supply conditions at the gear change to 4th gear (3rd --> 4th, 5th --> 4th) to reduce the shock that occurs at the gear change. If the 4th clutch transmission fluid pressure switch is OFF while driving with the rotation speed ratio of the input/output pulses in 4th gear, the PCM detects a 4th clutch transmission fluid pressure switch failure and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL OFF, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |

| | |
|---|---|
| No active DTCs | P0116, P0117, P0118, P0705, P0716, P0717, P0718, P0721, P0722, P0723, P0746, P0747, P0751, P0752, P0756, P0757, P0761, P0762, P0776, P0777, P0780, P0872, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 |

**Malfunction Threshold**

The input signal from the 4th clutch transmission fluid pressure switch to the PCM is high when driving in 4th gear.

**Driving Pattern**

Start the engine, and drive the vehicle in D5 position and 4th gear for at least 2 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the D5 indicator blinks, and the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0962 (16): ADVANCED DIAGNOSTICS

## DTC P0962: PROBLEM IN A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE A CIRCUIT

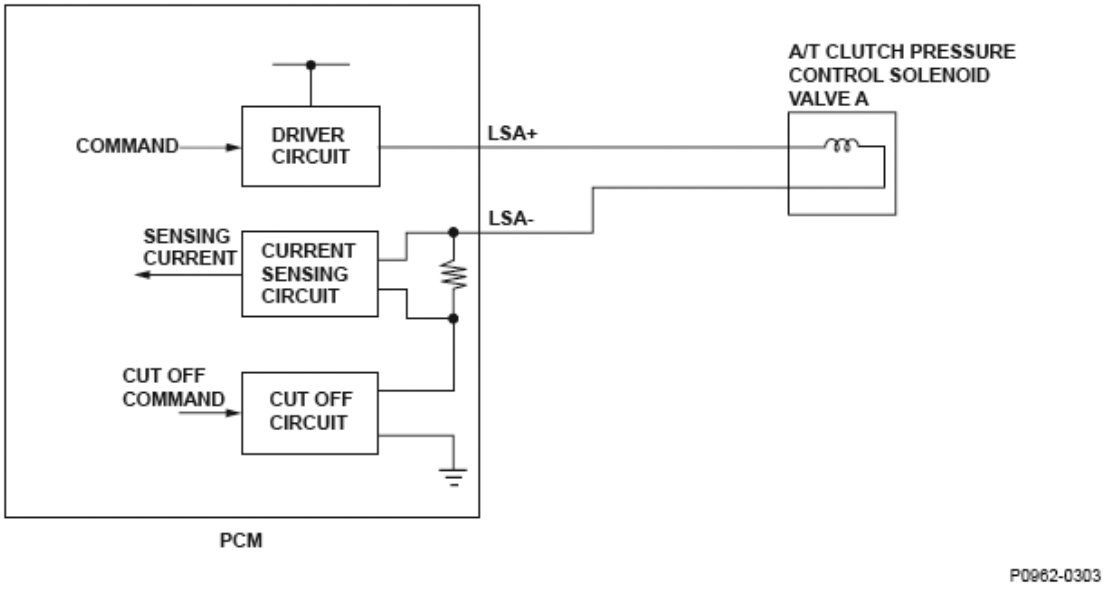



**Fig. 161: A/T Clutch Pressure Control Solenoid Valve A Circuit Diagram**

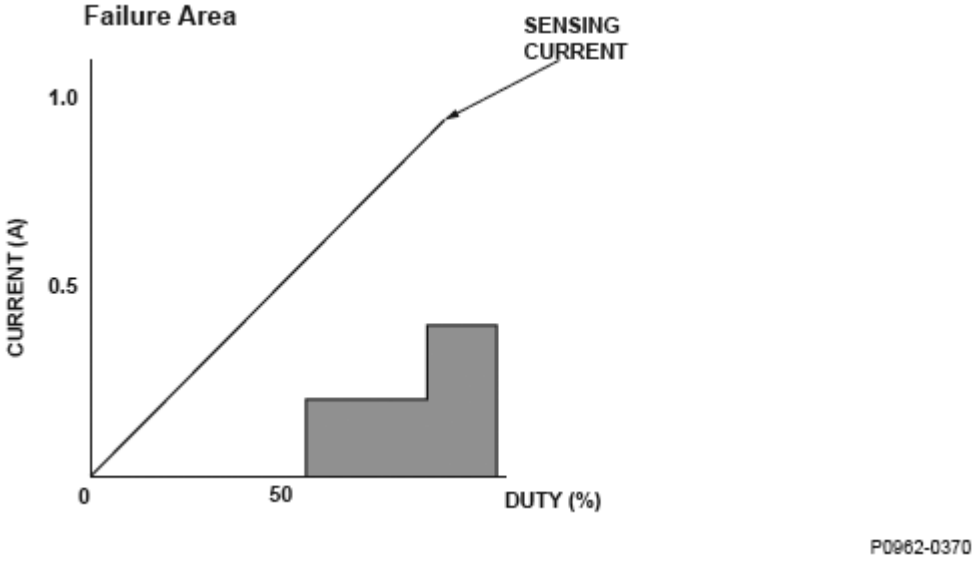



**Fig. 162: Current To Duty Failure Area Graph**

**General Description**

A/T clutch pressure control solenoid valve A is used for clutch pressure control. A spool in A/T clutch pressure control solenoid valve A pushes a valve according to the duty cycle that is controlled by the powertrain control module (PCM) so the hydraulic pressure is proportional to the current. The PCM measures the current flowing through A/T clutch pressure control solenoid valve A and uses feedback control to compensate for the difference between the actual current and the commanded one. If the measured current for the PCM output duty cycle is not within a specified range (open or short), a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| State of the engine | Running | |
| No active DTCs | P0746, P0747, P0751, P0777, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The measured current for the PCM's command value is as specified here for at least 1 second.

**MALFUNCTION THRESHOLD**

| Duty (%) | Current (A) | Failure mode |
|---|---|---|
| 57 - 89 | 0.2 or less | Low Input |
| More than 89 | 0.4 or less | Low Input |

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0963 (16): ADVANCED DIAGNOSTICS

**DTC P0963: PROBLEM IN A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE A**

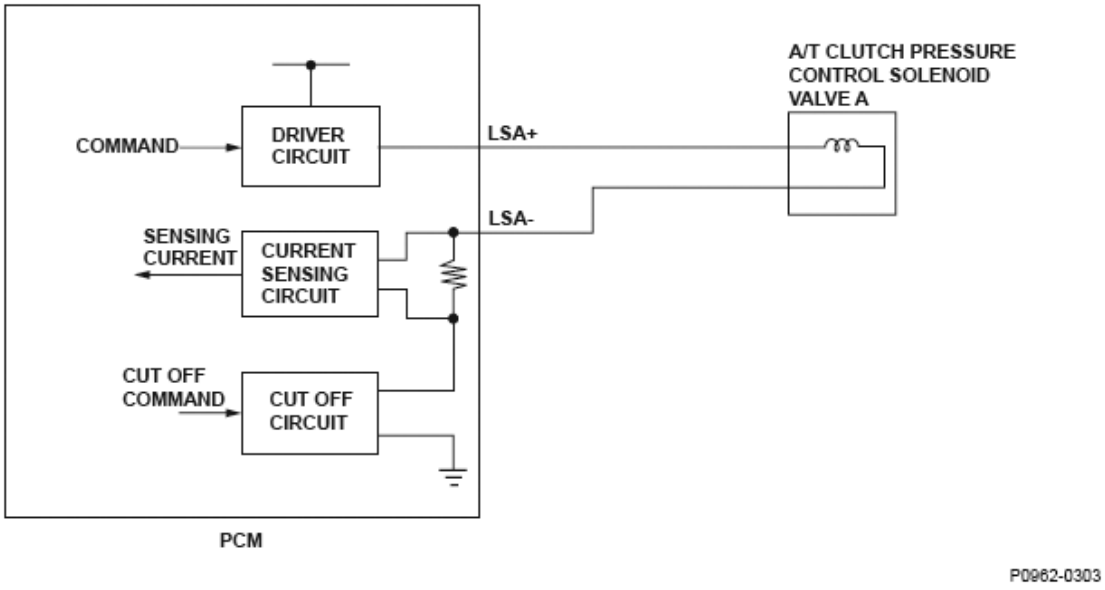



**Fig. 163: A/T Clutch Pressure Control Solenoid Valve A Circuit Diagram**

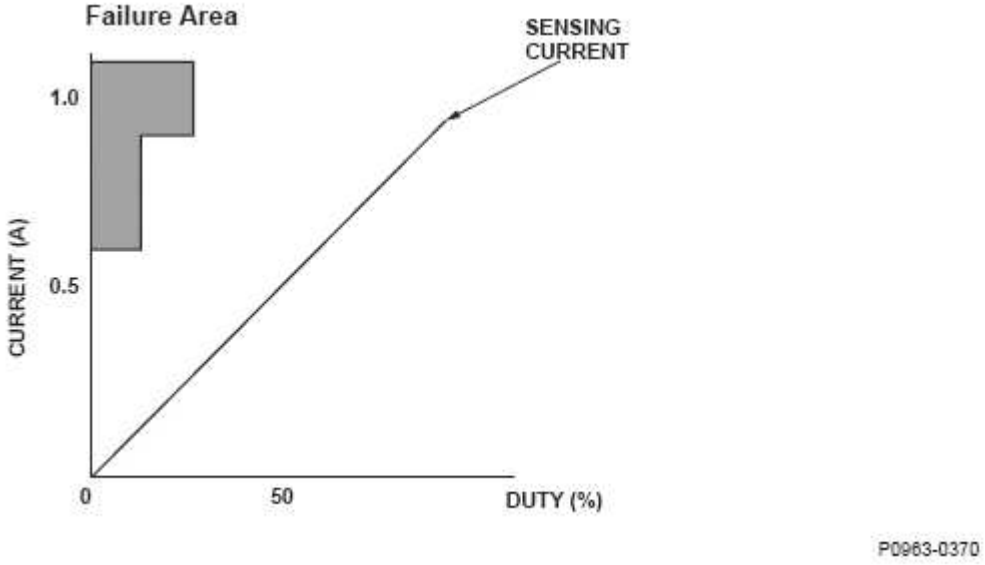



**Fig. 164: Current To Duty Failure Area Graph**

**General Description**

A/T clutch pressure control solenoid valve A is used for clutch pressure control. A spool in A/T clutch pressure control solenoid valve A pushes a valve according to the duty cycle that is controlled by the powertrain control module (PCM) so the hydraulic pressure is proportional to the current. The PCM measures the current flowing through A/T clutch pressure control solenoid valve A and uses feedback control to compensate for the difference between the actual current and the commanded one. If the measured current for the PCM output duty cycle is not within a specified range (open or short), a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| State of the engine | Running | |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The measured current for the PCM's command value is as specified here for at least 1 second.

**MALFUNCTION THRESHOLD**

| Duty (%) | Current (A) | Failure mode |
|---|---|---|
| Less than 13 | 0.6 or more | High Input |
| 13 - 27 | 0.9 or more | High Input |

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0966 (23): ADVANCED DIAGNOSTICS

## DTC P0966: PROBLEM IN A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE B CIRCUIT

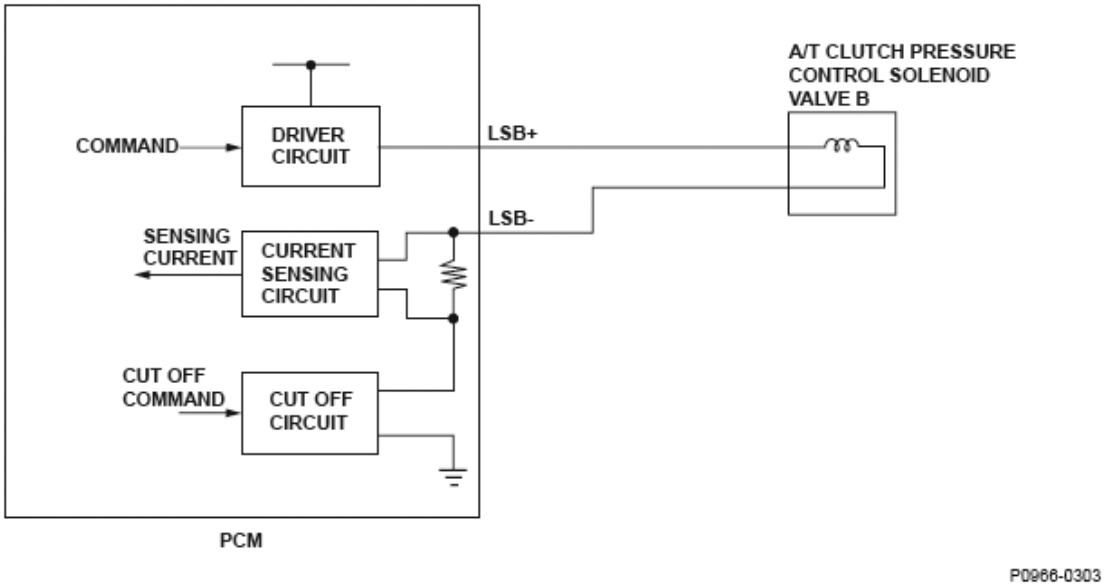



**Fig. 165: A/T Clutch Pressure Control Solenoid Valve B Circuit Diagram**

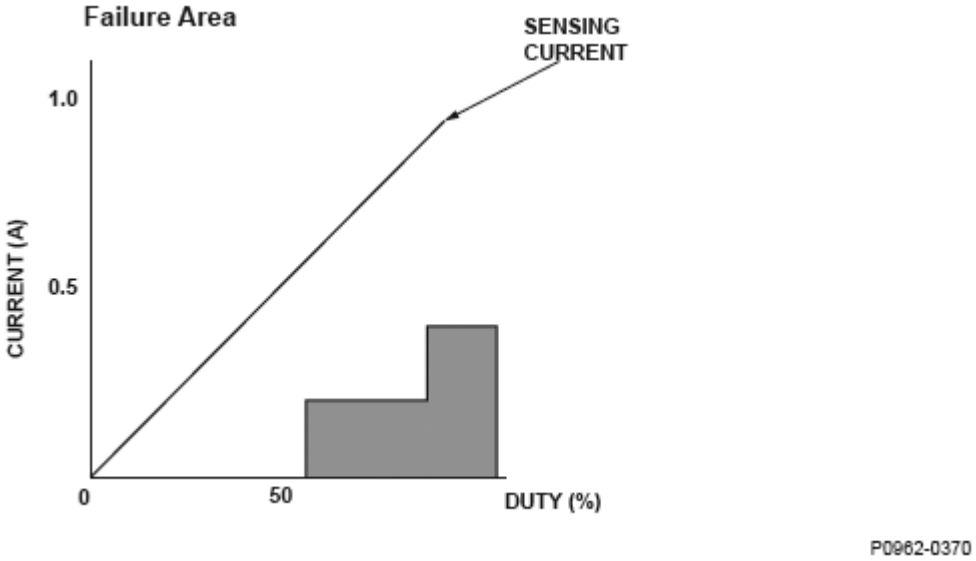



**Fig. 166: Current To Duty Failure Area Graph**

**General Description**

A/T clutch pressure control solenoid valve B is used for clutch pressure control. A spool in A/T clutch pressure control solenoid valve B pushes a valve according to the duty cycle that is controlled by the powertrain control module (PCM) so the hydraulic pressure is proportional to the current. The PCM measures the current flowing through A/T clutch pressure control solenoid valve B and uses feedback control to compensate for the difference between the actual current and the commanded one. If the measured current for the PCM output duty

cycle is not within a specified range (open or short), a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| State of the engine | Running | |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The measured current for the PCM's command value is as specified here for at least 1 second.

**MALFUNCTION THRESHOLD**

| Duty (%) | Current (A) | Failure mode |
|---|---|---|
| 57 - 89 | 0.2 or less | Low Input |
| More than 89 | 0.4 or less | Low Input |

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0967 (23): ADVANCED DIAGNOSTICS

## DTC P0967: PROBLEM IN A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE B

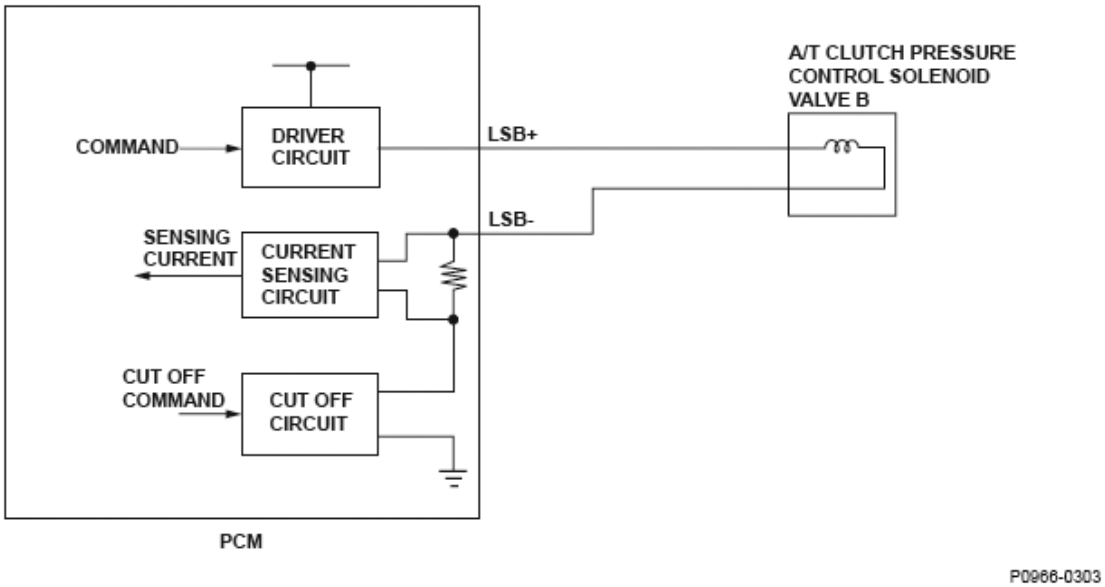



**Fig. 167: A/T Clutch Pressure Control Solenoid Valve B Circuit**

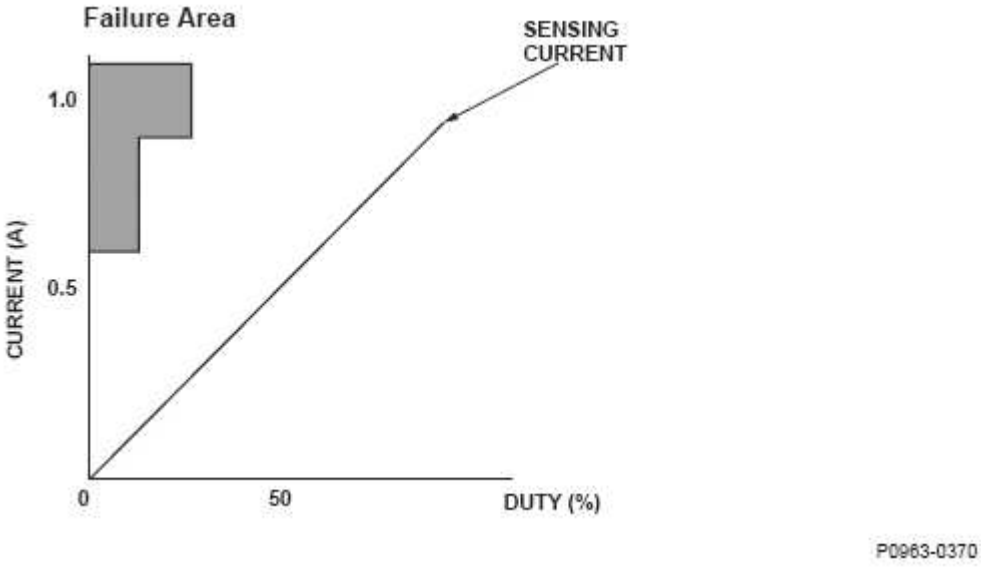



**Fig. 168: A/T Clutch Pressure Control Solenoid Valve Failure Area Graph**

**General Description**

A/T clutch pressure control solenoid valve B is used for clutch pressure control. A spool in A/T clutch pressure control solenoid valve B pushes a valve according to the duty cycle that is controlled by the powertrain control module (PCM) so the hydraulic pressure is proportional to the current. The PCM measures the current flowing

through A/T clutch pressure control solenoid valve B and uses feedback control to compensate for the difference between the actual current and the commanded one. If the measured current for the PCM output duty cycle is not within a specified range (open or short), a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| State of the engine | Running | |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The measured current for the PCM's command value is as specified here for at least 1 second.

**MALFUNCTION THRESHOLD**

| Duty (%) | Current (A) | Failure mode |
|---|---|---|
| Less than 13 | 0.6 or more | High Input |
| 13 - 27 | 0.9 or more | High Input |

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by

disconnecting the battery.

## DTC P0970 (29): ADVANCED DIAGNOSTICS

### DTC P0970: PROBLEM IN A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE C CIRCUIT

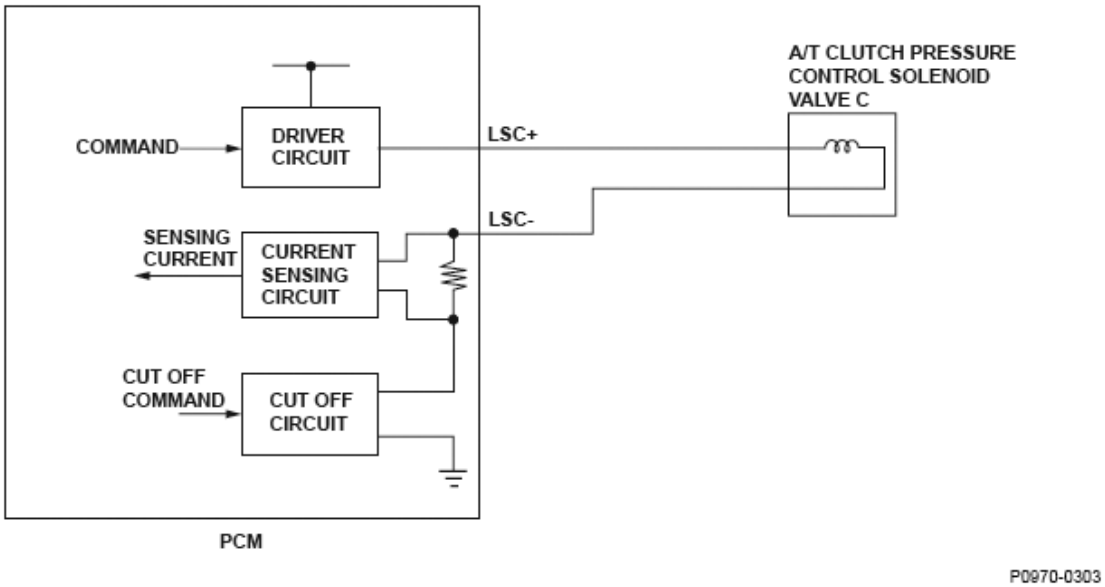



**Fig. 169: A/T Clutch Pressure Control Solenoid Valve C Circuit Diagram**

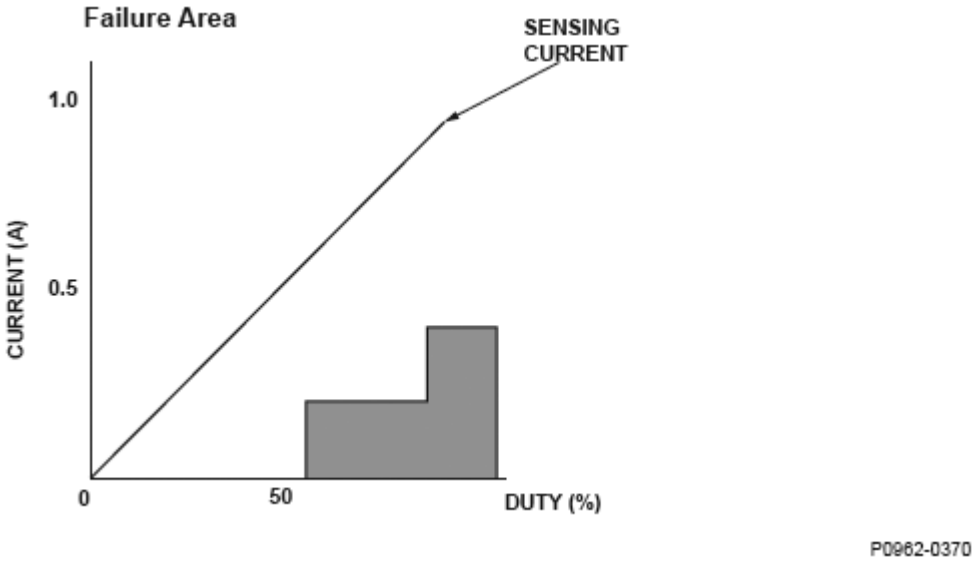



**Fig. 170: Current To Duty Failure Area Graph**

**General Description**

A/T clutch pressure control solenoid valve C is used for clutch pressure control and lock-up control. A spool in

A/T clutch pressure control solenoid valve C pushes a valve according to the duty cycle that is controlled by the powertrain control module (PCM) so the hydraulic pressure is proportional to the current. The PCM measures the current flowing through A/T clutch pressure control solenoid valve C and uses feedback control to compensate for the difference between the actual current and the commanded one. If the measured current for the PCM output duty cycle is not within a specified range (open or short), a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| State of the engine | Running | |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The measured current for the PCM's command value is as specified here for at least 1 second.

**MALFUNCTION THRESHOLD**

| Duty (%) | Current (A) | Failure mode |
|---|---|---|
| 57 - 89 | 0.2 or less | Low Input |
| More than 89 | 0.4 or less | Low Input |

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic

runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P0971 (29): ADVANCED DIAGNOSTICS

### DTC P0971: PROBLEM IN A/T CLUTCH PRESSURE CONTROL SOLENOID VALVE C

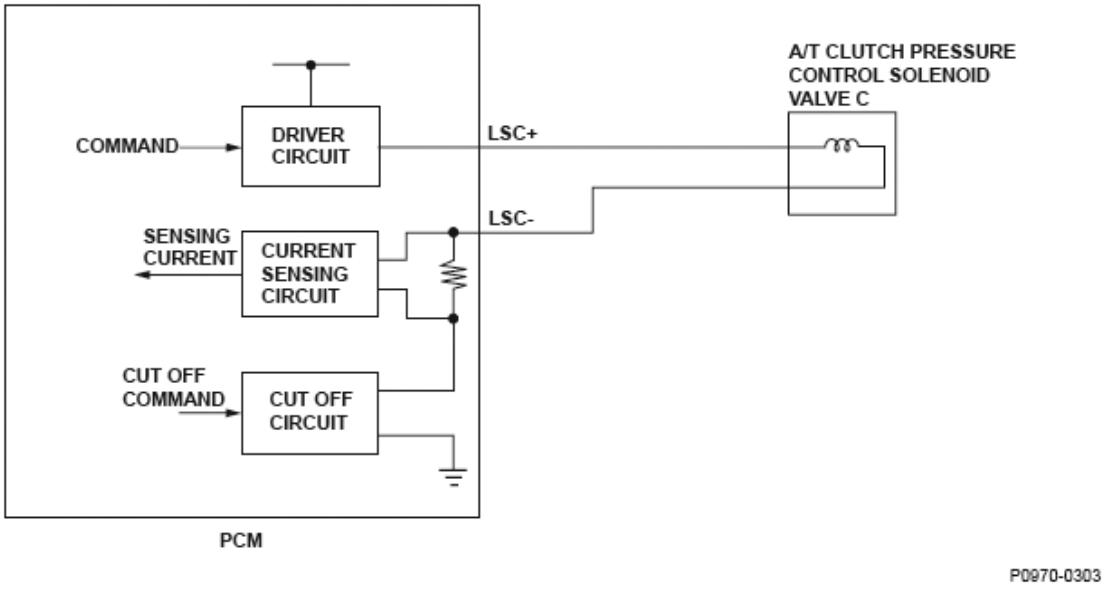



**Fig. 171: A/T Clutch Pressure Control Solenoid Valve C Circuit Diagram**

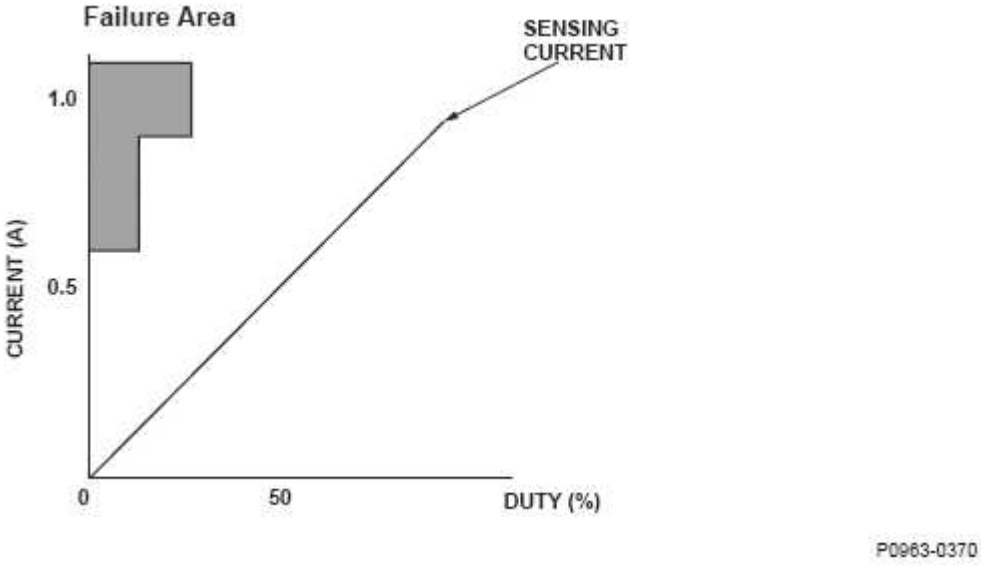



**Fig. 172: Current To Duty Failure Area Graph**

**General Description**

A/T clutch pressure control solenoid valve C is used for clutch pressure control and lock-up control. A spool in A/T clutch pressure control solenoid valve C pushes a valve according to the duty cycle that is controlled by the powertrain control module (PCM) so the hydraulic pressure is proportional to the current. The PCM measures the current flowing through A/T clutch pressure control solenoid valve C and uses feedback control to compensate for the difference between the actual current and the commanded one. If the measured current for the PCM output duty cycle is not within a specified range (open or short), a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| State of the engine | Running | |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0973, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The measured current for the PCM's command value is as specified here for at least 1 second.

**MALFUNCTION THRESHOLD**

| Duty (%) | Current (A) | Failure mode |
|---|---|---|
| Less than 13 | 0.6 or more | High Input |
| 13 - 27 | 0.9 or more | High Input |

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0973 (7): ADVANCED DIAGNOSTICS

## DTC P0973: SHORT IN SHIFT SOLENOID VALVE A CIRCUIT


**Fig. 173: Shift Solenoid Valve A Circuit Diagram**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 174: Gear Position To Shift Solenoid Valve Table**

**General Description**

When shift solenoid valves A, B, and C are turned ON, the hydraulic pressure circuit opens. The hydraulic pressure circuit supplies/discharges hydraulic pressure to/from each clutch according to the combination of the ON/OFF status of those valves and the shift valves. The powertrain control module (PCM) commands the driver circuit to turn on the shift solenoid valve. The circuit diagnoses malfunctions such as a circuit short or

open, and sends back a return signal during the PCM's command. When the return signal does not match the PCM command, a malfunction is detected by the PCM. The malfunction is detected when the return signal does not match the PCM command to turn ON the shift solenoid valve, and a DTC is stored.

#### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

#### Enable Conditions

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0974, P0976, P0977, P0979, P0980, P2769, P2770 | |

#### Malfunction Threshold

The return signal does not match the command to turn ON shift solenoid valve A for at least 1 second.

#### Driving Pattern

Start the engine, and drive the vehicle with the 1st gear in D5 position for at least 1 second.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

#### Diagnosis Details

##### Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

##### Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0974 (7): ADVANCED DIAGNOSTICS

## DTC P0974: OPEN IN SHIFT SOLENOID VALVE A CIRCUIT

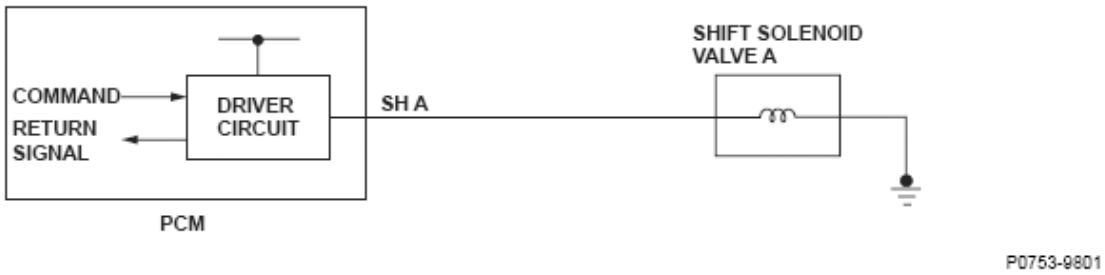



**Fig. 175: Shift Solenoid Valve A Circuit Diagram**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 176: Gear Position To Shift Solenoid Valve Table**

**General Description**

When shift solenoid valves A, B, and C are turned ON, the hydraulic pressure circuit opens. The hydraulic pressure circuit supplies/discharges hydraulic pressure to/from each clutch according to the combination of the ON/OFF status of those valves and the shift valves. The powertrain control module (PCM) commands the driver circuit to turn on the shift solenoid valve. The circuit diagnoses malfunctions such as a circuit short or open, and sends back a return signal during the PCM's command. When the return signal does not match the PCM command, a malfunction is detected by the PCM. The malfunction is detected when the return signal does not match the PCM command to turn OFF the shift solenoid valve, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0976, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The return signal does not match the command to turn OFF shift solenoid valve A for at least 1 second.

**Driving Pattern**

Start the engine, shift to P position, and wait for at least 1 second.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0976 (8): ADVANCED DIAGNOSTICS

**DTC P0976: SHORT IN SHIFT SOLENOID VALVE B CIRCUIT**


**Fig. 177: Shift Solenoid Valve B Circuit Diagram**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 178: Gear Position To Shift Solenoid Valve Table**

**General Description**

When shift solenoid valves A, B, and C are turned ON, the hydraulic pressure circuit opens. The hydraulic pressure circuit supplies/discharges hydraulic pressure to/from each clutch according to the combination of the ON/OFF status of those valves and the shift valves. The powertrain control module (PCM) commands the driver circuit to turn on the shift solenoid valve. The circuit diagnoses malfunctions such as a circuit short or open, and sends back a return signal during the PCM's command. When the return signal does not match the PCM command, a malfunction is detected by the PCM. The malfunction is detected when the return signal does not match the PCM command to turn ON the shift solenoid valve, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| | |

| | |
|---|---|
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0977, P0979, P0980, P2769, P2770 | |

**Malfunction Threshold**

The return signal does not match the command to turn ON shift solenoid valve B for at least 1 second.

**Driving Pattern**

Start the engine, shift to P position, and wait for at least 1 second.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0977 (8): ADVANCED DIAGNOSTICS

## DTC P0977: OPEN IN SHIFT SOLENOID VALVE B CIRCUIT

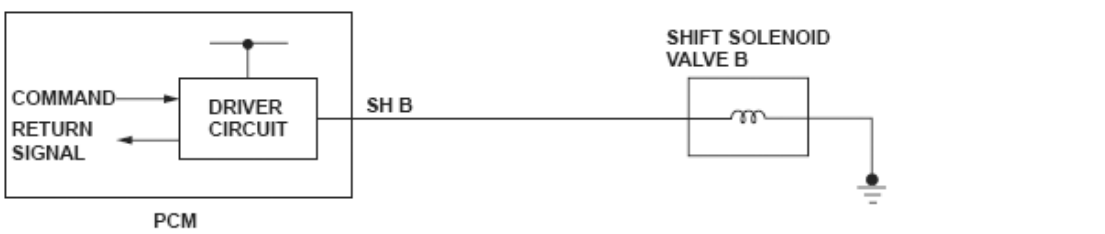
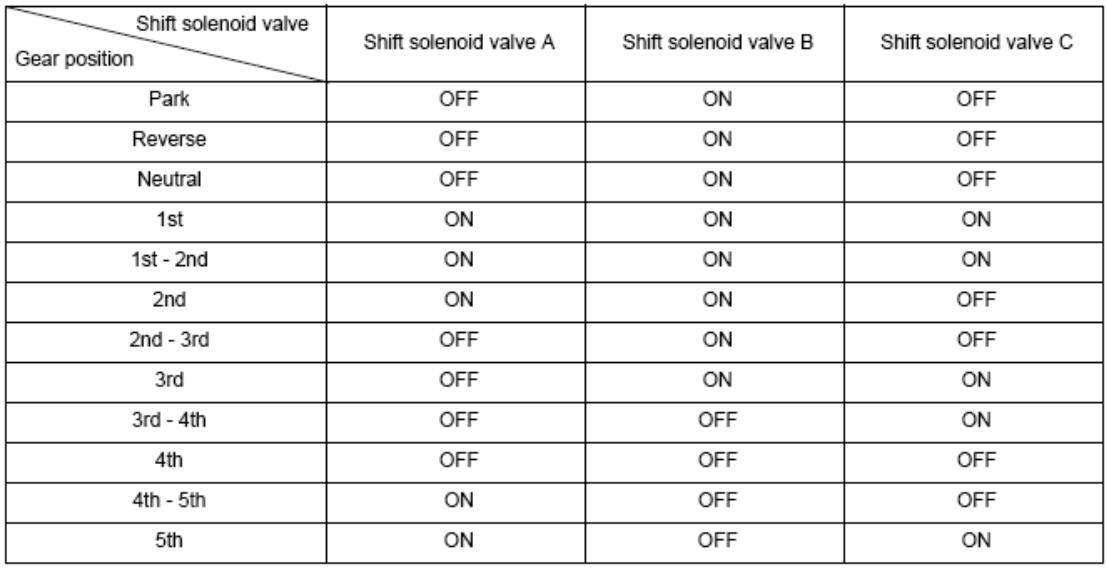


**Fig. 179: Shift Solenoid Valve B Circuit Diagram**



| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 180: Gear Shift To Shift Solenoid Valve Table**

**General Description**

When shift solenoid valves A, B, and C are turned ON, the hydraulic pressure circuit opens. The hydraulic pressure circuit supplies/discharges hydraulic pressure to/from each clutch according to the combination of the ON/OFF status of those valves and the shift valves. The powertrain control module (PCM) commands the driver circuit to turn on the shift solenoid valve. The circuit diagnoses malfunctions such as a circuit short or open, and sends back a return signal during the PCM's command. When the return signal does not match the PCM command, a malfunction is detected by the PCM. The malfunction is detected when the return signal does not match the PCM command to turn OFF the shift solenoid valve, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |

| | |
|---|---|
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0979, P0980, P2769, P2770 |

**Malfunction Threshold**

The return signal does not match the command to turn OFF shift solenoid valve B for at least 1 second.

**Driving Pattern**

Start the engine, drive the vehicle so that it shifts from 1st to 4th gear in D5 position, then drive the vehicle in 4th gear for at least 1 second.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0979 (22): ADVANCED DIAGNOSTICS

## DTC P0979: SHORT IN SHIFT SOLENOID VALVE C CIRCUIT

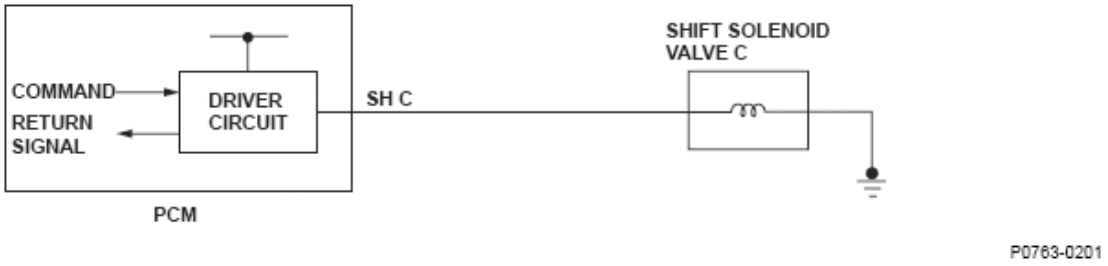



**Fig. 181: Shift Solenoid Valve C Circuit Diagram**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 182: Gear Position To Shift Solenoid Valve Table**

**General Description**

When shift solenoid valves A, B, and C are turned ON, the hydraulic pressure circuit opens. The hydraulic pressure circuit supplies/discharges hydraulic pressure to/from each clutch according to the combination of the ON/OFF status of those valves and the shift valves. The powertrain control module (PCM) commands the driver circuit to turn on the shift solenoid valve. The circuit diagnoses malfunctions such as a circuit short or open, and sends back a return signal during the PCM's command. When the return signal does not match the PCM command, a malfunction is detected by the PCM. The malfunction is detected when the return signal does not match the PCM command to turn ON the shift solenoid valve, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0980, P2769, P2770 | |

**Malfunction Threshold**

The return signal does not match the command to turn ON shift solenoid valve C for at least 1 second.

**Driving Pattern**

Start the engine, and drive the vehicle in 1st gear in D5 position for at least 1 second.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P0980 (22): ADVANCED DIAGNOSTICS

## DTC P0980: OPEN IN SHIFT SOLENOID VALVE C CIRCUIT

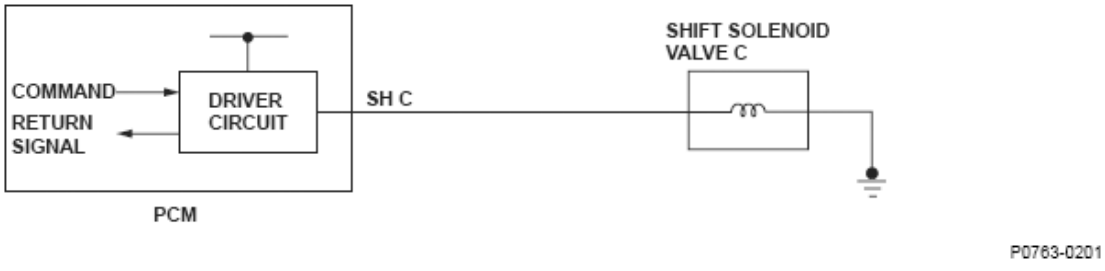



**Fig. 183: Shift Solenoid Valve C Circuit Diagram**

| Shift solenoid valve / Gear position | Shift solenoid valve A | Shift solenoid valve B | Shift solenoid valve C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Reverse | OFF | ON | OFF |
| Neutral | OFF | ON | OFF |
| 1st | ON | ON | ON |
| 1st - 2nd | ON | ON | ON |
| 2nd | ON | ON | OFF |
| 2nd - 3rd | OFF | ON | OFF |
| 3rd | OFF | ON | ON |
| 3rd - 4th | OFF | OFF | ON |
| 4th | OFF | OFF | OFF |
| 4th - 5th | ON | OFF | OFF |
| 5th | ON | OFF | ON |

**Fig. 184: Gear Position To Shift Solenoid Valve Table**

**General Description**

When shift solenoid valves A, B, and C are turned ON, the hydraulic pressure circuit opens. The hydraulic pressure circuit supplies/discharges hydraulic pressure to/from each clutch according to the combination of the ON/OFF status of those valves and the shift valves. The powertrain control module (PCM) commands the driver circuit to turn on the shift solenoid valve. The circuit diagnoses malfunctions such as a circuit short or open, and sends back a return signal during the PCM's command. When the return signal does not match the PCM command, a malfunction is detected by the PCM. The malfunction is detected when the return signal does not match the PCM command to turn OFF the shift solenoid valve, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P2769, P2770 | |

**Malfunction Threshold**

The return signal does not match the command to turn OFF shift solenoid valve C for at least 1 second.

**Driving Pattern**

Start the engine, shift to P position, and wait for at least 1 second.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1077 (106): ADVANCED DIAGNOSTICS

### DTC P1077: INTAKE MANIFOLD TUNING (IMT) (INTAKE MANIFOLD RUNNER CONTROL (IMRC)) VALVE STUCK IN HIGH RPM POSITION

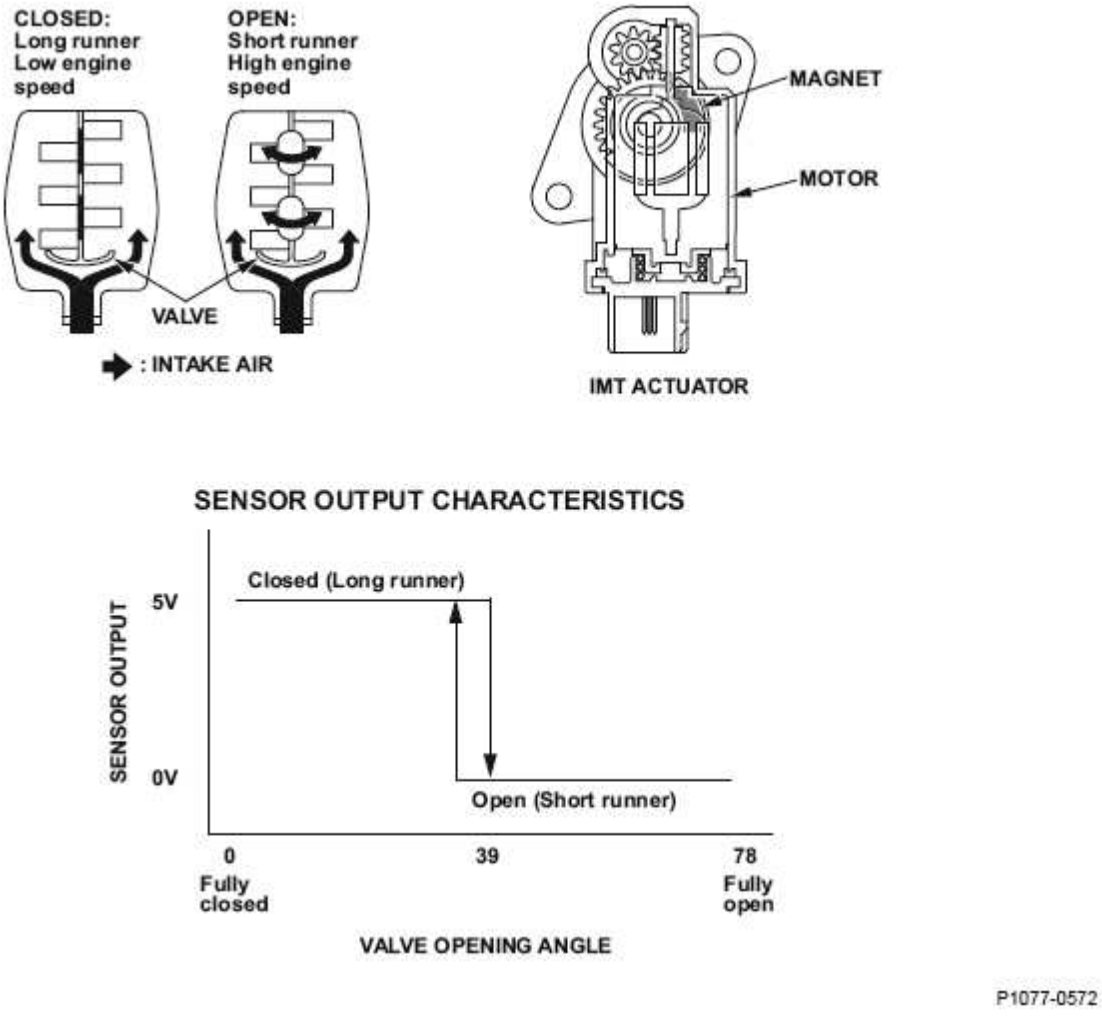



**Fig. 185: Identifying Intake Manifold Tuning (Intake Manifold Runner Control) Valve**

**General Description**

The intake manifold tuning (IMT) (the intake manifold runner control (IMRC)) system controls engine output by selecting either long or short intake runner lengths. The system consists of the IMT (IMRC) valve, the IMT (IMRC) actuator, and the powertrain control module (PCM). The IMT (IMRC) actuator is attached to the intake manifold and it includes the motor and the Hall-effect-IC position sensing unit. The PCM actuates the motor, which operates the IMT (IMRC) valve. When the IMT (IMRC) valve is closed, the long runner is selected, increasing torque at low engine speed. When the IMRC valve is open, the short runner is selected, increasing torque at high engine speed. A Hall-effect-IC position sensing unit is integrated with the motor to provide precise open/close feedback to the PCM. The IMT (IMRC) actuator sends a long runner return signal to the PCM when the IMT (IMRC) valve is closed, and it sends a short runner return signal when the IMT (IMRC) valve is open. If the PCM receives no closed return signal when it sends a close command, or if it receives no open return signal when sending an open command to the IMT (IMRC) actuator, for a specified time, it detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Intake air temperature | 5°F (-15°C) | - |
| Engine speed | - | 3,500 rpm |
| Battery voltage | 10.5 V | - |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0563, P1109, P1128, P1129, P2227, P2228, P2229 | |

**Malfunction Threshold**

When the PCM sends a close (long runner) command, no long runner return signal is received for at least 2 seconds.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Let the engine idle for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P1078 (106): ADVANCED DIAGNOSTICS

## DTC P1078: INTAKE MANIFOLD TUNING (IMT) (INTAKE MANIFOLD RUNNER CONTROL (IMRC)) VALVE STUCK IN LOW RPM POSITION

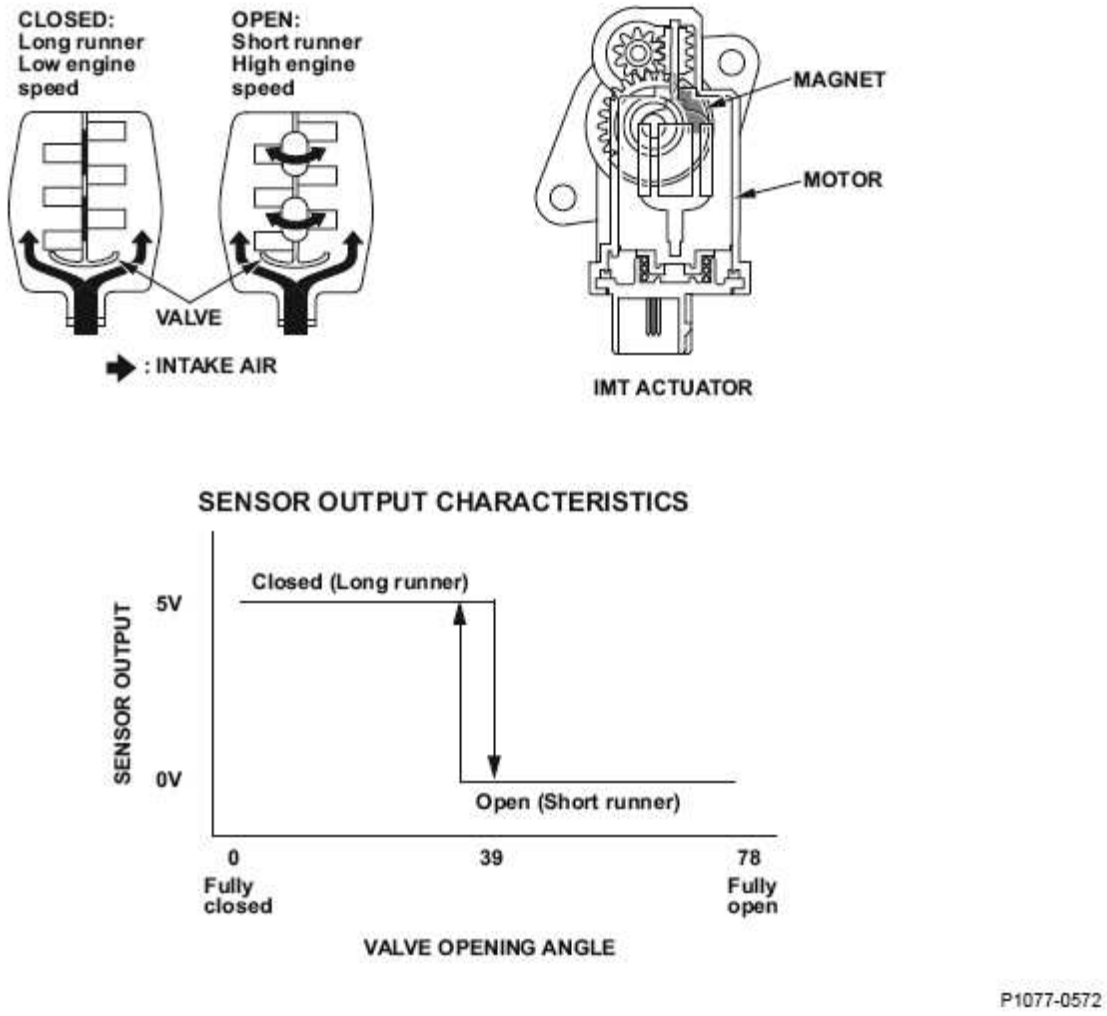



**Fig. 186: Intake Manifold Tuning (Intake Manifold Runner Control) Valve**

**General Description**

The intake manifold tuning (IMT) (the intake manifold runner control (IMRC)) system controls engine output by selecting either long or short intake runner lengths. The system consists of the IMT (IMRC) valve, the IMT (IMRC) actuator, and the powertrain control module (PCM). The IMT (IMRC) actuator is attached to the intake manifold and it includes the motor and the Hall-effect-IC position sensing unit. The PCM actuates the motor, which operates the IMT (IMRC) valve. When the IMT (IMRC) valve is closed, the long runner is selected, increasing torque at low engine speed. When the IMRC valve is open, the short runner is selected, increasing torque at high engine speed. A Hall-effect-IC position sensing unit is integrated with the motor to provide precise open/close feedback to the PCM. The IMT (IMRC) actuator sends a long runner return signal to the PCM when the IMT (IMRC) valve is closed, and it sends a short runner return signal when the IMT (IMRC) valve is open. If the PCM receives no closed return signal when it sends a close command, or if it receives no open return signal when sending an open command to the IMT (IMRC) actuator, for a specified time, it detects

a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Intake air temperature | 5 °F (-15 °C) | - |
| Engine speed | 3,700 rpm | - |
| Battery voltage | 10.5 V | - |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0563, P1109, P1128, P1129, P2227, P2228, P2229 | |

**Malfunction Threshold**

When the PCM sends an open (short runner) command, no short runner return signal is received for at least 2 seconds.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Hold the engine speed to 3,700 rpm or more for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1109 (13): ADVANCED DIAGNOSTICS

### DTC P1109: BAROMETRIC PRESSURE (BARO) SENSOR CIRCUIT OUT OF RANGE-HIGH

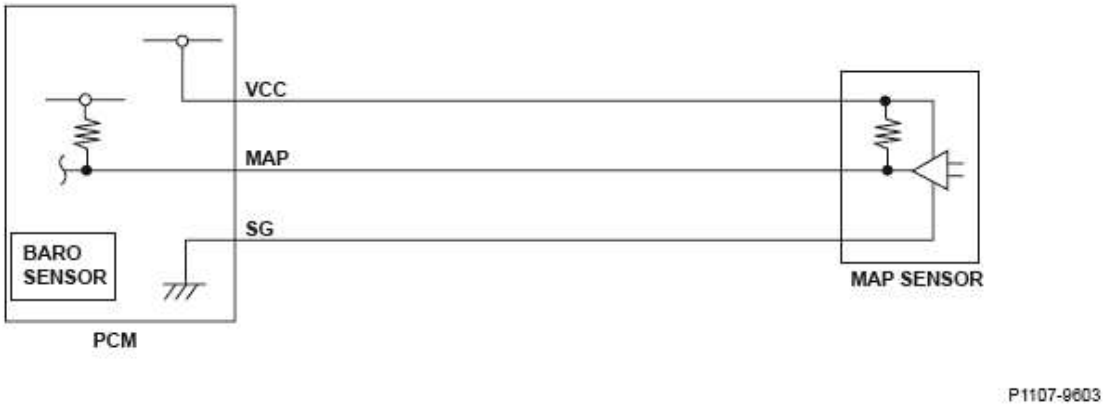



**Fig. 187: Barometric Pressure (BARO) Sensor Circuit Diagram**

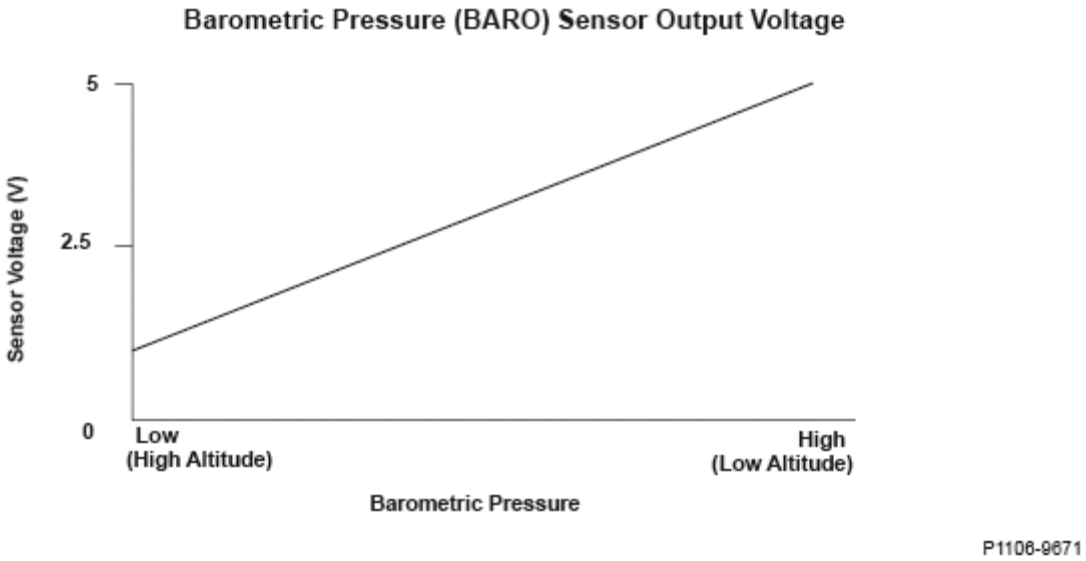



**Fig. 188: Barometric Pressure (BARO) Sensor Output Voltage - Graph**

#### General Description

The barometric pressure (BARO) sensor is built into the powertrain control module (PCM) and monitors atmospheric pressure. The PCM estimates appropriate intake airflow from the manifold absolute pressure (MAP) sensor output voltage and BARO sensor output voltage. When BARO sensor output voltage is within the specified range, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

### MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

### ENABLE CONDITIONS

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P2228, P2229 |

**Malfunction Threshold**

The BARO sensor output voltage is between 3.59 V to 4.49 V for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P1116 (86): ADVANCED DIAGNOSTICS

### DTC P1116: ENGINE COOLANT TEMPERATURE (ECT) SENSOR PERFORMANCE PROBLEM

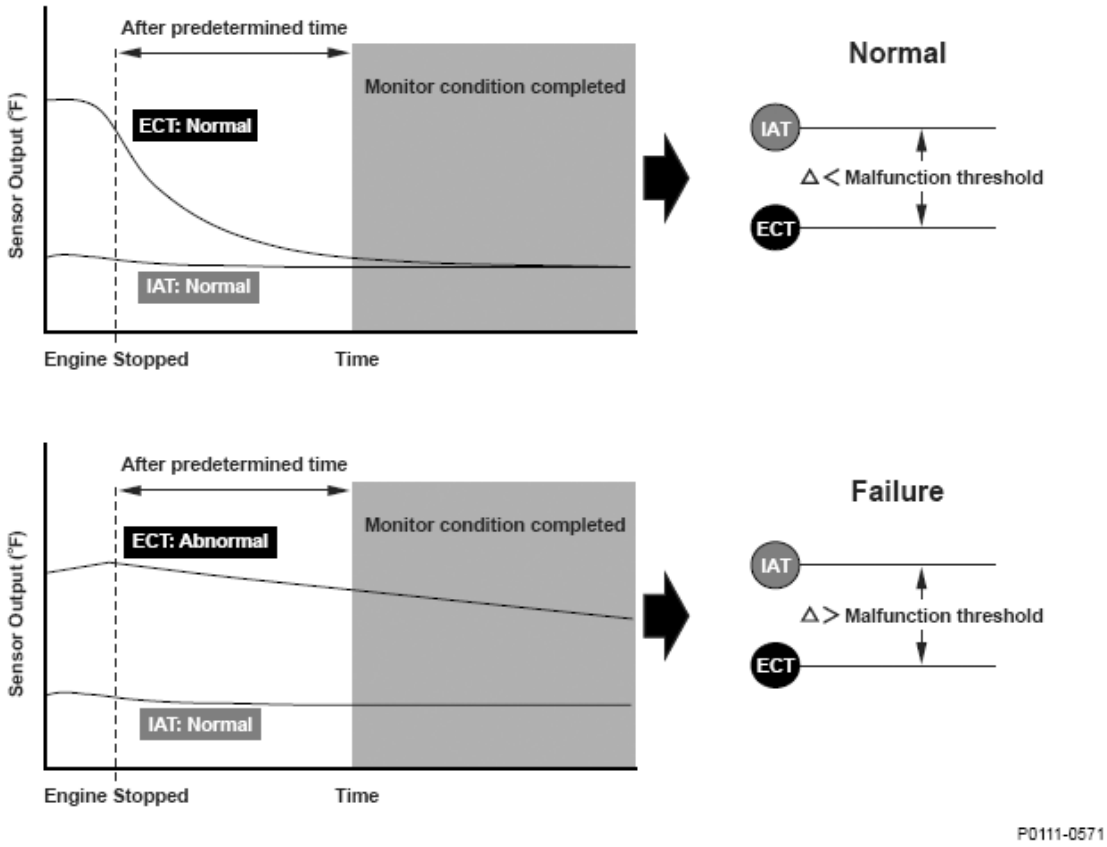



**Fig. 189: Engine Coolant Temperature Sensor Graph**

**General Description**

Two engine coolant temperature sensors and one intake air temperature sensor are used by the powertrain control module (PCM).

When the engine is stopped and enough time has passed, the temperature of the engine will equal the ambient temperature. When an inappropriate temperature is detected after comparing the temperature readings of each sensor, a malfunction in the corresponding sensor is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine off time | 6 hours | - |
| No active DTCs | P0111, P0112, P0113, P0116, P0117, P0118, P0125, P2610 | |

**Malfunction Threshold**

A malfunction is detected if the temperature difference (IAT minus ECT) is 52°F (29°C) or more after the engine and the ignition switch have been off for at least 6 hours before restarting the engine.

**Driving Pattern**

1. Turn the ignition off, and wait at least 6 hours.
2. Start the engine, and let it idle for at least 10 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1128 (5): ADVANCED DIAGNOSTICS

## DTC P1128: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR SIGNAL LOWER THAN EXPECTED

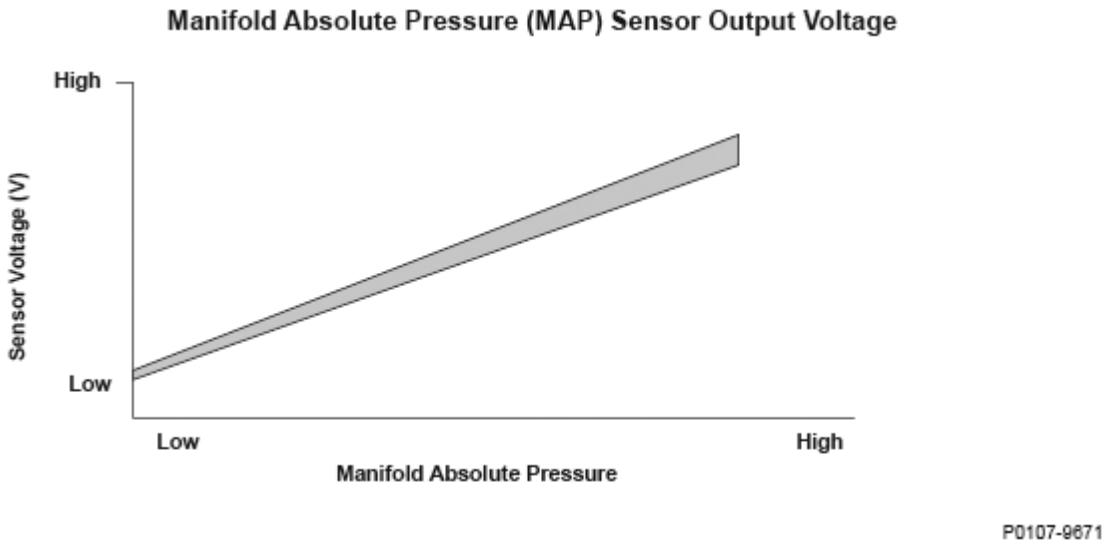



**Fig. 190: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph**

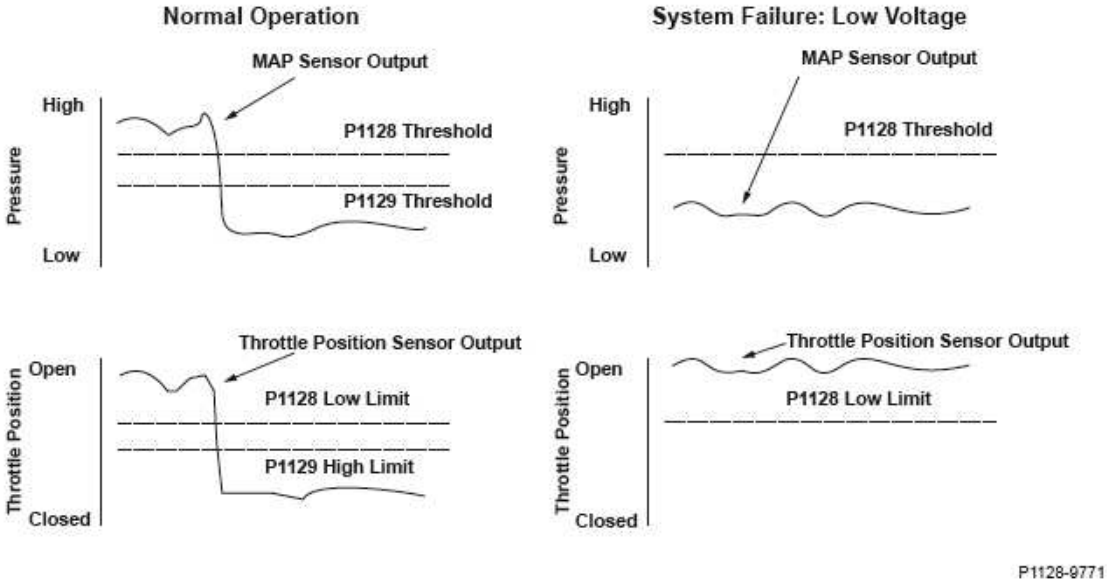



**Fig. 191: Manifold Absolute Pressure (MAP) Sensor Signal - Graph**

**General Description**

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (idling) and high signal voltage at low-vacuum (throttle valve wide open).

The powertrain control module (PCM) compares a predetermined MAP value at a given throttle position and manifold absolute pressure to the output voltage value of the MAP sensor.

If the MAP sensor outputs lower voltage than expected, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | | Minimum | Maximum |
|---|---|---|---|
| Engine coolant temperature | | 156 °F (69 °C) | - |
| Engine speed | | 1,150 rpm | 5,500 rpm |
| Vehicle speed | | 15 mph (24 km/h) | - |
| Throttle position | 1,000 rpm | 11.8 ° | - |
| | 3,000 rpm | 25.0 ° | - |
| No active DTCs | | P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P0403, P0404, P0506, P0507, P0627, P0641, P1077, P1078, P1109, P1129, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2227, P2228, P2229, P2279, P2413, P2646, P2647, P2648, P2649, U0107 | |

**Malfunction Threshold**

- The MAP sensor output is 36 kPa (10.9 in.Hg, 277 mmHg) or less for at least 2 seconds when atmospheric pressure is 61 kPa (18.1 in.Hg, 460 mmHg).
- The MAP sensor output is 53 kPa (15.9 in.Hg, 405 mmHg) or less for at least 2 seconds when atmospheric pressure is 103 kPa (30.5 in.Hg, 776 mmHg).

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed of 15 mph (24 km/h) or more with a throttle position as specified under Enable Conditions for at least 2 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1129 (5): ADVANCED DIAGNOSTICS

## DTC P1129: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR SIGNAL HIGHER THAN EXPECTED

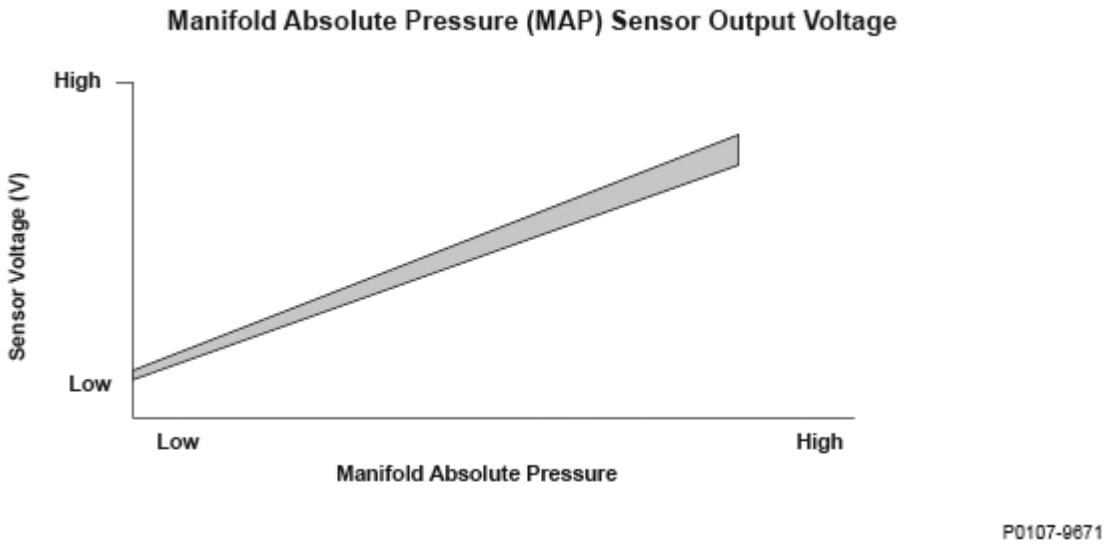



**Fig. 192: Manifold Absolute Pressure (MAP) Sensor - Graph**

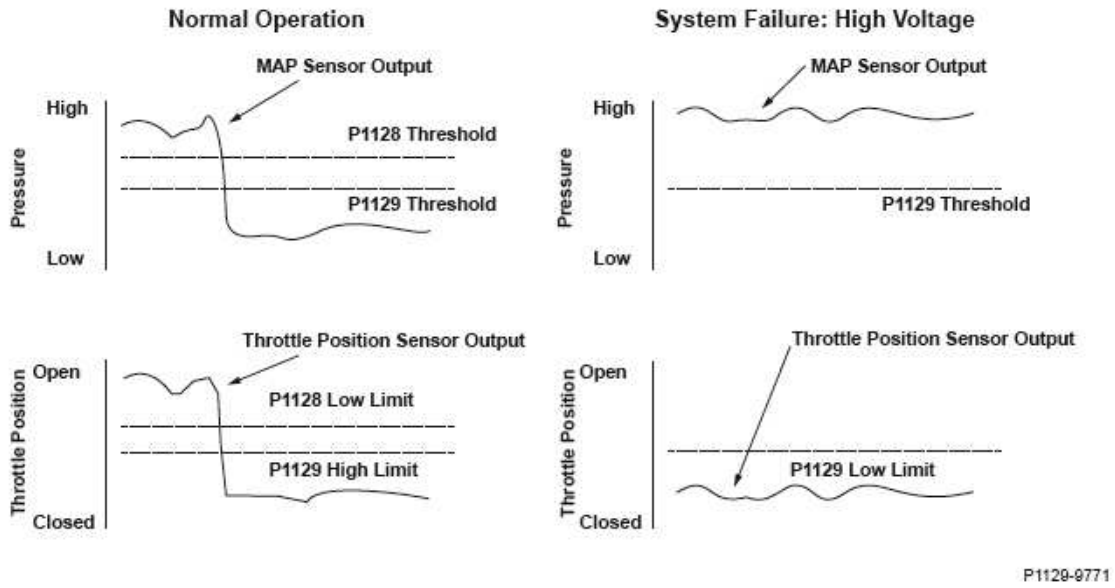



**Fig. 193: Manifold Absolute Pressure (MAP) Sensor Signal - Graph**

**General Description**

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open).

The powertrain control module (PCM) compares a predetermined MAP value at a given throttle position and manifold absolute pressure to the output voltage value of the MAP sensor.

If the MAP sensor outputs high voltage during fuel cut-off operation for deceleration with the throttle valve fully closed, which should make the manifold absolute pressure lower, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 156°F (69°C) | - |

| | | |
|---|---|---|
| Engine speed | 1,150 rpm | 5,500 rpm |
| Vehicle speed | 15 mph (24 km/h) | - |
| Fuel feedback | During deceleration | |
| Throttle position | Fully closed | |
| No active DTCs | P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P0403, P0404, P0506, P0507, P0627, P0641, P1077, P1078, P1128, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2413, P2646, P2647, P2648, P2649, U0107 | |

**Malfunction Threshold**

The MAP sensor output is 36 kPa (10.9 in.Hg, 277 mmHg) or more for at least 2 seconds.

**Driving Pattern**

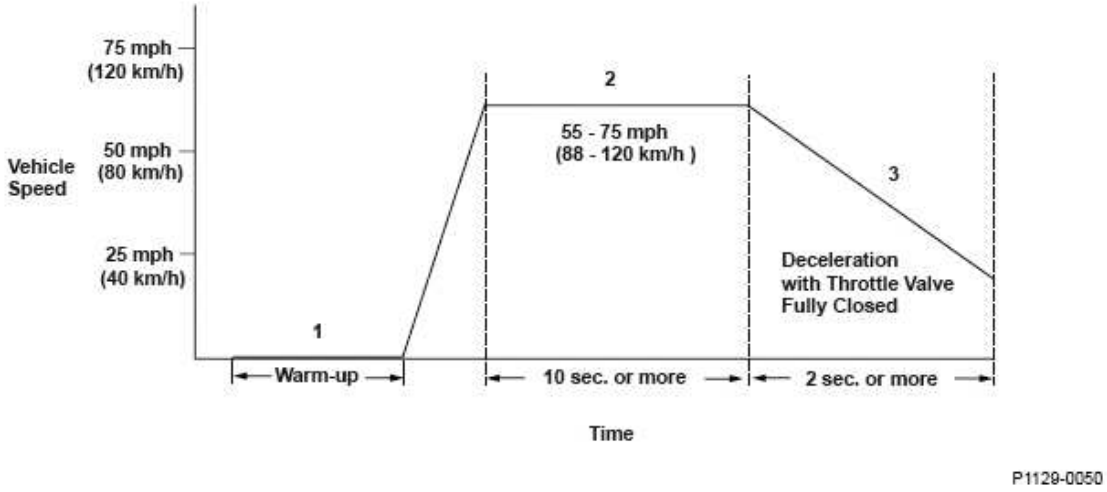



**Fig. 194: Driving Pattern - Graph**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed between 55 - 75 mph (88 - 120 km/h) for at least 10 seconds.
3. Then, decelerate with the throttle valve fully closed for at least 2 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If

the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1172 (157): ADVANCED DIAGNOSTICS

### DTC P1172: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) CIRCUIT OUT OF RANGE HIGH

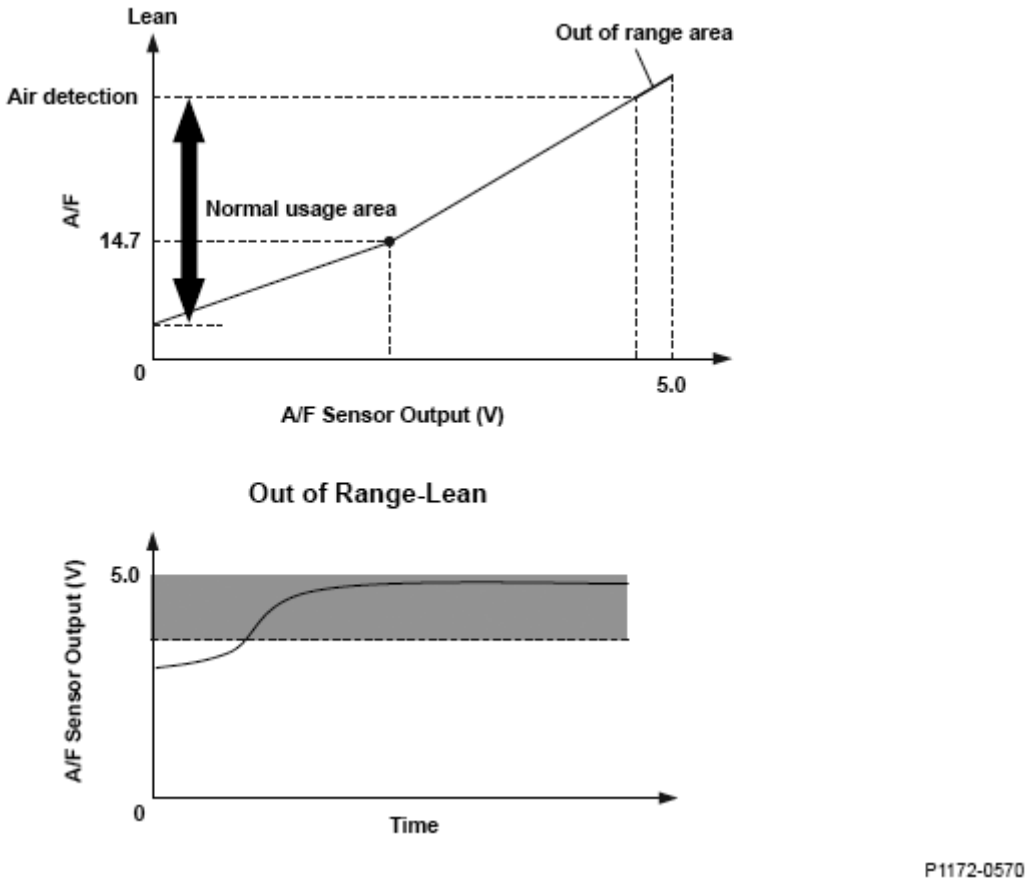



**Fig. 195: Air/Fuel Ratio (A/F) Sensor (Bank 1, Sensor 1) - Graph**

**General Description**

If a malfunction causes the rear air/fuel sensor (bank 1, sensor 1) signal to the powertrain control module

(PCM) to deviate from the normal control area, the rear air/fuel ratio (A/F) sensor becomes active after the engine starts, but the air/fuel feedback does not start normally and the emissions deteriorate. When the rear A/F sensor output is out of the normal area, and this condition continues after the rear A/F sensor is active, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 7 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| No active DTCs | P0107, P0108, P0117, P0118, P0134, P0135, P0171, P0172, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0443, P0496, P0627, P0641, P0657, P1128, P1129, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2627, P2628 |

**Malfunction Threshold**

A malfunction is detected when the rear A/F sensor (bank 1, sensor 1) output voltage is 4.7 V or more.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1174 (158): ADVANCED DIAGNOSTICS

## DTC P1174: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) CIRCUIT OUT OF RANGE HIGH

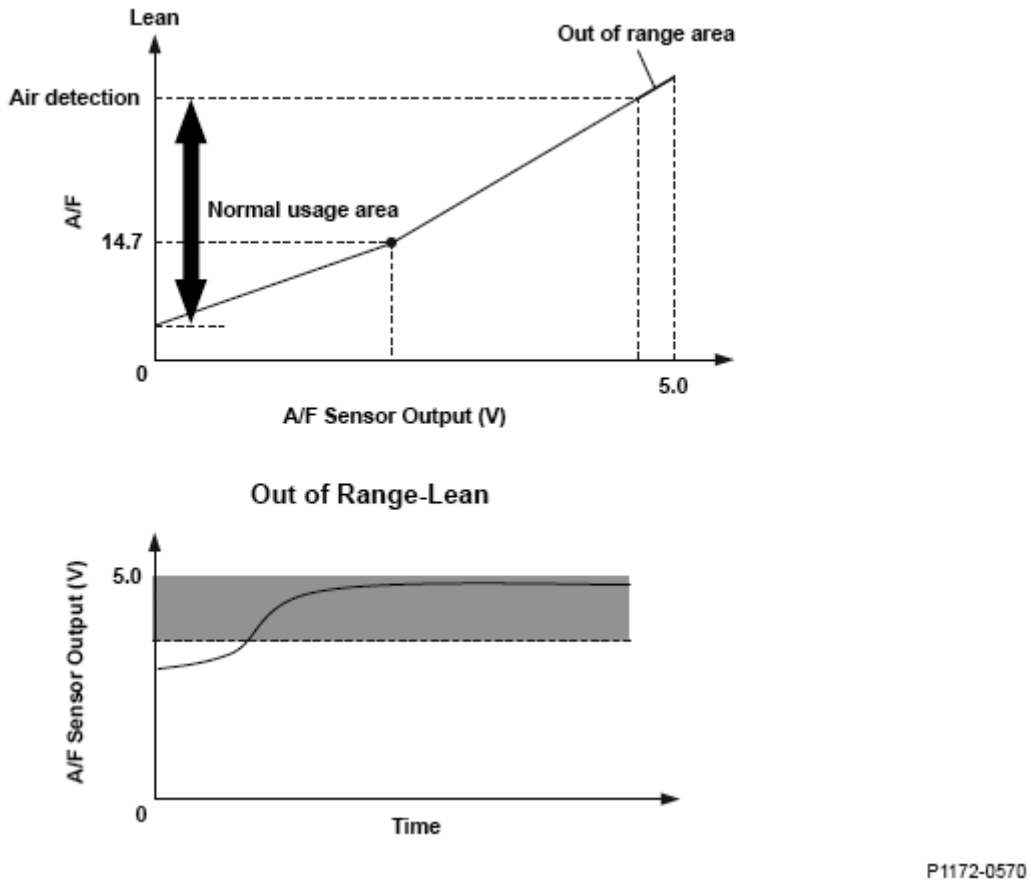



**Fig. 196: Air/Fuel Ratio (A/F) Sensor (Bank 2, Sensor 1) - Graph**

### General Description

If a malfunction causes the front air/fuel sensor (bank 2, sensor 1) signal to the powertrain control module (PCM) to deviate from the normal control area, the front air/fuel ratio (A/F) sensor becomes active after the engine starts, but the air/fuel feedback does not start normally and the emissions deteriorate. When the front A/F sensor output is out of the normal area, and this condition continues after the front A/F sensor is active, the PCM detects a malfunction and a DTC is stored.

### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 7 seconds or more |

| | |
|---|---|
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| No active DTCs | P0107, P0108, P0117, P0118, P0154, P0155, P0174, P0175, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0443, P0496, P0627, P0641, P0657, P1128, P1129, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2630, P2631 |

**Malfunction Threshold**

A malfunction is detected when the front A/F sensor (bank 2, sensor 1) output voltage is 4.7 V or more.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1297 (20): ADVANCED DIAGNOSTICS

## DTC P1297: ELECTRICAL LOAD DETECTOR (ELD) CIRCUIT LOW VOLTAGE

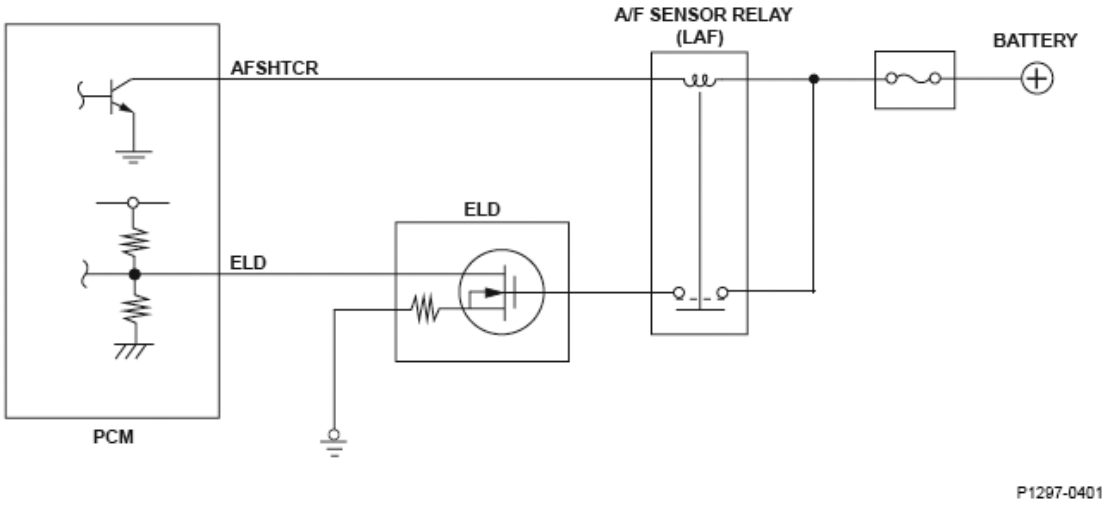



**Fig. 197: Electrical Load Detector (ELD) Circuit Diagram**

**General Description**

The electrical load detector (ELD) is built into the under-hood fuse/relay box. It monitors the current fed to the ignition switch and sends a signal to the powertrain control module (PCM). If the ELD output voltage is extremely low, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.0 V | - |
| Ignition switch | ON | |
| No active DTCs | P1298 | |

**Malfunction Threshold**

The ELD output voltage is 0.27 V or less for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1298 (20): ADVANCED DIAGNOSTICS

## DTC P1298: ELECTRICAL LOAD DETECTOR (ELD) CIRCUIT HIGH VOLTAGE

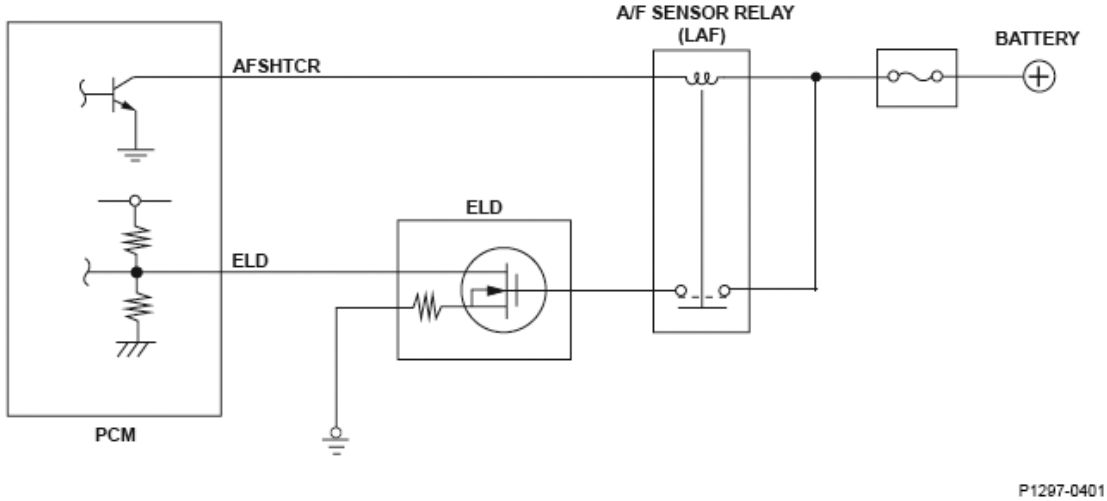



**Fig. 198: Electrical Load Detector (ELD) Circuit Diagram**

**General Description**

The electrical load detector (ELD) is built into the under-hood fuse/relay box. It monitors the current fed to the ignition switch and sends a signal to the powertrain control module (PCM). If the ELD output voltage is extremely high, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.0 V | - |
| Ignition switch | ON | |
| No active DTCs | P1297 | |

**Malfunction Threshold**

The ELD output voltage is 4.95 V or more for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1454 (91): ADVANCED DIAGNOSTICS

## DTC P1454: FUEL TANK PRESSURE (FTP) SENSOR RANGE/PERFORMANCE PROBLEM

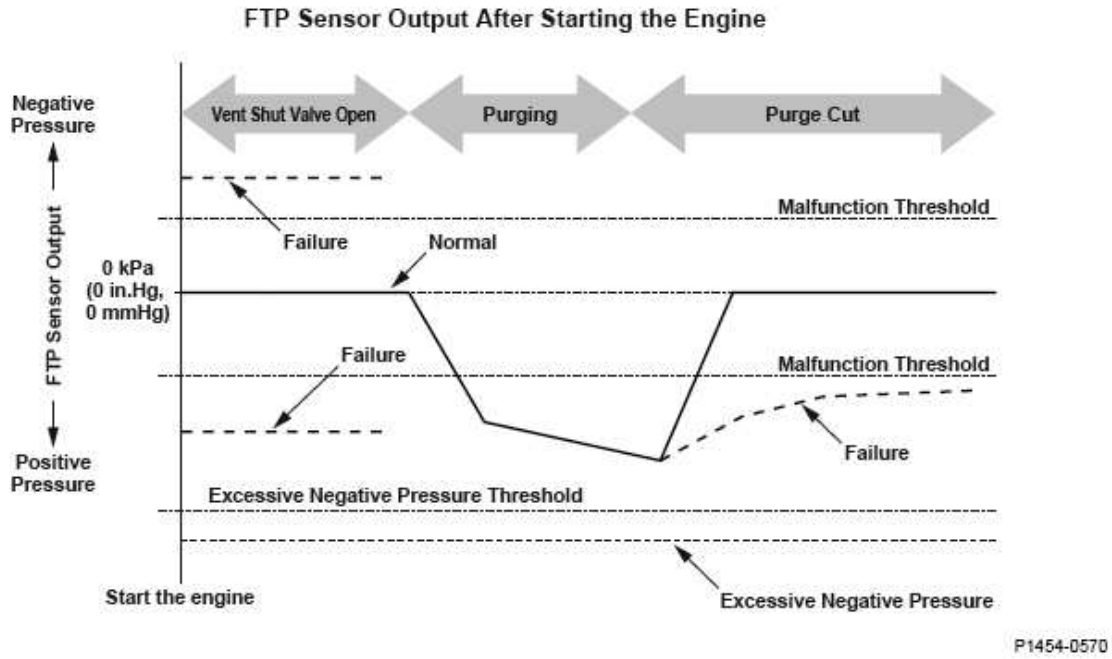



**Fig. 199: Fuel Tank Pressure (FTP) Sensor Range/Performance - Graph**

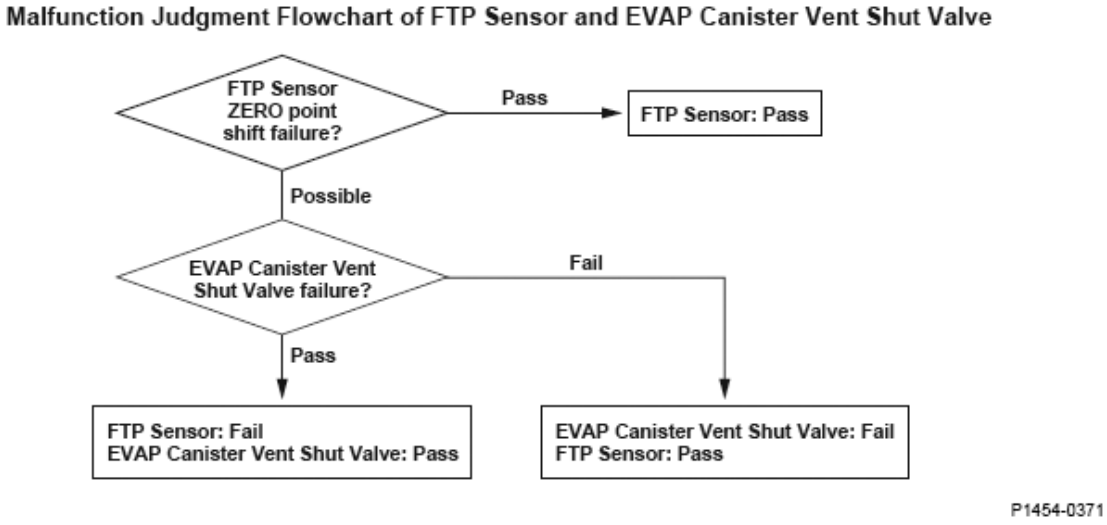



**Fig. 200: FTP Sensor And EVAP Canister Vent Shut Valve Flow Chart**

**General Description**

The fuel tank pressure is about 0 kPa (0 in.Hg, 0 mmHg) when starting a cold engine. When the fuel tank pressure (FTP) sensor output value is out of a specified range and the powertrain control module (PCM) judges that there's no other cause [no evaporative emission (EVAP) canister vent shut valve failure, etc.] of the FTP sensor zero point shift, the PCM detects an FTP sensor malfunction.

However, if the FTP sensor output when starting the engine is a prescribed negative value or less (excessive negative pressure is detected), the malfunction judgment should be done as follows because it is difficult to

distinguish the FTP sensor zero point shift (P1454) from the EVAP canister vent shut valve failure (P2422).

1. If either Temporary DTC P1454 or P2422 is not stored, the PCM stores both DTCs.
2. If both P1454 and P2422 Temporary DTCs are stored and an excessive negative pressure is detected, both P1454 and P2422 DTCs are stored.
3. If either Temporary DTC P1454 or P2422 is stored and an excessive negative pressure is detected, the PCM stores the DTC of the temporary DTC that was stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | One per driving cycle |
| Sequence | None |
| Duration | 3 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time after starting the engine | 10 seconds | - |
| Elapsed time after stopping the purge control | 5 seconds | - |
| No active DTCs | P0107, P0108, P0116, P0117, P0118, P0125, P0134, P0135, P0154, P0155, P0335, P0339, P0443, P0451, P0452, P0453, P0496, P0498, P0499, P0641, P0651, P0657, P1109, P1116, P1128, P1129, P1172, P1174, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2422, P2627, P2628, P2630, P2631 | |

**Malfunction Threshold**

One of these conditions is met.

- The FTP sensor output fluctuates by -0.6 kPa (-0.1 in.Hg, -5 mmHg) or more, or -0.6 kPa (-0.1 in.Hg, -5 mmHg) or less for at least 3 seconds.
- The FTP sensor output value is -1.3 kPa (-0.3 in.Hg, -10 mmHg) or less for at least 3 seconds.

**Confirmation Procedure with the HDS**

Do the EVAP CVS ON in the INSPECTION MENU with the HDS.

**Driving Pattern**

Start the engine, and let it idle until the radiator fan comes on.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1460 (121): ADVANCED DIAGNOSTICS

## DTC P1460: FUEL LEVEL SENSOR (FUEL GAUGE SENDING UNIT) POWER SUPPLY CIRCUIT

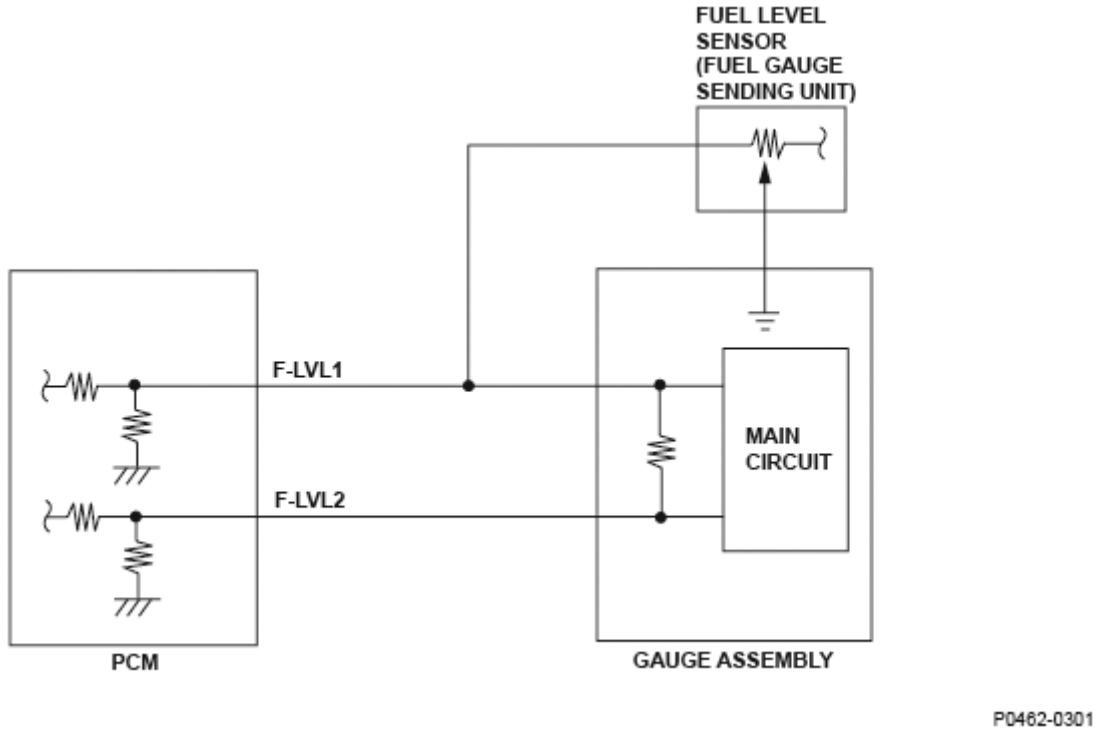



**Fig. 201: Fuel Level Sensor (Fuel Gauge Sending Unit) Circuit Diagram**

**General Description**

The fuel level sensor is incorporated with the fuel pump and installed in the fuel tank. Using a built-in potentiometer and float, it converts the movement of the float into electrical signals that correspond to fuel level, and it measures the remaining fuel in the fuel tank. If the powertrain control module (PCM) detects a signal voltage from the fuel level sensor below a predetermined value for a set time or more, it detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |

**Malfunction Threshold**

The F-LVL2 terminal voltage is 0.5 V or less for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1683 (40): ADVANCED DIAGNOSTICS

## DTC P1683: THROTTLE VALVE DEFAULT POSITION SPRING PERFORMANCE PROBLEM

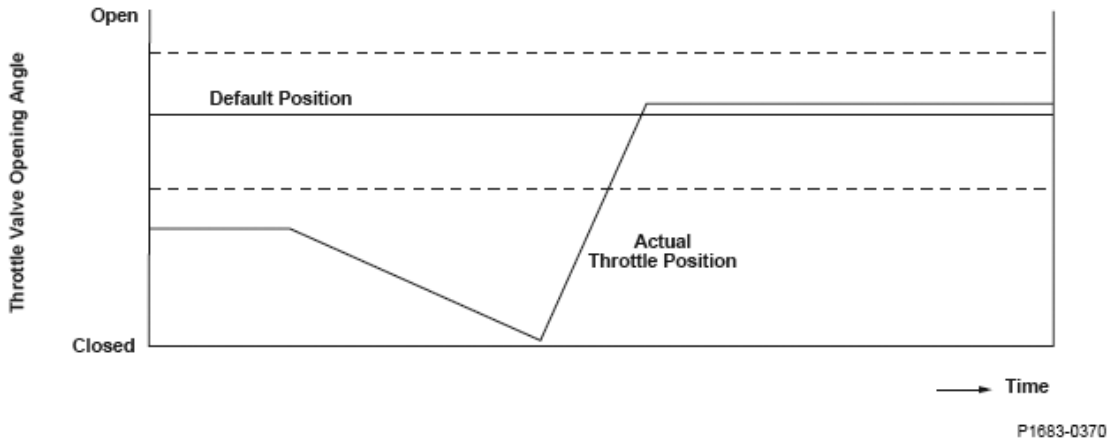



**Fig. 202: Throttle Valve Default Position Spring - Graph**

**General Description**

The electronic throttle control system (ETCS) controls the throttle valve opening. The system is composed of the throttle actuator, the throttle valve, throttle position (TP) sensors A and B, the throttle actuator control module, the throttle actuator control module relay, the accelerator pedal position (APP) sensor, and the powertrain control module (PCM).

The throttle valve default position spring is attached to the throttle valve gear. It opens the throttle valve to improve starting performance in cold conditions, or to retain minimum running performance in case of an electronic throttle control system failure.

If the throttle valve does not return to the default position when the throttle actuator control module moves the throttle actuator to the default position from the fully closed position, a malfunction is detected and the malfunction data is transmitted to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects the malfunction of the throttle valve default position spring and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 2.5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 6.0 V | - |

| | | |
|---|---|---|
| Engine coolant temperature | 158°F (70°C) | - |
| Ignition switch | OFF | |
| No active DTCs | P0117, P0118, P2101, P2108, P2118, P2135, P2176, U0107 | |

**Malfunction Threshold**

The throttle valve is at a position greater than +5° from the fully closed position, or at a position lower than +3° from the fully closed position, for at least 2.5 seconds.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.
2. Turn the ignition switch OFF.
3. Turn the ignition switch ON.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1684 (40): ADVANCED DIAGNOSTICS

## DTC P1684: THROTTLE VALVE RETURN SPRING PERFORMANCE PROBLEM

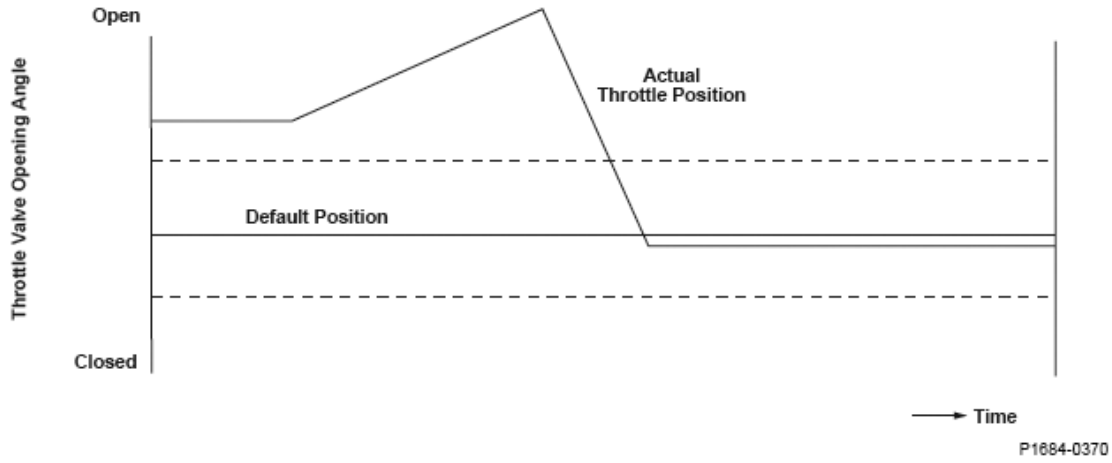



**Fig. 203: Throttle Valve Return Spring - Graph**

**General Description**

The electronic throttle control system (ETCS) controls the throttle valve opening. The system is composed of the throttle actuator, the throttle valve, throttle position (TP) sensors A and B, the throttle actuator control module, the throttle actuator control module relay, the accelerator pedal position (APP) sensor, and the powertrain control module (PCM).

The throttle valve return spring is attached to the throttle valve gear to return the throttle valve to the default position. If the throttle valve does not return to the default position when the throttle actuator control module moves the throttle actuator to the default position from the middle position, a malfunction is detected and the malfunction data is transmitted to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects the malfunction of the throttle valve return spring and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 2.5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 6.0 V | - |
| Engine coolant temperature | 158°F (70°C) | - |
| Ignition switch | OFF | |

| | |
|---|---|
| No active DTCs | P0117, P0118, P2101, P2108, P2118, P2135, P2176, U0107 |

**Malfunction Threshold**

The throttle valve opening angle is 17° or more, or 11° or less, for at least 2.5 seconds.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.
2. Turn the ignition switch OFF.
3. Turn the ignition switch ON.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P1710 (63): ADVANCED DIAGNOSTICS

## DTC P1710: 1ST-HOLD SWITCH STUCK ON OR SHORT IN 1ST-HOLD SWITCH CIRCUIT

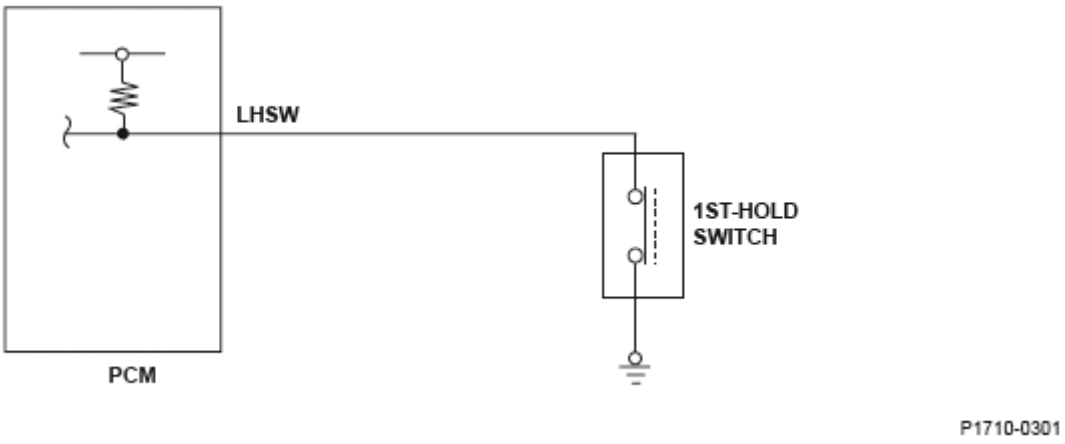



**Fig. 204: 1st-Hold Switch Or Short In 1st-Hold Switch Circuit Diagram**

## TRANSMISSION RANGE SWITCH CONTACT POINT INPUT MATRIX

| Shift lever position | Input per switch | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | R | N | D5 | D4 | D3 | 2/1 | LHSW | FWD |
| P | O | X | X | X | X | X | X | X | X |
| R | X | O | X | X | X | X | X | X | X |
| N | X | X | O | X | X | X | X | X | X |
| D5 | X | X | X | O | X | X | X | X | O |
| D4 | X | X | X | X | O | X | X | X | O |
| D3 | X | X | X | X | X | O | X | X | O |
| 2 | X | X | X | X | X | X | O | X | X |
| 1 | X | X | X | X | X | X | O | O | X |
| O: Closed X: Open | | | | | | | | | |

**General Description**

The 1st-hold switch is installed in the detent bracket of the shift lever assembly, and it detects the 1st and 2nd shift lever positions. It is used by the PCM to identify the shift lever position as either 1st or 2nd. When the 1st-hold switch is open, the PCM receives a high signal, and the 1st-hold switch is closed; it receives a low signal when the 1st-hold switch is closed. If the PCM receives a low signal in spite of the shift lever position being out of 1st or 2nd, it detects a malfunction, and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL OFF, D5 indicator OFF |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11 V | - |
| No active DTCs | P0705, P0706 | |

**Malfunction Threshold**

The 1st-hold switch signal is low when the shift lever position is out of 1st and 2nd.

**Driving Pattern**

Start the engine, and keep the shift lever in P position for at least 1 second.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2101 (40): ADVANCED DIAGNOSTICS

## DTC P2101: THROTTLE ACTUATOR SYSTEM MALFUNCTION

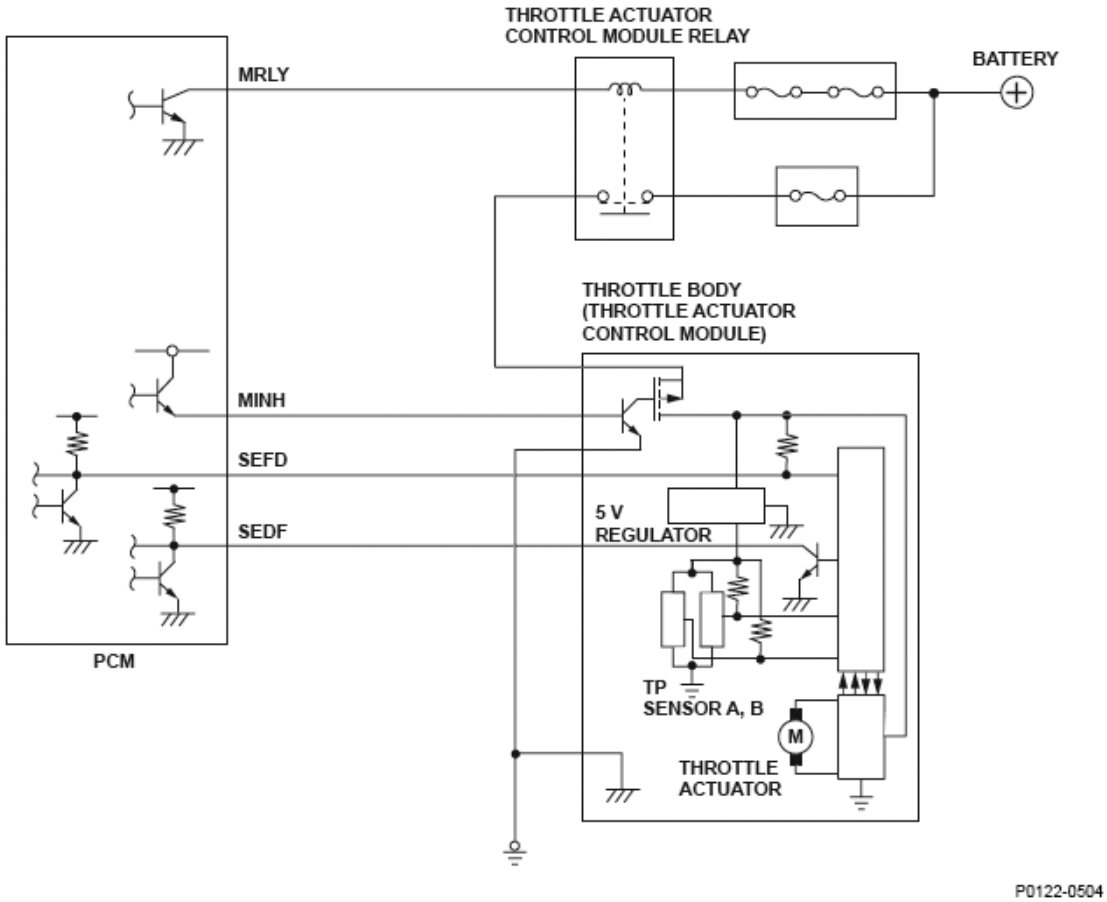



**Fig. 205: Throttle Actuator Circuit Diagram**

**General Description**

The electronic throttle control system (ETCS) controls the throttle valve opening. The system is composed of

the throttle actuator, the throttle valve, throttle position (TP) sensors A and B, the throttle actuator control module, the throttle actuator control module relay, the accelerator pedal position (APP) sensor, and the powertrain control module (PCM).

The accelerator pedal position (APP) sensor is operated via the throttle cable to determine the accelerator opening value when the driver presses the accelerator pedal. The accelerator pedal opening value is converted to a signal in the APP sensor and transmitted to the PCM to compute the target position. The target position signal is then transmitted to the throttle actuator control module.

The throttle actuator control module determines the throttle valve target position according to the signal received and operates the throttle actuator to move the throttle valve to the target position. The actual throttle valve position is determined by TP sensor A installed in the throttle body.

The throttle actuator control module compares the throttle valve target opening angle and the actual throttle valve opening angle from TP sensor A, and when the difference exceeds the specification, the throttle actuator control module transmits the malfunction data to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects the malfunction of the throttle actuator system and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.25 seconds or more(1), 0.5 seconds or more(2) |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |
| (1) Throttle valve closed direction<br>(2) Throttle valve open direction | |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 6.0 V | - |
| Ignition switch | ON | |
| No active DTCs | P2108, P2118, P2135, P2176, U0107 | |

**Malfunction Threshold**

One of the conditions in this table must be met for at least 0.25 seconds* (0.5 seconds**).

**MALFUNCTION THRESHOLD**

| | Difference between the throttle valve target |
|---|---|

| Throttle valve target position | position and the actual throttle valve position |
|---|---|
| 2° | 4° or more |
| 6° | 5.4° or more |
| 10° | 5.7° or more |
| 15° | 6° or more |
| 90° | 6° or more |

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2108 (40): ADVANCED DIAGNOSTICS

## DTC P2108: THROTTLE ACTUATOR CONTROL MODULE PROBLEM

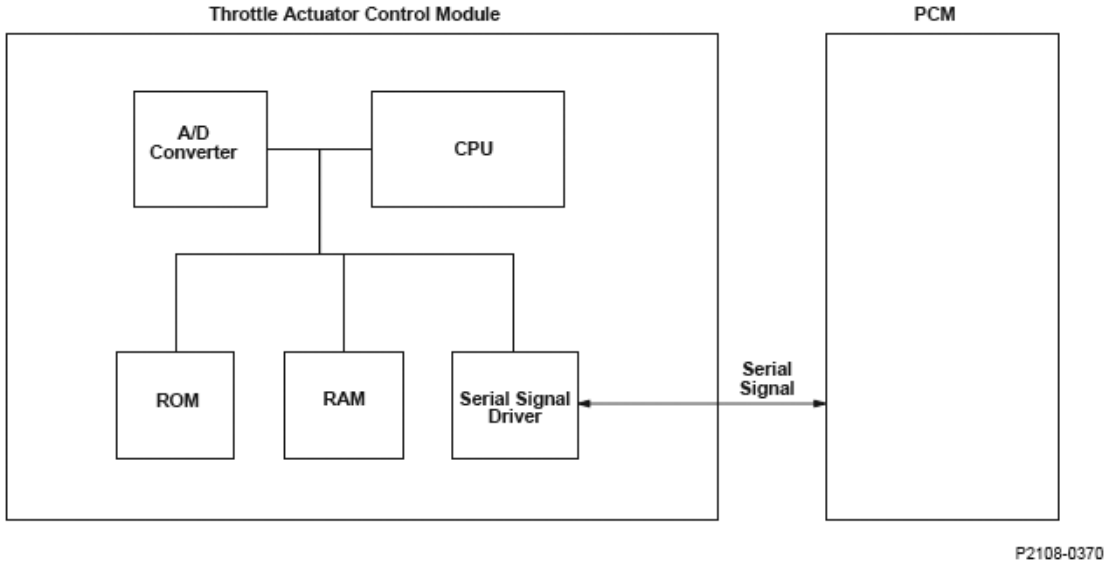



**Fig. 206: Throttle Actuator Control Module Communication Diagram**

**General Description**

The electronic throttle control system (ETCS) controls the throttle valve opening. The system is composed of the throttle actuator, the throttle valve, throttle position (TP) sensors A and B, the throttle actuator control module, the throttle actuator control module relay, the accelerator pedal position (APP) sensor, and the powertrain control module (PCM).

The APP sensor is operated via the throttle cable to determine the accelerator opening value when the driver presses the accelerator pedal. The accelerator pedal opening value is converted to a signal in the APP sensor and transmitted to the PCM to compute the target position. The target position signal is then transmitted to the throttle actuator control module. The throttle actuator control module determines the throttle valve target position according to the signal received and operates the throttle actuator to move the throttle valve to the target position. The actual throttle valve position is determined by TP sensor A installed in the throttle body.

The CPU in the throttle actuator control module performs self-diagnosis for the ROM, the RAM, and the A/D converter. If internal data is found to be abnormal, a malfunction is detected and the malfunction data is transmitted to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects a malfunction in the throttle actuator control module and stores a DTC. When the PCM monitors the serial signal between the PCM and the throttle actuator control module and finds these signals do not agree, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 8.0 V | - |
| Ignition switch | ON | |
| No active DTCs | P2101, P2118, P2135, P2176, U0107 | |

**Malfunction Threshold**

One of these conditions must be met for at least 0.2 seconds.

- Data read from the ROM is abnormal.
- Data read from the RAM is abnormal.
- The A/D converter standard voltage is out of specified value.
- The serial signals between the PCM and the throttle actuator control module do not agree.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2118 (40): ADVANCED DIAGNOSTICS

## DTC P2118: THROTTLE ACTUATOR CURRENT RANGE/PERFORMANCE PROBLEM

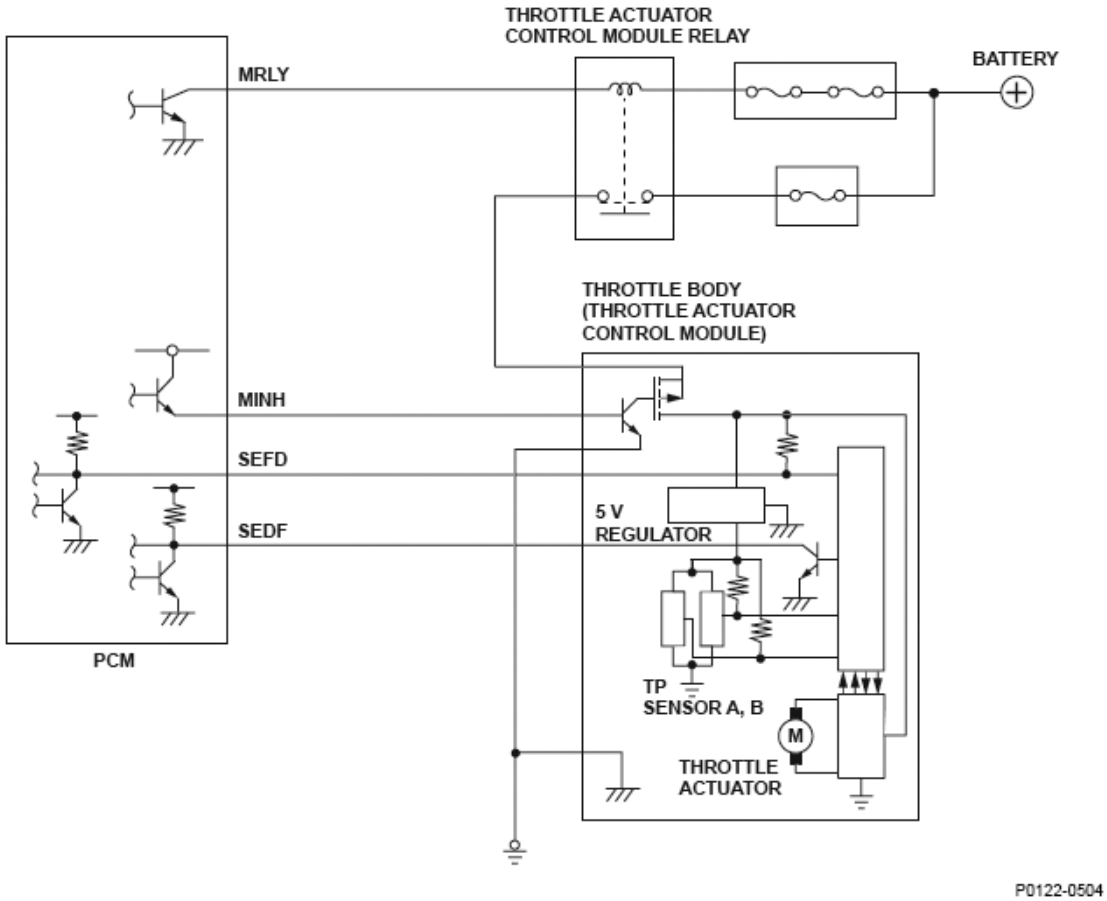



**Fig. 207: Throttle Actuator Current Range/Performance Circuit Diagram**

**General Description**

The electronic throttle control system (ETCS) controls the throttle valve opening. The system is composed of the throttle actuator, the throttle valve, throttle position (TP) sensors A and B, the throttle actuator control module, the throttle actuator control module relay, the accelerator pedal position (APP) sensor, and the powertrain control module (PCM).

The APP sensor is operated via the throttle cable to determine the accelerator opening value when the driver presses the accelerator pedal. The accelerator pedal opening value is converted to a signal in the APP sensor and transmitted to the PCM to compute the target position. The target position signal is then transmitted to the throttle actuator control module. The throttle actuator control module determines the throttle valve target position according to the signal received and operates the throttle actuator to move the throttle valve to the target position. The actual throttle valve position is determined by TP sensor A installed in the throttle body.

When the output current to the throttle actuator exceeds the specification for a set time, the throttle actuator control module detects a malfunction and transmits the malfunction data to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects a malfunction of the throttle actuator system and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 6.0 V | - |
| Ignition switch | ON | |
| No active DTCs | P2101, P2108, P2135, P2176, U0107 | |

**Malfunction Threshold**

The current flow to the throttle actuator is 16 A or more for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2122 (37): ADVANCED DIAGNOSTICS

## DTC P2122: ACCELERATOR PEDAL POSITION (APP) SENSOR A (THROTTLE POSITION (TP) SENSOR D) CIRCUIT LOW VOLTAGE

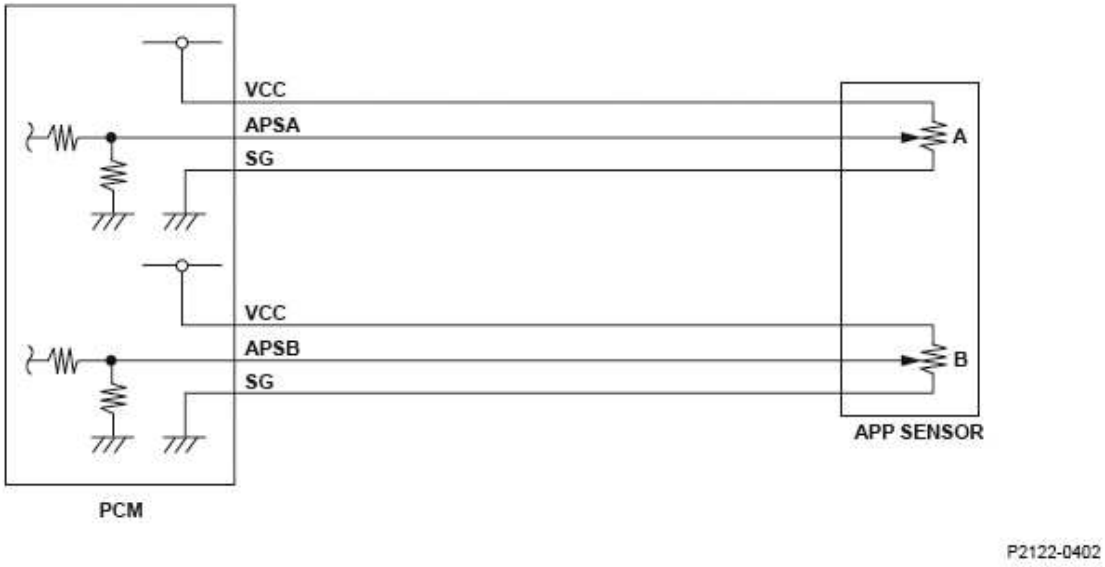



**Fig. 208: Accelerator Pedal Position (APP) Sensor Circuit Diagram**

**General Description**

Accelerator pedal position (APP) sensor A is a part of the electronic throttle control system (ETCS), and it is used to convert the position of the accelerator pedal into electrical signals. Based on these signals, the powertrain control module (PCM) controls the throttle actuator so that the throttle position agrees with the accelerator pedal position. If the signal voltage from APP sensor A is a set value or less, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |

| | |
|---|---|
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P2123 |

**Malfunction Threshold**

The APP sensor A output voltage is 0.1 V or less for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2123 (37): ADVANCED DIAGNOSTICS

## DTC P2123: ACCELERATOR PEDAL POSITION (APP) SENSOR A (THROTTLE POSITION (TP) SENSOR D) CIRCUIT HIGH VOLTAGE

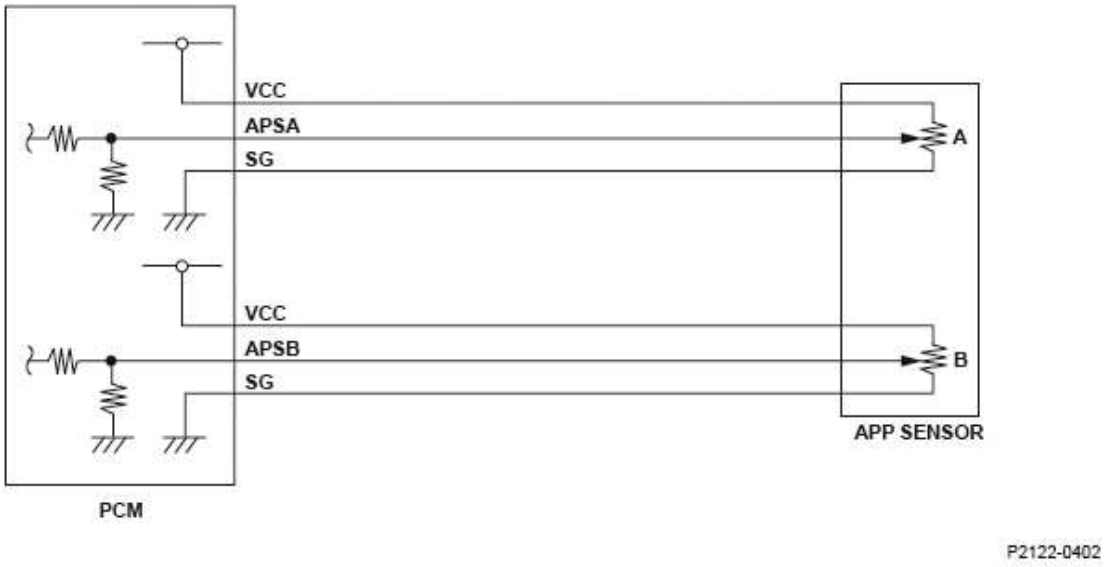



**Fig. 209: Accelerator Pedal Position (APP) Sensor Circuit Diagram**

**General Description**

Accelerator pedal position (APP) sensor A is a part of the electronic throttle control system (ETCS), and it is used to convert the position of the accelerator pedal into electrical signals. Based on these signals, the powertrain control module (PCM) controls the throttle actuator so that the throttle position agrees with the accelerator pedal position. If the signal voltage from APP sensor A is a set value or more, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P2122 |

**Malfunction Threshold**

The APP sensor A output voltage is 4.85 V or more for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2127 (37): ADVANCED DIAGNOSTICS

## DTC P2127: ACCELERATOR PEDAL POSITION (APP) SENSOR B (THROTTLE POSITION (TP) SENSOR E) CIRCUIT LOW VOLTAGE

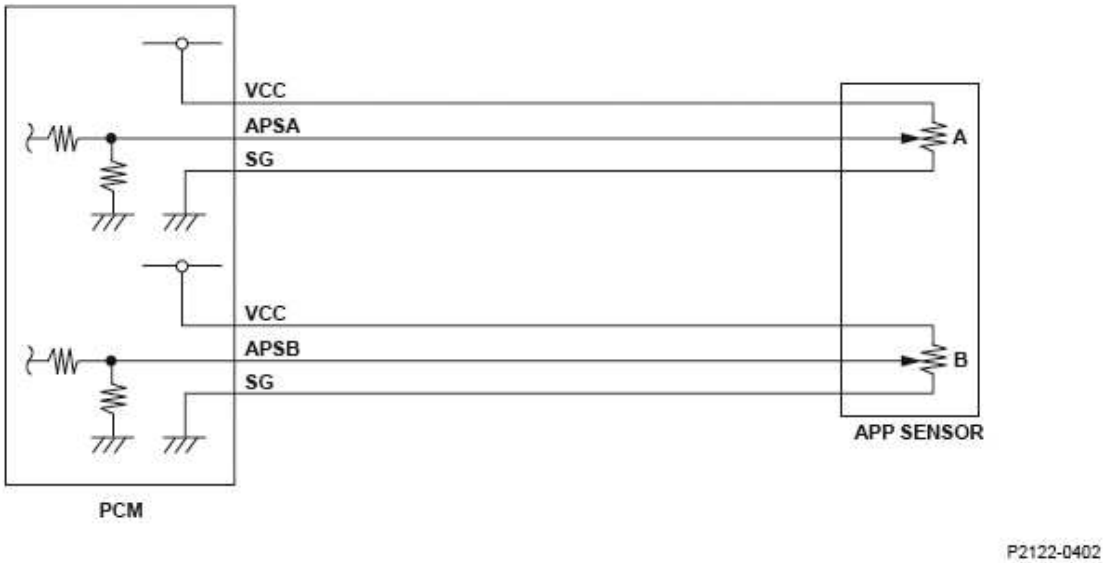



**Fig. 210: Accelerator Pedal Position (APP) Sensor Circuit Diagram**

**General Description**

Accelerator pedal position (APP) sensor B is a part of the electronic throttle control system (ETCS), and it is used to convert the position of the accelerator pedal into electrical signals. Based on these signals, the powertrain control module (PCM) controls the throttle actuator so that the throttle position agrees with the accelerator pedal position. If the signal voltage from APP sensor B is a set value or less, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P2128 |

**Malfunction Threshold**

The APP sensor B output voltage is 0.1 V or less for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2128 (37): ADVANCED DIAGNOSTICS

**DTC P2128: ACCELERATOR PEDAL POSITION (APP) SENSOR B (THROTTLE POSITION (TP) SENSOR E) CIRCUIT HIGH VOLTAGE**

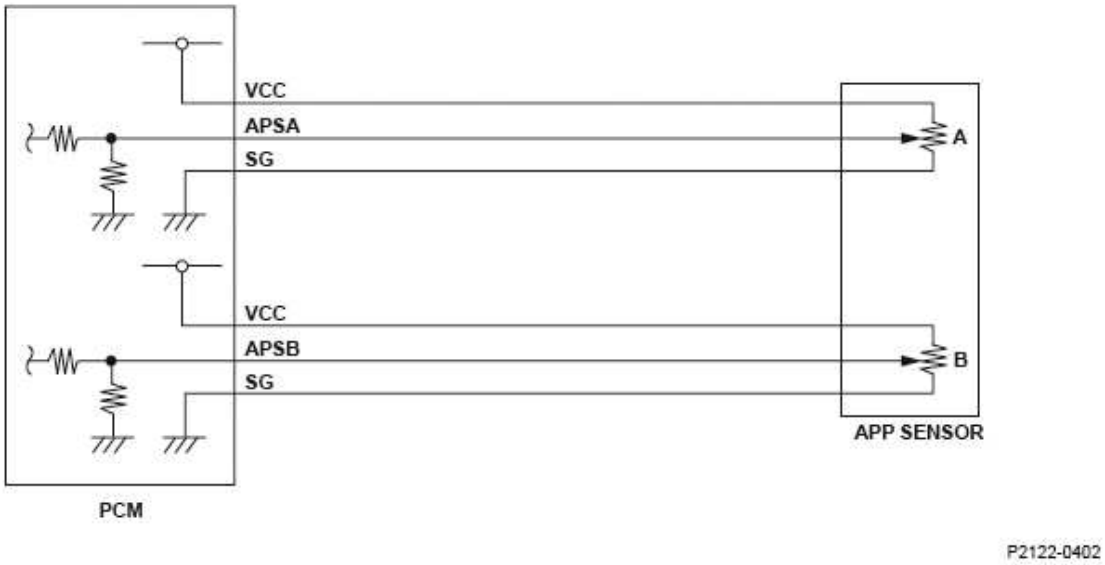



**Fig. 211: Accelerator Pedal Position (APP) Sensor Circuit Diagram**

**General Description**

Accelerator pedal position (APP) sensor B is a part of the electronic throttle control system (ETCS), and it is used to convert the position of the accelerator pedal into electrical signals. Based on these signals, the powertrain control module (PCM) controls the throttle actuator so that the throttle position agrees with the accelerator pedal position. If the signal voltage from APP sensor B is a set value or more, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P2127 |

**Malfunction Threshold**

The APP sensor B output voltage is 4.0 V or more for at least 0.2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2135 (7): ADVANCED DIAGNOSTICS

## DTC P2135: THROTTLE POSITION SENSOR A/B INCORRECT VOLTAGE CORRELATION

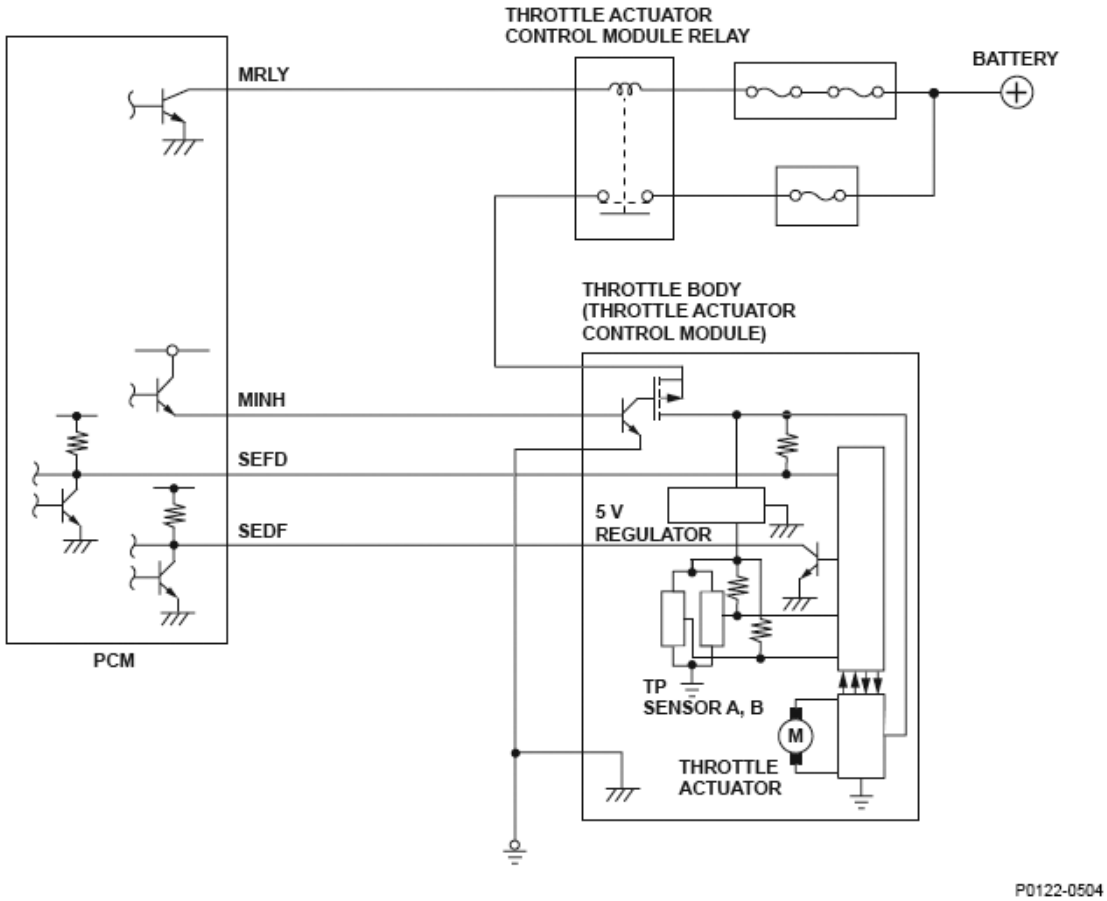



**Fig. 212: Throttle Position (TP) Sensor Circuit Diagram**

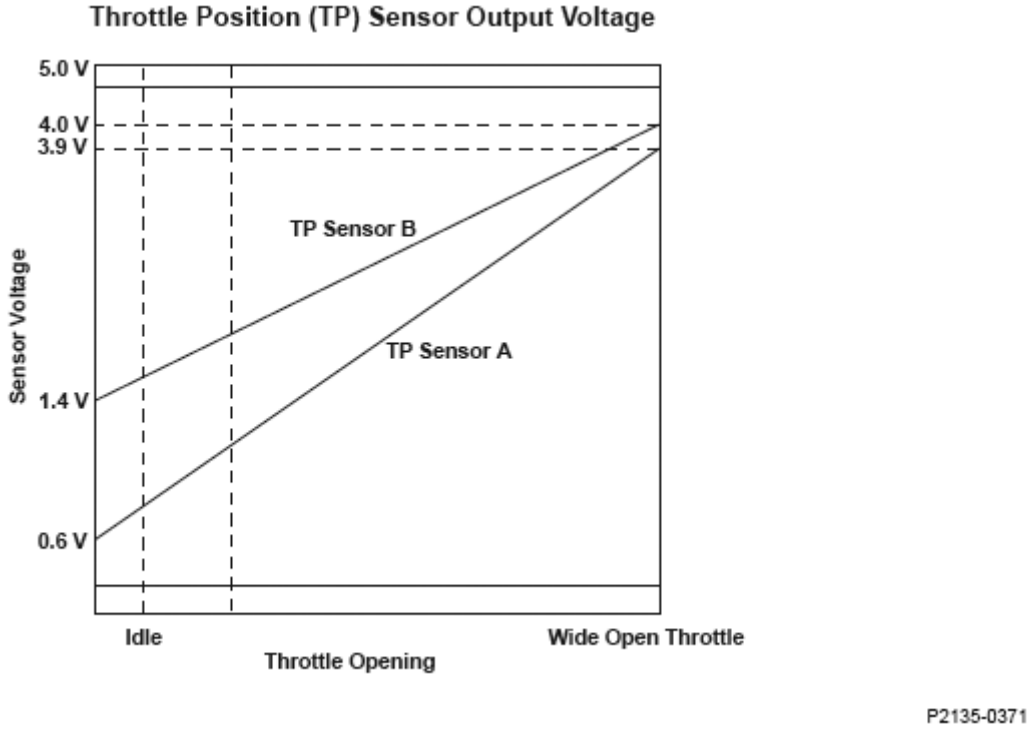



**Fig. 213: Throttle Position (TP) Sensor Output Voltage - Graph**

**General Description**

The electronic throttle control system (ETCS) controls the throttle valve opening. The system is composed of the throttle actuator, the throttle valve, throttle position (TP) sensors A and B, the throttle actuator control module, the throttle actuator control module relay, the accelerator pedal position (APP) sensor, and the powertrain control module (PCM).

The APP sensor is operated via the throttle cable to determine the accelerator opening value when the driver presses the accelerator pedal. The accelerator pedal opening value is converted to a signal in the APP sensor and transmitted to the PCM to compute the target position. The target position signal is then transmitted to the throttle actuator control module. The throttle actuator control module determines the throttle valve target position according to the signal received and operates the throttle actuator to move the throttle valve to the target position. The actual throttle valve position is determined by TP sensor A installed in the throttle body.

The throttle actuator control module compares the voltages and the throttle valve positions of TP sensor A and TP sensor B. If the difference of the voltages or the throttle valve positions is the fixed value or less for a set time, the throttle actuator control module detects a malfunction and the malfunction data is transmitted to the PCM. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects a malfunction in the relationship between TP sensor A and TP sensor B, and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |

| | |
|---|---|
| Sequence | None |
| Duration | 0.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| TP sensor B voltage | - | 2.3 V |
| Ignition switch | ON | |
| No active DTCs | P0122, P0123, P0222, P0223, P2101, P2108, P2118, P2176, U0107 | |
| Other | After the throttle valve fully closed position registration is completed | |

**Malfunction Threshold**

One of these conditions must be met for at least 0.2 seconds.

- The difference between the TP sensor A voltage and the TP sensor B voltage is 200 mV (5 °) or less.
- The difference between the throttle valve positions that TP sensor A and TP sensor B determined exceeds the value shown in this table.

**MALFUNCTION THRESHOLD**

| Throttle valve position determined by TP sensor A | Difference between TP sensor A and TP sensor B |
|---|---|
| 0 ° | 1.8 ° or more |
| 83.3 ° | 14.7 ° or more |

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P2138 (37): ADVANCED DIAGNOSTICS

## DTC P2138: ACCELERATOR PEDAL POSITION (APP) SENSOR A/B (THROTTLE POSITION (TP) SENSOR D/E) INCORRECT VOLTAGE CORRELATION

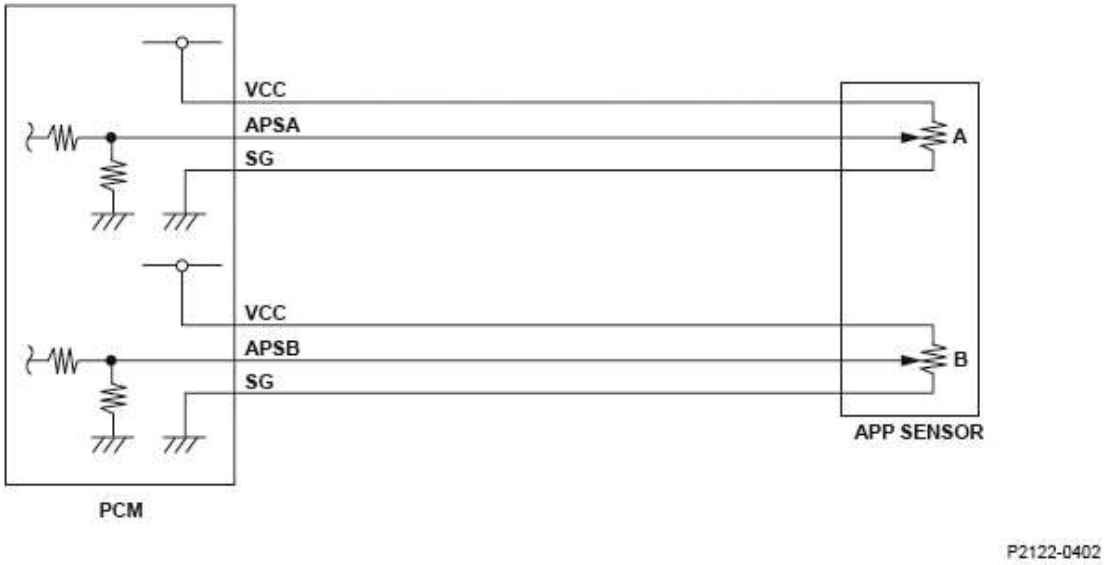



**Fig. 214: Accelerator Pedal Position (APP) Sensor Circuit Diagram**

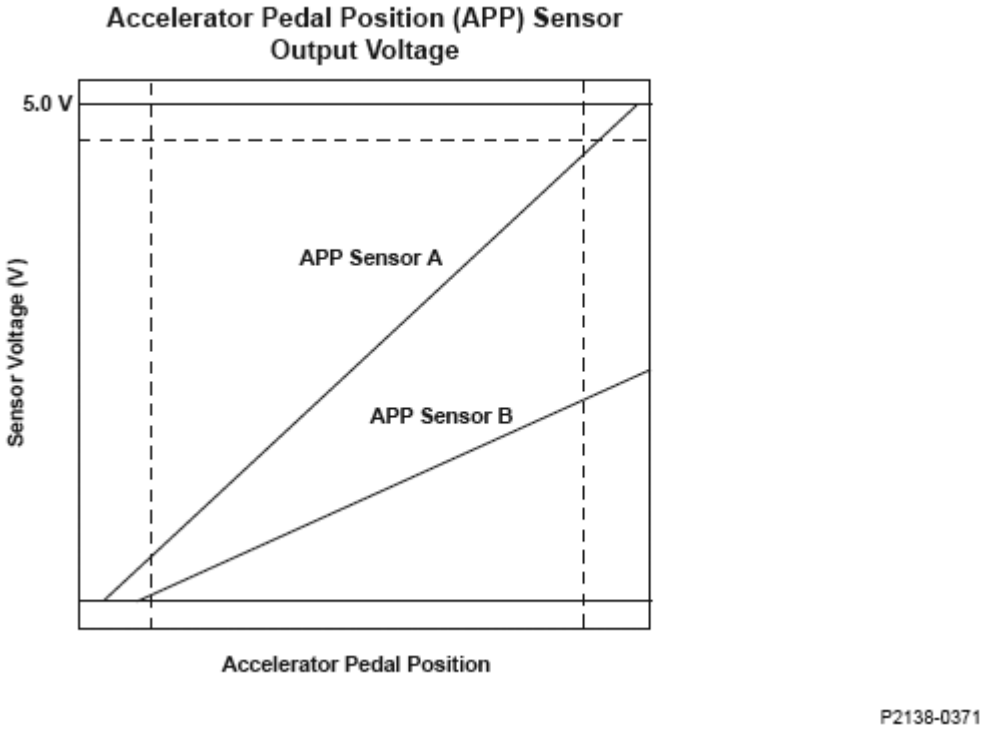



**Fig. 215: Accelerator Pedal Position (APP) Sensor Output Voltage - Graph**

**General Description**

Accelerator pedal position (APP) sensor A and accelerator pedal position (APP) sensor B are potentiometers, and they are installed in the engine compartment. These sensor output voltages differ from each other.

APP sensors A and B are operated via the throttle cable to determine the accelerator opening value when the driver presses the accelerator pedal. The accelerator pedal opening value is converted to a signal in APP sensors A and B and transmitted to the powertrain control module (PCM) to compute the target position. The target position signal is then transmitted to the throttle actuator control module.

APP sensor A is for the primary control, and APP sensor B is a back-up of APP sensor A in case it malfunctions. Both sensors compare their output voltage to each other for malfunction detection.

When the voltage difference of APP sensor B is out of a fixed range for a set time, the PCM detects a malfunction, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.3 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P2122, P2123, P2127, P2128 |

**Malfunction Threshold**

One of these conditions must be met for at least 0.3 seconds.

- If the APP sensor B voltage exceeds the range from 0 V or less to 0.361 V or more when the APP sensor A voltage is 0.361 V.
- If the APP sensor B voltage exceeds the range from 2.319 V or less to 2.681 V or more when the APP sensor A voltage is 4.995 V.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2176 (40): ADVANCED DIAGNOSTICS

## DTC P2176: THROTTLE ACTUATOR CONTROL SYSTEM IDLE POSITION NOT LEARNED

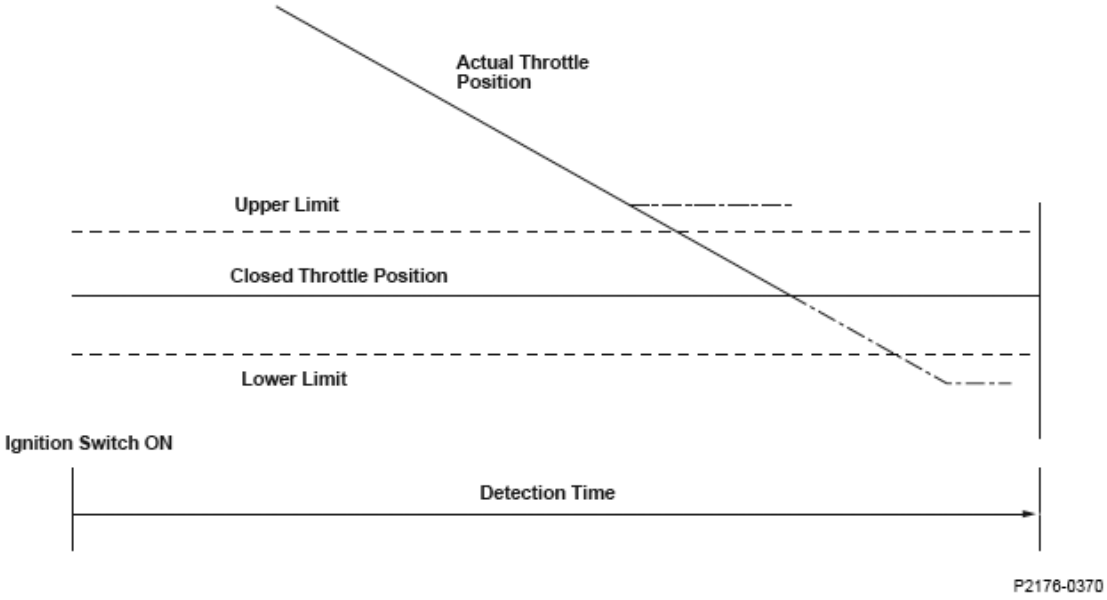



**Fig. 216: Identifying Throttle Actuator Control System Idle Position Graph**

**General Description**

The electronic throttle control system (ETCS) controls the throttle valve opening. The system is composed of the throttle actuator, the throttle valve, throttle position (TP) sensors A and B, the throttle actuator control module, the throttle actuator control module relay, the accelerator pedal position (APP) sensor, and the powertrain control module (PCM).

The APP sensor is operated via the throttle cable to determine the accelerator opening value when the driver presses the accelerator pedal. The accelerator pedal opening value is converted to a signal in the APP sensor and transmitted to the PCM to compute the target position. The target position signal is then transmitted to the throttle actuator control module. The throttle actuator control module determines the throttle valve target position according to the signal received and operates the throttle actuator to move the throttle valve to the target position. The actual throttle valve position is determined by TP sensor A installed in the throttle body.

The throttle actuator control module transmits a signal to the throttle actuator and moves the throttle valve to the

fully closed position to register the throttle valve fully closed position after the ignition switch is turned ON.

The throttle actuator control module detects the malfunction of the throttle actuator control system, and it transmits a malfunction signal to the PCM when the registration of the throttle valve fully closed position is not completed within a predetermined time or the registered value is out of predetermined range after the ignition switch is turned ON. When the PCM receives the malfunction data from the throttle actuator control module, the PCM detects a malfunction in the throttle actuator control system and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 0.7 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 6.0 V | - |
| Ignition switch | ON | |
| Other | Engine is stopped and ignition switch is not in the ON position | |
| No active DTCs | P0122, P0123, P0222, P0223, P2101, P2108, P2118, P2135, U0107 | |

**Malfunction Threshold**

One of these conditions must be met for at least 0.7 seconds.

- The registration of the throttle valve fully closed position is not completed within a predetermined time after the ignition switch is ON.
- The registered value of the throttle valve fully closed position is 0.74 $V^{*1}$ , 1.61 $V^{*2}$ or more, or 0.49 $V^{*1}$ , 1.37 $V^{*2}$ or less.

*1: TP sensor A

*2: TP sensor B

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2195 (155): ADVANCED DIAGNOSTICS

## DTC P2195: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) SIGNAL STUCK LEAN

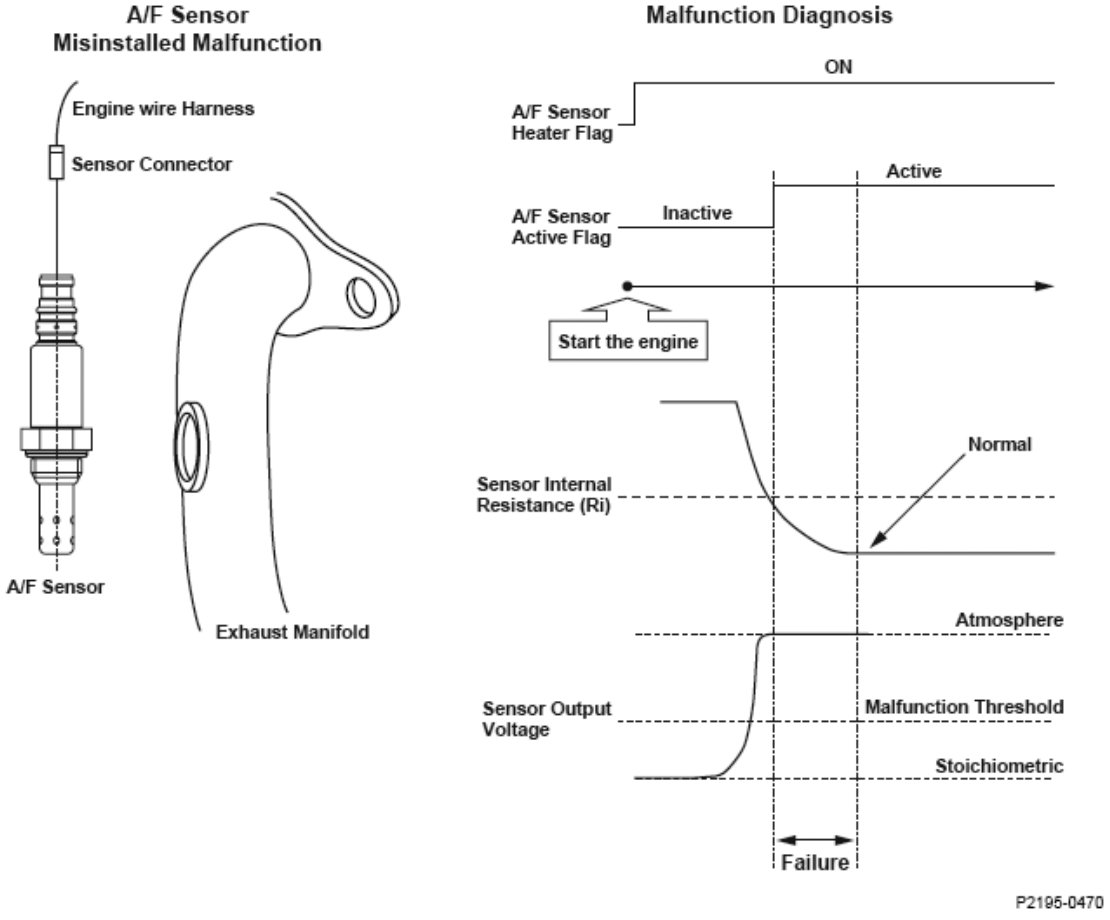



**Fig. 217: Air/Fuel Ratio (A/F) Sensor (Sensor 1) Signal Stuck Lean Malfunction Diagram**

**General Description**

When the rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is properly connected to the engine wire harness, but it is not installed in the exhaust pipe, the A/F feedback is not performed properly even if the rear A/F sensor is active after starting the engine. Thus, the exhaust emissions increase.

When the rear A/F sensor output stays out of the normal range after the rear A/F sensor becomes active, the

powertrain control module (PCM) detects that the rear A/F sensor is not properly installed and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 7 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Fuel feedback | Other than during fuel cut-off operation |
| No active DTCs | P0134, P0135, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0627, P0657, P1172, P2237, P2238, P2243, P2245, P2251, P2252, P2627, P2628 |

**Malfunction Threshold**

The rear A/F sensor (bank 1, sensor 1) output voltage is 3.48 V or more for at least 7 seconds.

**Driving Pattern**

Start the engine, then let it idle for at least 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P2197 (156): ADVANCED DIAGNOSTICS

**DTC P2197: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) SIGNAL STUCK**

**LEAN**

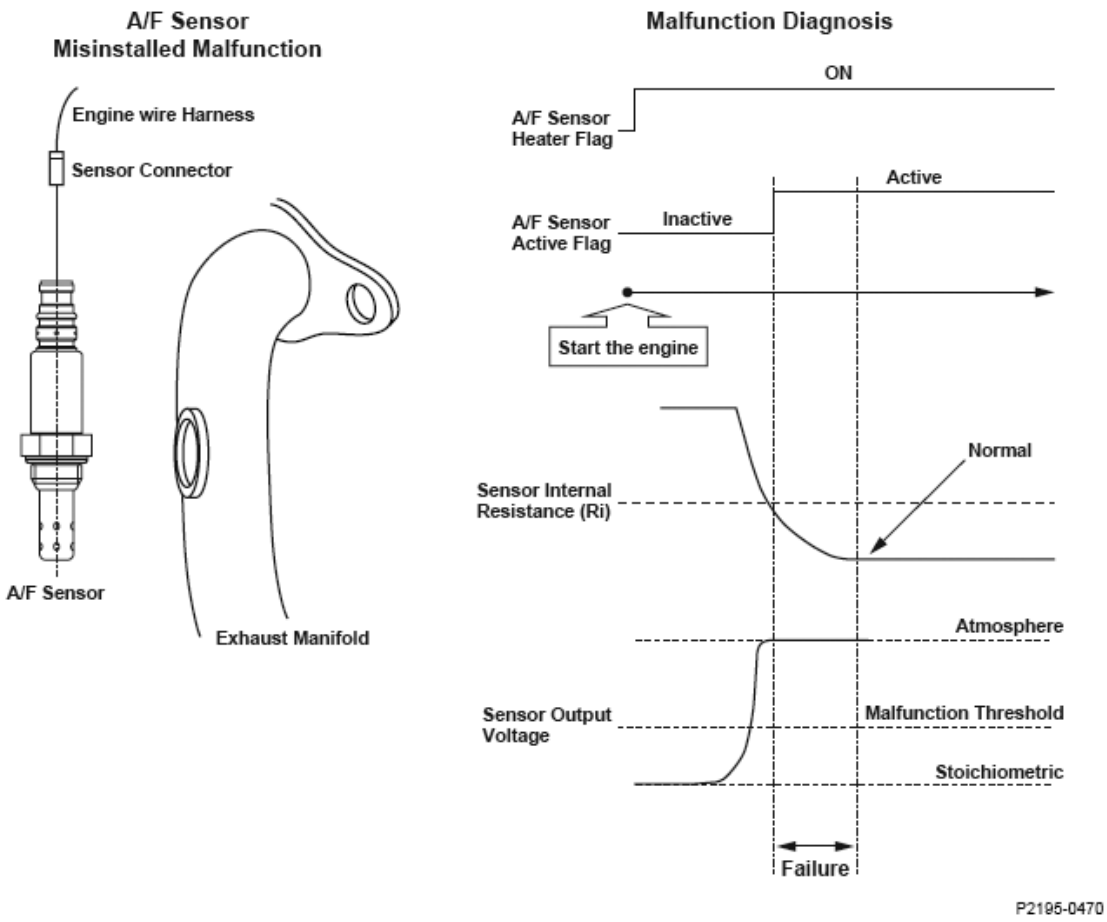



**Fig. 218: Air/Fuel Ratio (A/F) Sensor (Sensor 1) Signal Stuck Lean Malfunction Diagram**

**General Description**

When the front air/fuel ratio (A/F) sensor (bank 2, sensor 1) is properly connected to the engine wire harness, but it is not installed in the exhaust pipe, the A/F feedback is not performed properly even if the front A/F sensor is active after starting the engine. Thus, the exhaust emissions increase.

When the front A/F sensor output stays out of the normal range after the front A/F sensor becomes active, the powertrain control module (PCM) detects that the front A/F sensor is not properly installed and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 7 seconds or more |
| DTC Type | One drive cycle, MIL ON |

| | |
|---|---|
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Fuel feedback | Other than during fuel cut-off operation |
| No active DTCs | P0154, P0155, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0627, P0657, P1174, P2240, P2241, P2247, P2249, P2254, P2255, P2630, P2631 |

**Malfunction Threshold**

The front A/F sensor (bank 2, sensor 1) output voltage is 3.48 V or more for at least 7 seconds.

**Driving Pattern**

Start the engine, then let it idle for at least 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2227 (13): ADVANCED DIAGNOSTICS

## DTC P2227: BAROMETRIC PRESSURE (BARO) SENSOR RANGE/PERFORMANCE PROBLEM

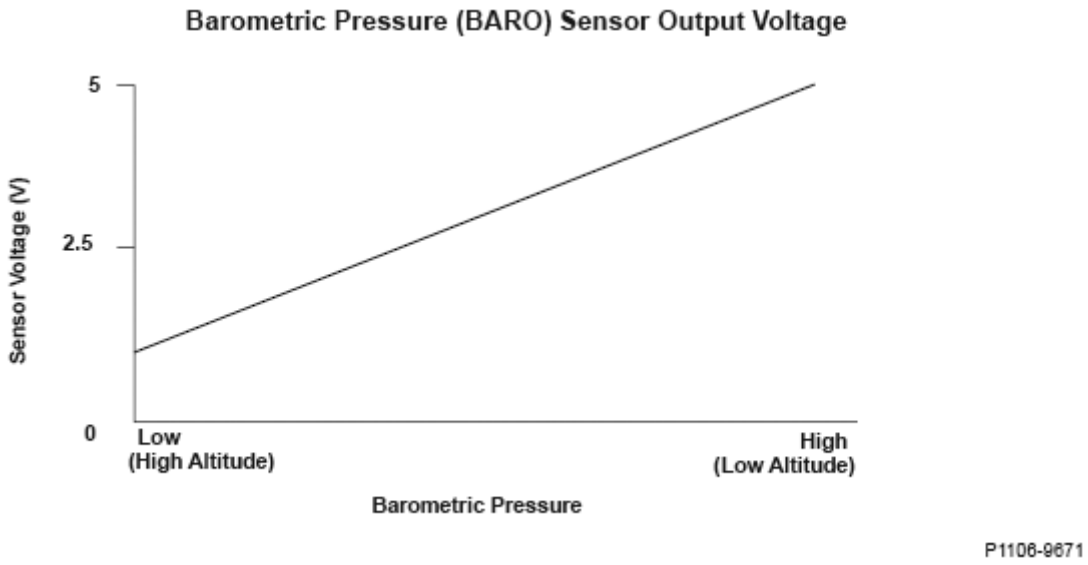



**Fig. 219: Barometric Pressure (BARO) Sensor Output Voltage - Graph**

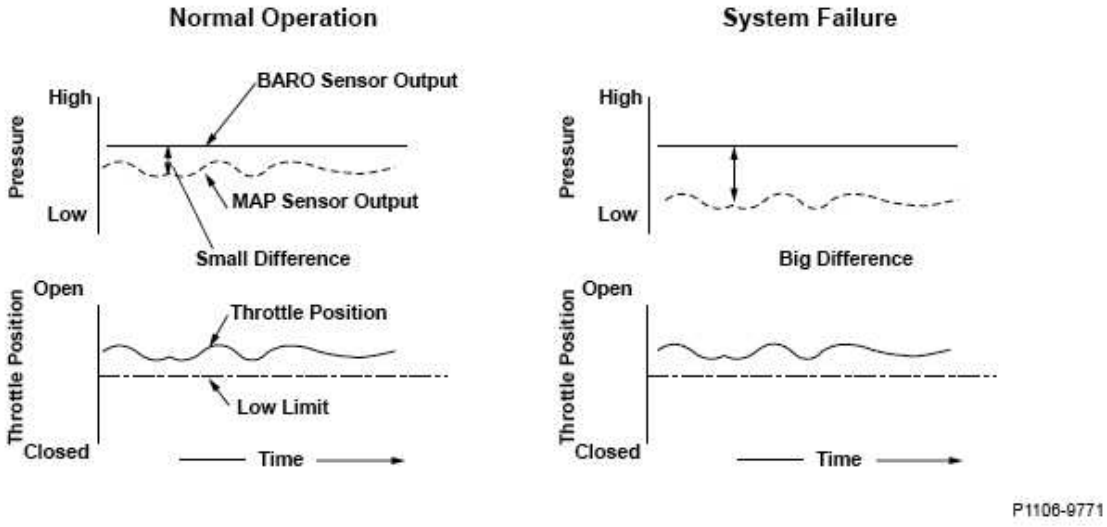



**Fig. 220: Barometric Pressure (BARO) Sensor Output Voltage Throttle Position - Graph**

**General Description**

The barometric pressure (BARO) sensor is built into the powertrain control module (PCM) and monitors atmospheric pressure. When the throttle valve is wide open, the manifold absolute pressure (MAP) sensor output is nearly equal to the BARO sensor output. Making use of this characteristic, a malfunction can be detected in the BARO sensor output.

If the throttle position is beyond a value stored in the PCM that is used to detect "wide-open throttle," and if the difference between the MAP sensor output and the BARO sensor output is equal to or greater than a set value, a malfunction in the BARO sensor output is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | | Minimum | Maximum |
|---|---|---|---|
| Throttle position | 1,000 rpm | 13.0 ° | - |
| | 3,000 rpm | 27.0 ° | - |
| No active DTCs | | P0107, P0108, P0117, P0118, P0122, P0123, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P0403, P0404, P0506, P0507, P0627, P0641, P1077, P1078, P1109, P1128, P1129, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2228, P2229, P2279, P2413, P2646, P2647, P2648, P2649, U0107 | |

**Malfunction Threshold**

The difference between the BARO sensor output and the MAP sensor output is 26 kPa (7.5 in.Hg, 190 mmHg) or more for at least 2 seconds.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle with the throttle position as specified under Enable Conditions for at least 2 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P2228 (13): ADVANCED DIAGNOSTICS

### DTC P2228: BAROMETRIC PRESSURE (BARO) SENSOR CIRCUIT LOW VOLTAGE

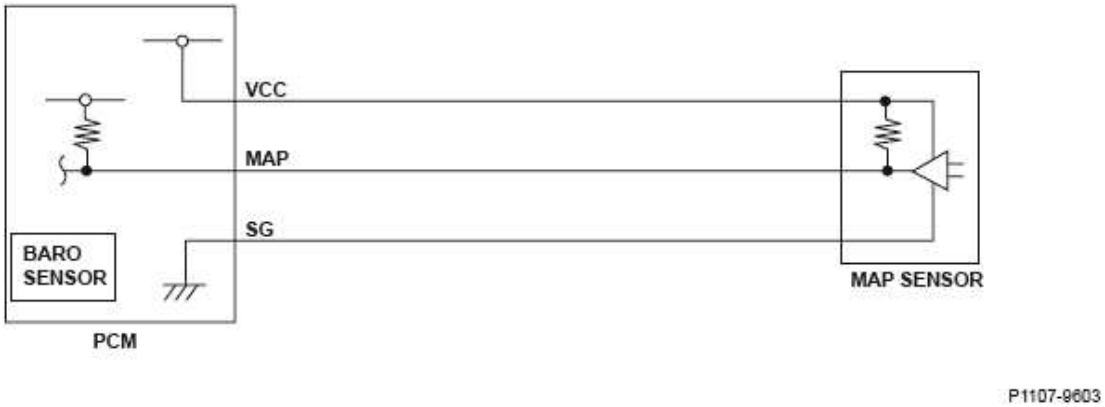



**Fig. 221: Barometric Pressure (BARO) Sensor Circuit Diagram**

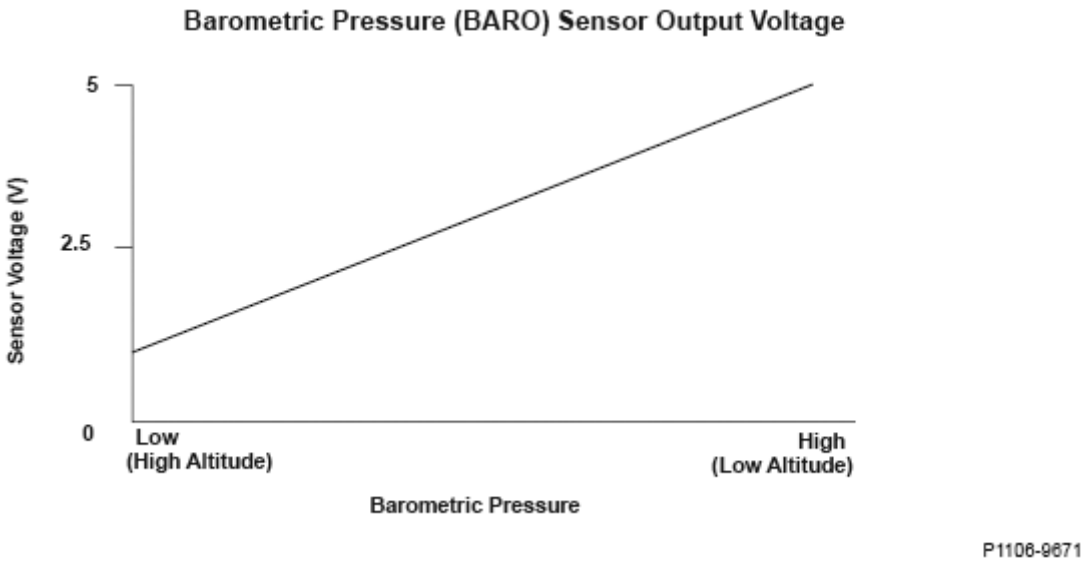



**Fig. 222: Barometric Pressure (BARO) Sensor Output Voltage - Graph**

#### General Description

The barometric pressure (BARO) sensor is built into the powertrain control module (PCM) and monitors atmospheric pressure. The PCM estimates appropriate intake airflow from the manifold absolute pressure

(MAP) sensor output voltage and BARO sensor output voltage. If the BARO sensor output voltage is a specified value or less, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P1109, P2229 |

**Malfunction Threshold**

The BARO sensor output voltage is 1.58 V or less for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P2229 (13): ADVANCED DIAGNOSTICS

**DTC P2229: BAROMETRIC PRESSURE (BARO) SENSOR CIRCUIT HIGH VOLTAGE**

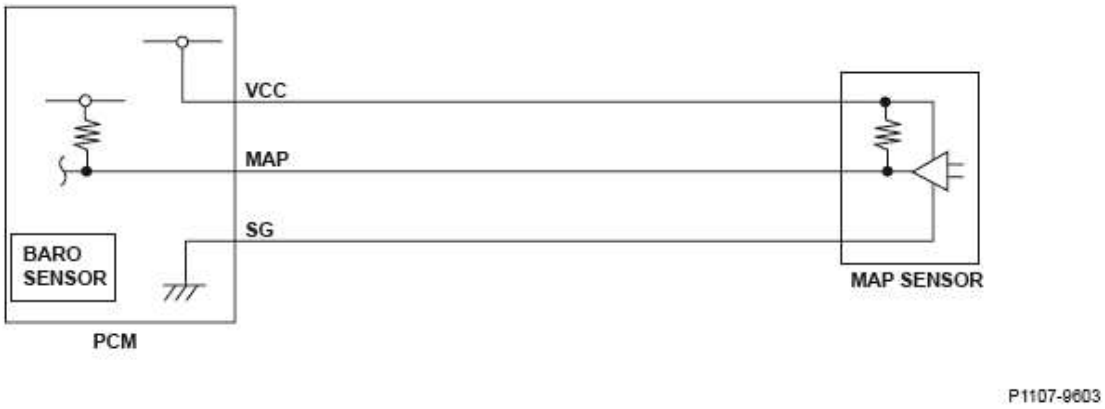



**Fig. 223: Barometric Pressure (BARO) Sensor Circuit Diagram**

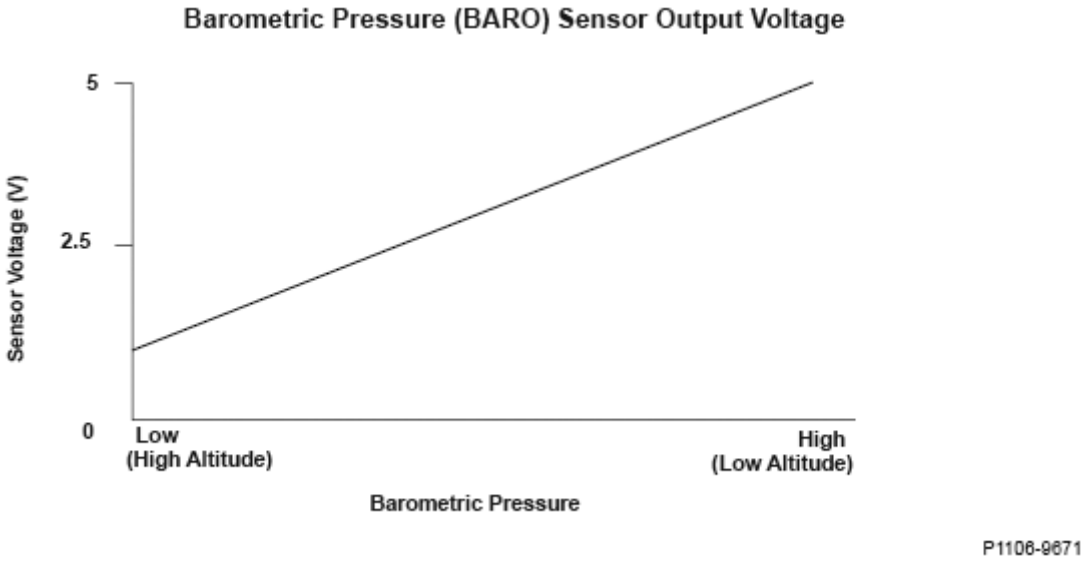



**Fig. 224: Barometric Pressure (BARO) Sensor Output Voltage - Graph**

**General Description**

The barometric pressure (BARO) sensor is built into the powertrain control module (PCM) and monitors atmospheric pressure. The PCM estimates appropriate intake airflow from the manifold absolute pressure (MAP) sensor output voltage and BARO sensor output voltage. If the BARO sensor output voltage is a specified value or more, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 2 seconds or more |
| DTC Type | One drive cycle, MIL ON |

| | |
|---|---|
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P1109, P2228 |

**Malfunction Threshold**

The BARO sensor output voltage is 4.49 V or more for at least 2 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2237 (155): ADVANCED DIAGNOSTICS

## DTC P2237: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) IP LINE HIGH VOLTAGE

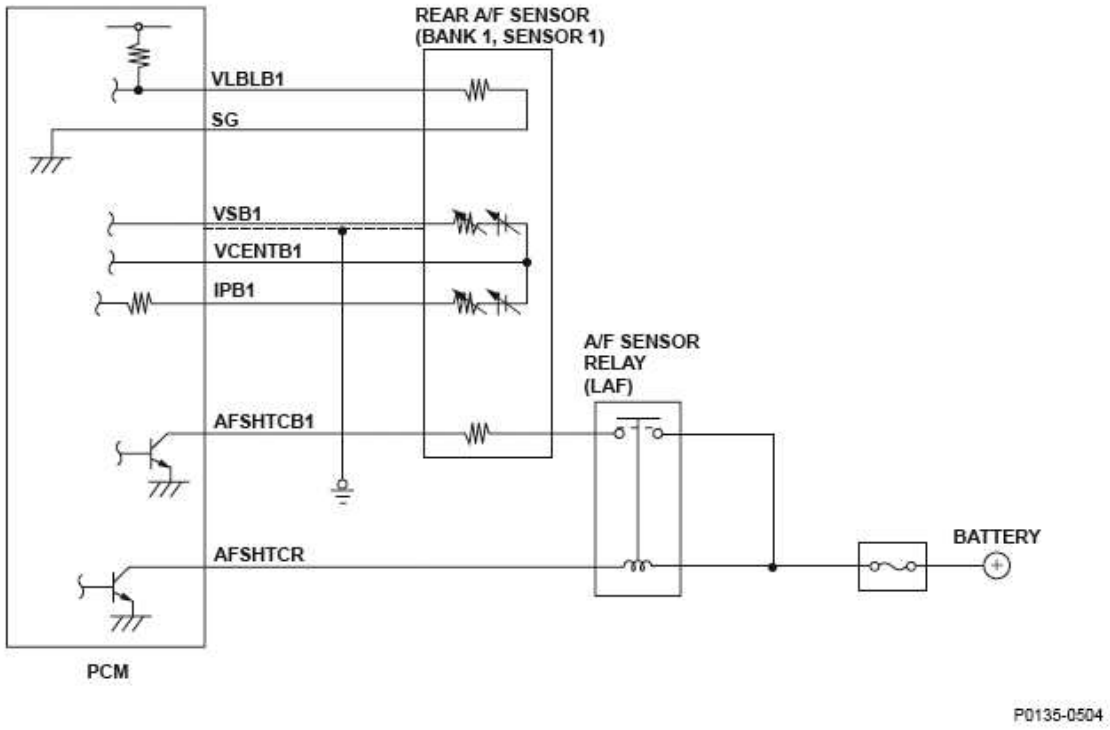



**Fig. 225: Rear Air/Fuel Ratio (A/F) Sensor Heater Circuit Diagram**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

If the IPB1 terminal voltage is out of a specified range, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 15 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|

| | | |
|---|---|---|
| VSB1 terminal voltage | 3.4 V | 4.8 V |
| No active DTCs | P0135, P2195, P2238, P2243, P2245, P2251, P2252, P2627, P2628 | |

**Malfunction Threshold**

The IPB1 terminal voltage is 2.0 V or less, or 5.6 V or more, for at least 15 seconds.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2238 (155): ADVANCED DIAGNOSTICS

### DTC P2238: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) IP LINE LOW VOLTAGE

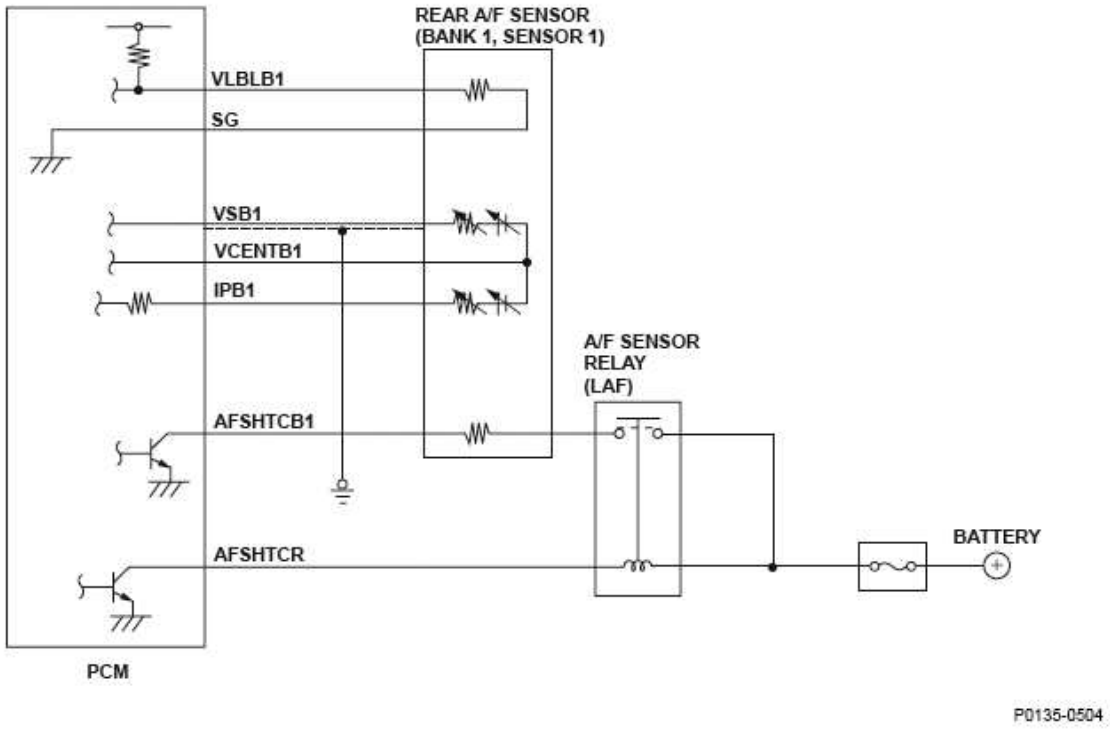



**Fig. 226: Rear Air/Fuel Ratio (A/F) Sensor Heater Circuit Diagram**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

If the IPB1 terminal voltage is a specified value or less, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more(1), 85 seconds or more(2) |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |
| (1) After the sensor becomes active<br>(2) Before the sensor becomes active | |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0135, P2195, P2237, P2243, P2245, P2251, P2252, P2627, P2628 |

**Malfunction Threshold**

The IPB1 input terminal voltage is 1.0 V or less for at least 5 seconds* (85 seconds)**.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2240 (156): ADVANCED DIAGNOSTICS

## DTC P2240: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) IP LINE HIGH VOLTAGE

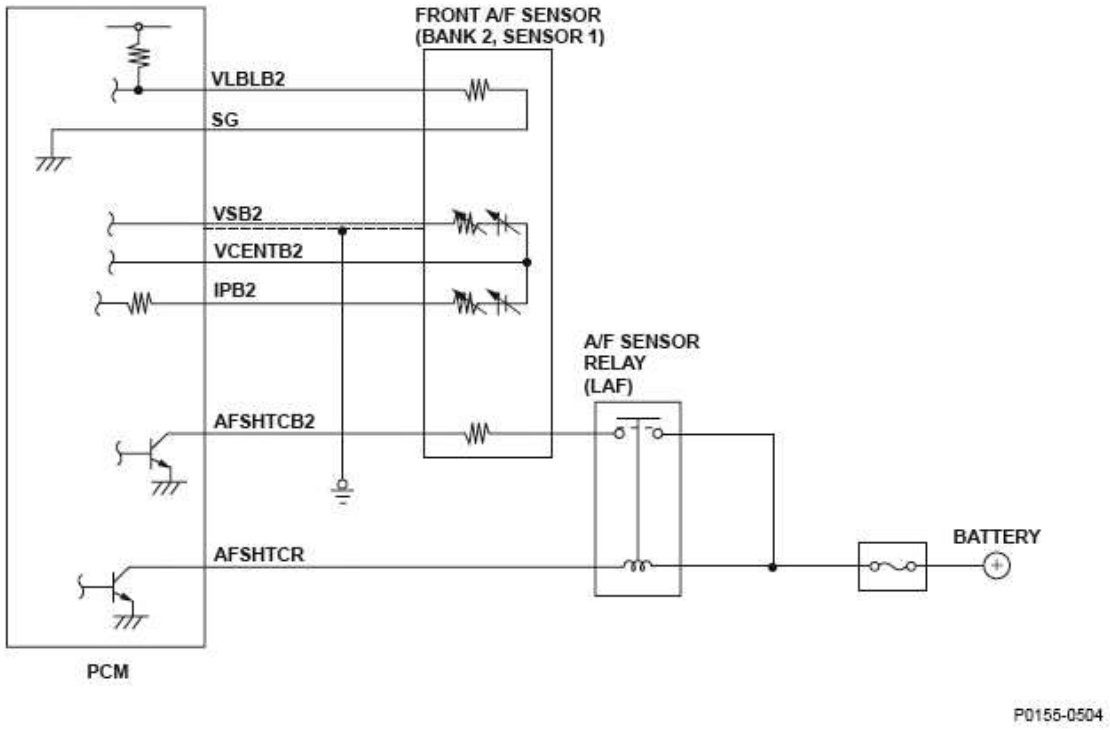



**Fig. 227: Front Air/Fuel Ratio (A/F) Sensor Heater Circuit Diagram**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 2, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The front A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the front A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

If the IPB2 terminal voltage is out of a specified range, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 15 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|

| | | |
|---|---|---|
| VSB2 terminal voltage | 3.4 V | 4.8 V |
| State of the engine | Running | |
| No active DTCs | P0155, P2197, P2241, P2247, P2249, P2254, P2255, P2630, P2631 | |

**Malfunction Threshold**

The IPB2 terminal voltage is 5.6 V or more, or 2.0 V or less, for at least 15 seconds.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2241 (156): ADVANCED DIAGNOSTICS

## DTC P2241: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) IP LINE LOW VOLTAGE

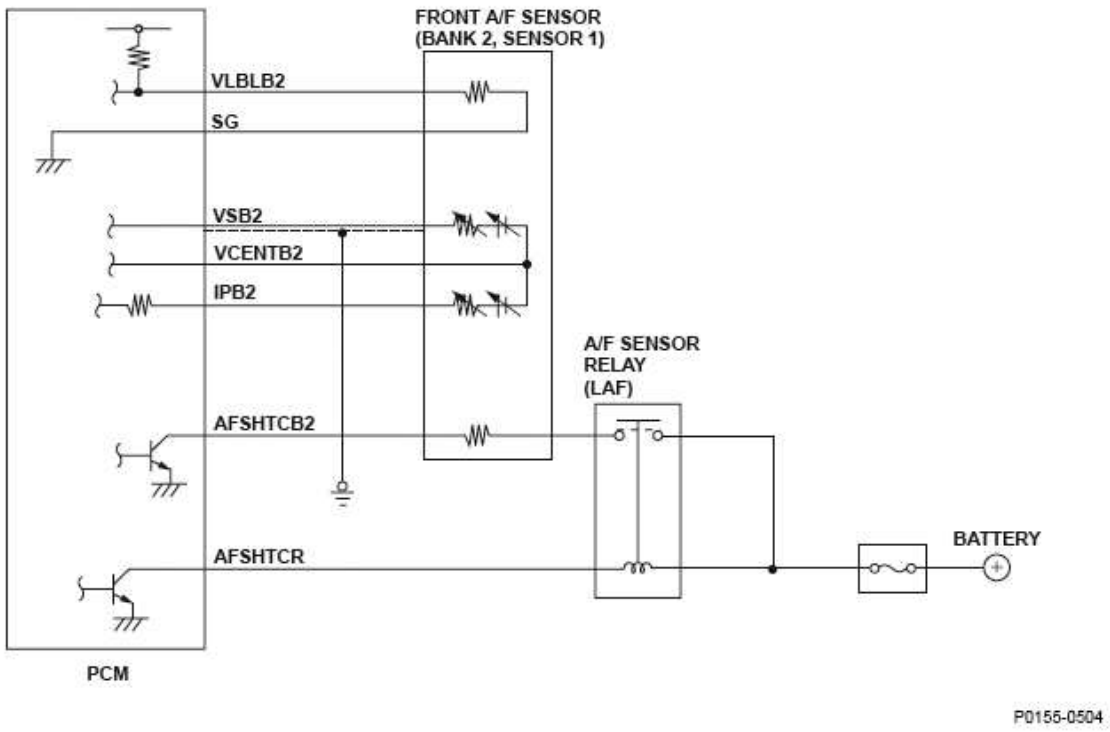



**Fig. 228: Front Air/Fuel Ratio (A/F) Sensor Heater Circuit Diagram**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 2, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The front A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the front A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

If the IPB2 terminal voltage is a specified value or less, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more(1), 85 seconds or more(2) |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |
| (1) After the sensor becomes active<br>(2) Before the sensor becomes active | |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0155, P2197, P2240, P2247, P2249, P2254, P2255, P2630, P2631 |

**Malfunction Threshold**

The IPB2 input terminal voltage is 1.0 V or less for at least 5 seconds* (85 seconds)**.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2243 (155): ADVANCED DIAGNOSTICS

## DTC P2243: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) VCENT LINE HIGH VOLTAGE

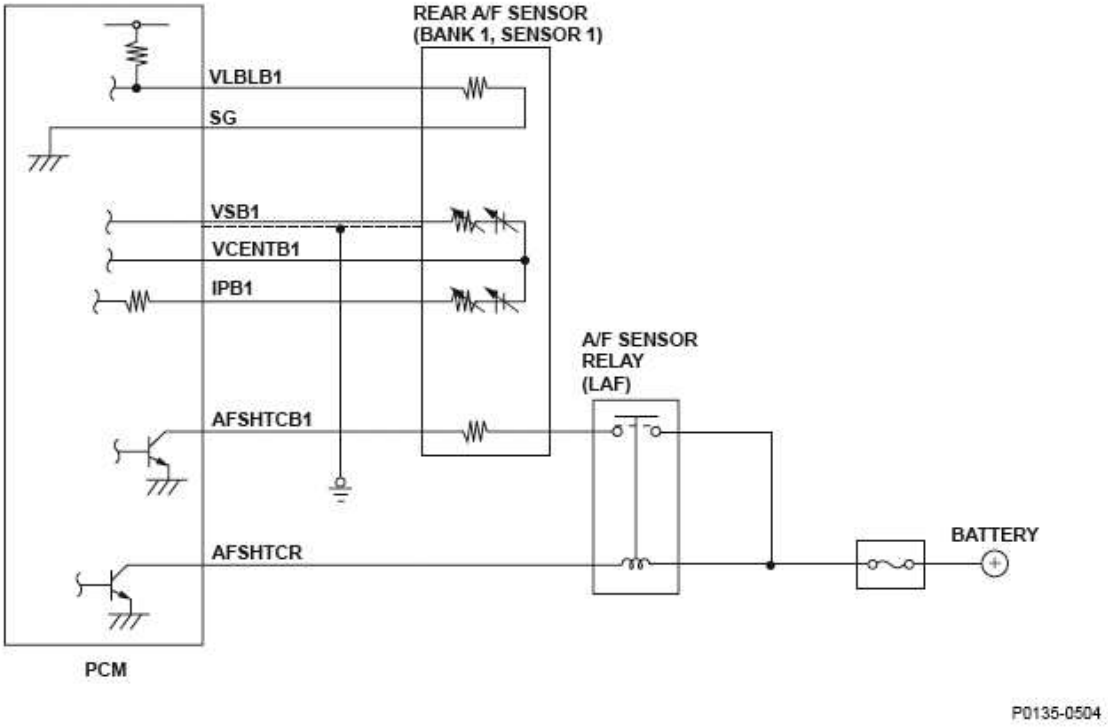



**Fig. 229: Rear Air/Fuel Ratio (A/F) Sensor Heater Circuit Diagram**

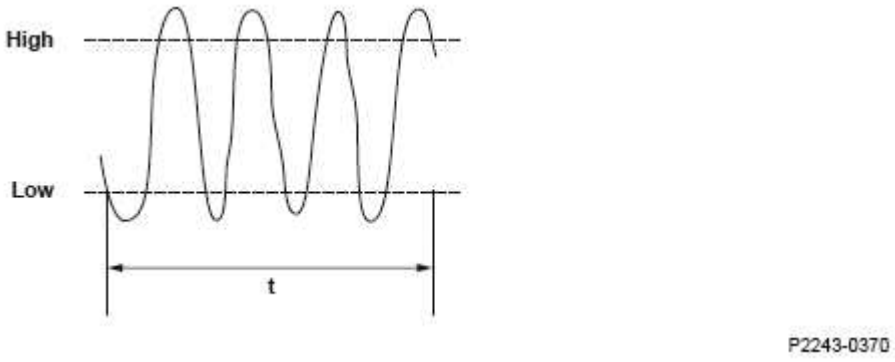



**Fig. 230: Air/Fuel Ratio Sensor Voltage Graph**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

When the VSB1 terminal voltage repeatedly fluctuates between a value above the specification and a value below the specification at a certain frequency, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | - |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0135, P2195, P2237, P2238, P2245, P2251, P2252, P2627, P2628 |

**Malfunction Threshold**

The VSB1 terminal voltage repeatedly fluctuates from a value above 4.8 V to a value below 3.4 V, 150 times or more.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2245 (155): ADVANCED DIAGNOSTICS

**DTC P2245: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) VCENT LINE LOW VOLTAGE**

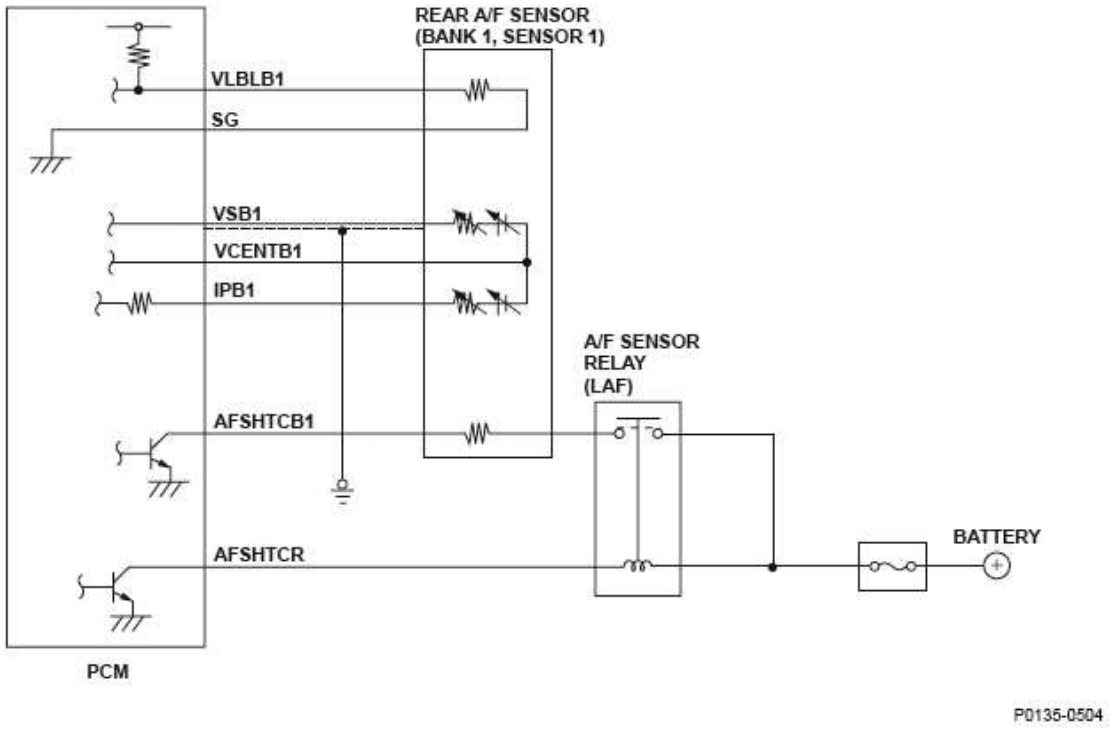



**Fig. 231: Rear Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

If the IPB1 terminal voltage is a specified value or more, and the VCENTB1 terminal voltage is less than the specified value, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more(1), 85 seconds or more(2) |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

(1) After the sensor becomes active

(2) Before the sensor becomes active

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| VSB1 terminal voltage | 0.3 V | 1.5 V |
| State of the engine | Running | |
| No active DTCs | P0135, P2195, P2237, P2238, P2243, P2251, P2252, P2627, P2628 | |

**Malfunction Threshold**

The IPB1 input terminal voltage is 1.0 V or less for at least 5 seconds* (85 seconds)**.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2247 (156): ADVANCED DIAGNOSTICS

## DTC P2247: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) VCENT LINE HIGH VOLTAGE

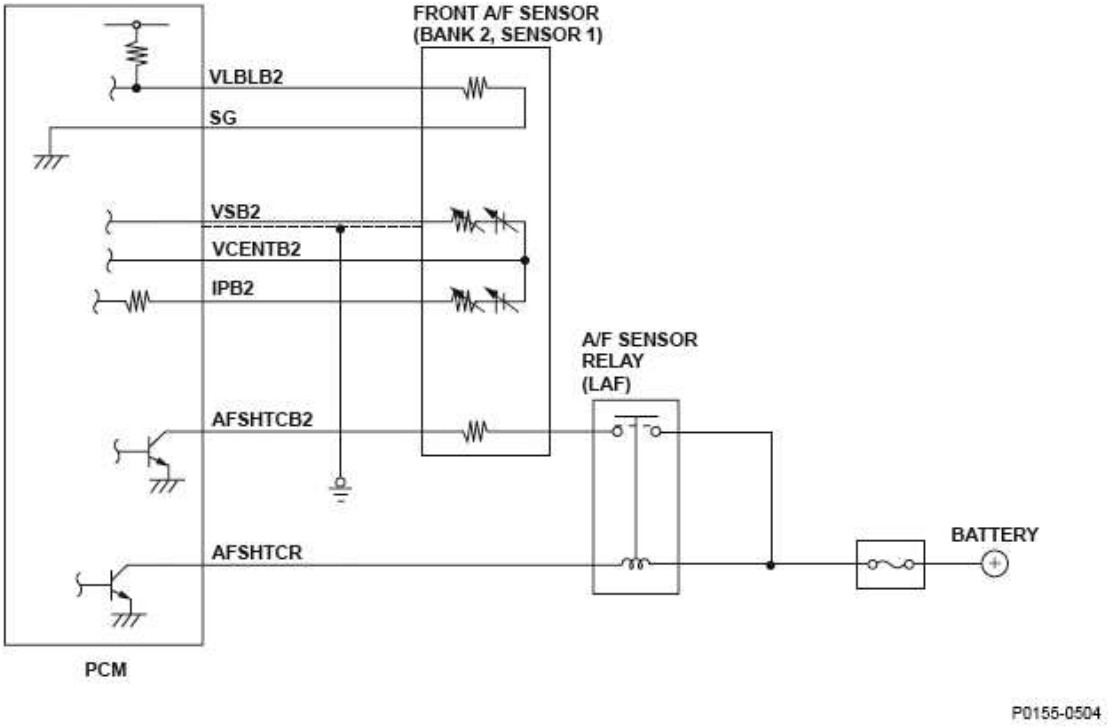



**Fig. 232: Front Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

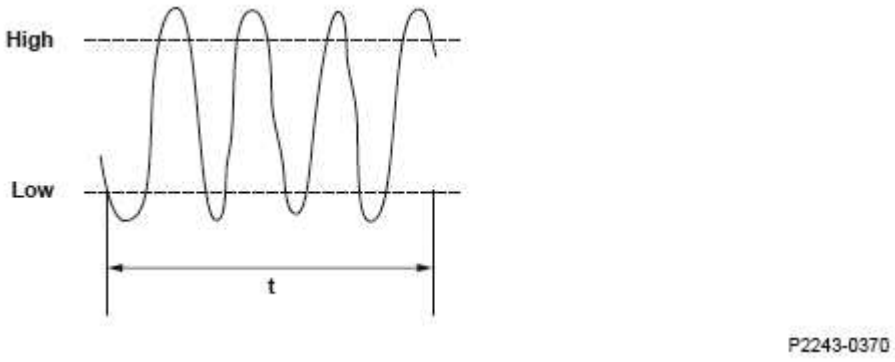



**Fig. 233: Air/Fuel Ratio Sensor Voltage Graph**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

When the VSB2 terminal voltage repeatedly fluctuates between a value above the specification and a value below the specification at a certain frequency, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | - |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0155, P2197, P2240, P2241, P2249, P2254, P2255, P2630, P2631 |

**Malfunction Threshold**

The VSB2 terminal voltage repeatedly fluctuates from a value above 4.8 V to a value below 3.4 V, at least 150 times.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2249 (156): ADVANCED DIAGNOSTICS

**DTC P2249: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) VCENT LINE LOW VOLTAGE**

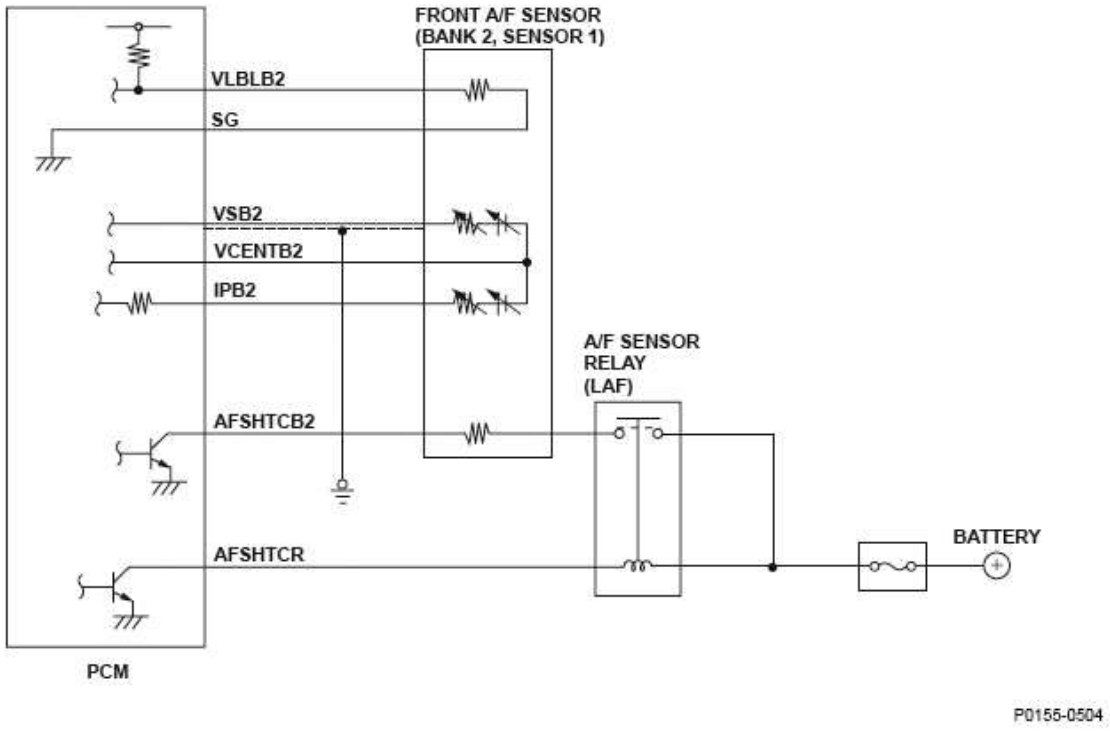



**Fig. 234: Front Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 2, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The front A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the front A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

If the IPB2 terminal voltage is a specified value or more, and the VCENTB2 terminal voltage is less than the specified value, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more(1), 85 seconds or more(2) |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

(1) After the sensor becomes active

(2) Before the sensor becomes active

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| VSB2 terminal voltage | 0.3 V | 1.5 V |
| State of the engine | Running | |
| No active DTCs | P0155, P2197, P2240, P2241, P2247, P2254, P2255, P2630, P2631 | |

**Malfunction Threshold**

The IPB2 input terminal voltage is 1.0 V or less for at least 5 seconds* (85 seconds)**.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2251 (155): ADVANCED DIAGNOSTICS

## DTC P2251: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) VS LINE HIGH VOLTAGE

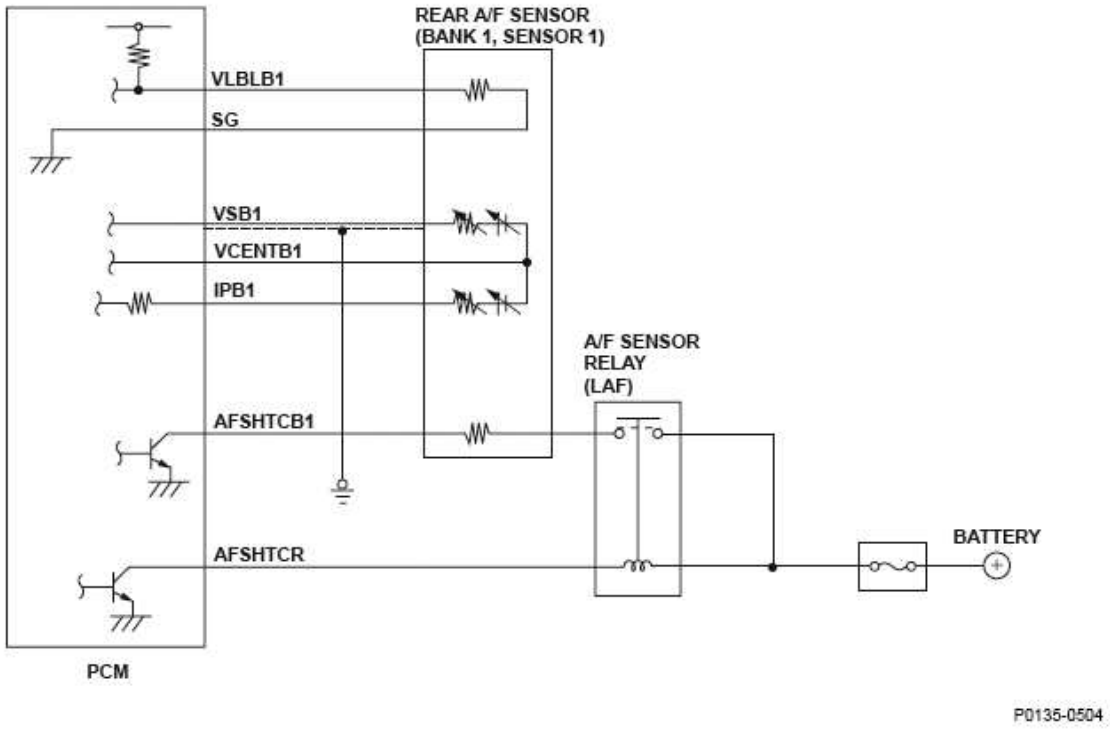



**Fig. 235: Rear Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

When the VSB1 terminal voltage and the PCM internal signal voltage are more than a specified value for more than a predetermined time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0135, P2195, P2237, P2238, P2243, P2245, P2252, P2627, P2628 |

**Malfunction Threshold**

The VSB1 terminal voltage is 6.0 V or more, and the PCM internal signal voltage is 4.6 V or more, for at least 5 seconds.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2252 (155): ADVANCED DIAGNOSTICS

## DTC P2252: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) VS LINE LOW VOLTAGE

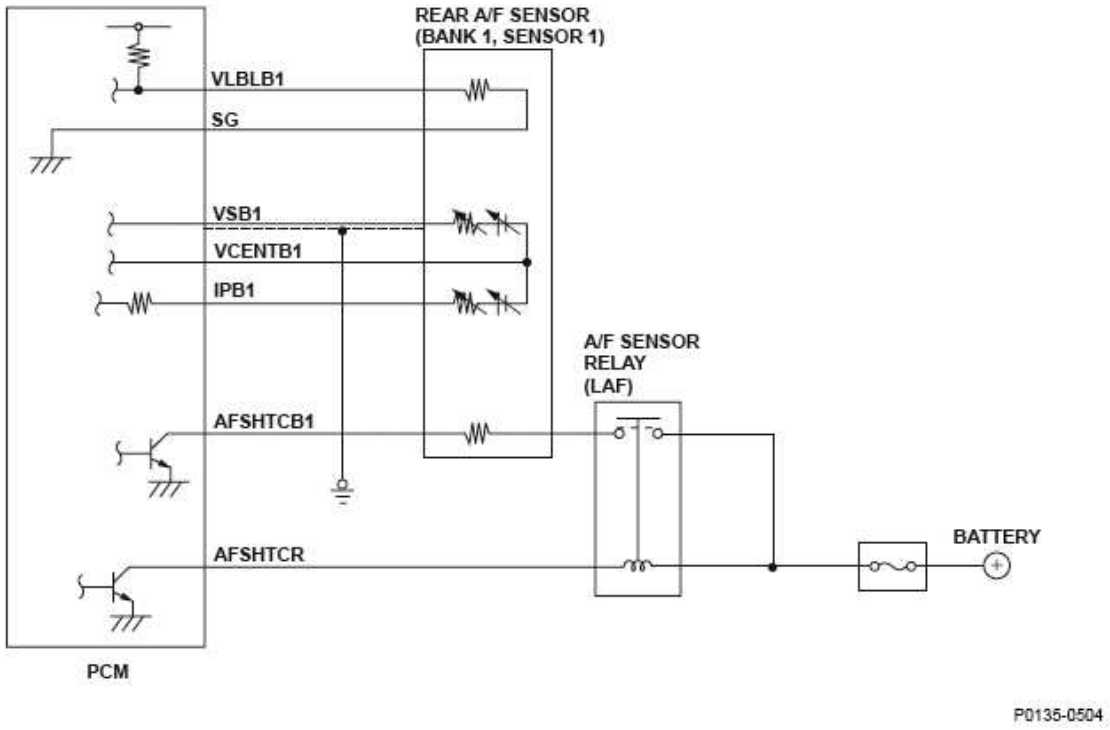



**Fig. 236: Rear Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

When the VSB1 terminal voltage is less than the specified value and the IPB1 terminal voltage is more than the specified value for more than a set time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |
| Engine coolant temperature | 68 °F (20 °C) | - |
| State of the engine | Running | |
| No active DTCs | P0135, P2195, P2237, P2238, P2243, P2245, P2251, P2627, P2628 | |

**Malfunction Threshold**

The VSB1 terminal voltage is 0.4 V or less for at least 5 seconds.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2254 (156): ADVANCED DIAGNOSTICS

### DTC P2254: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) VS LINE HIGH VOLTAGE

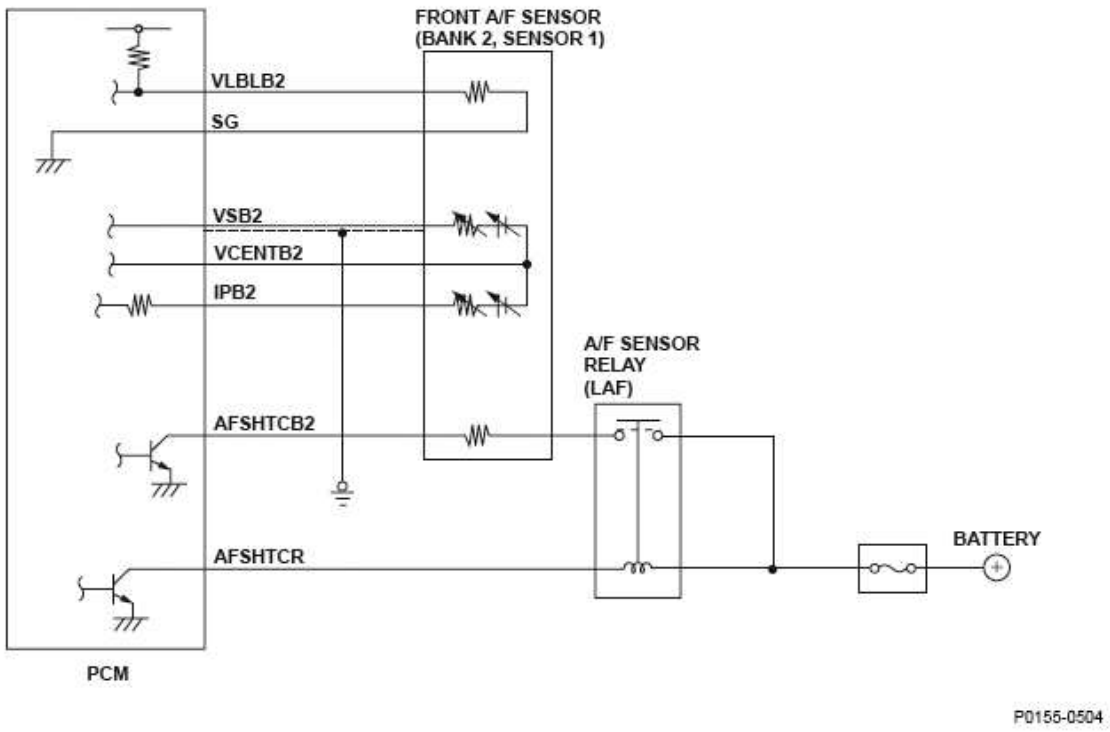



**Fig. 237: Front Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 2, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The front A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the front A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

When the VSB2 terminal voltage and the PCM internal signal voltage are more than a specified value for more than a predetermined time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0155, P2197, P2240, P2241, P2247, P2249, P2255, P2630, P2631 |

**Malfunction Threshold**

The VSB2 terminal voltage is 6.0 V or more, and the PCM internal signal voltage is 4.6 V or more, for at least 5 seconds.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2255 (156): ADVANCED DIAGNOSTICS

## DTC P2255: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) VS LINE LOW VOLTAGE

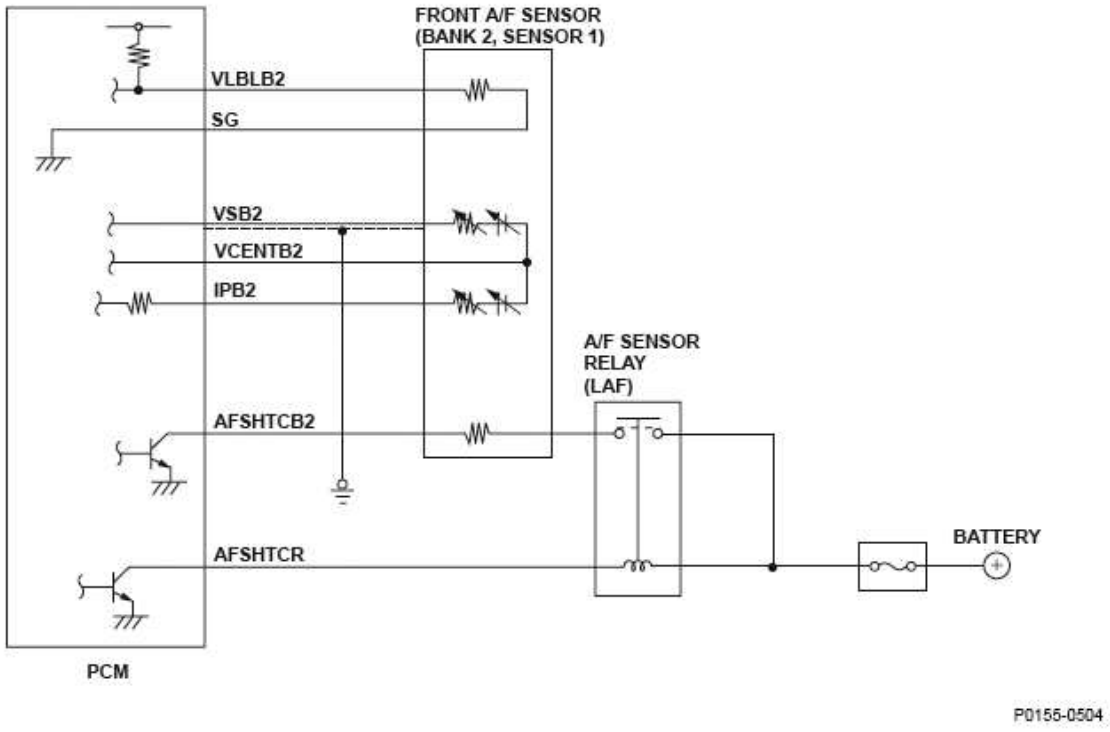



**Fig. 238: Front Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 2, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The front A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the front A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

When the VSB2 terminal voltage is less than the specified value and the IPB2 terminal voltage is more than the specified value for more than a set time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more(1), 85 seconds or more(2) |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

(1) After the sensor becomes active

(2) Before the sensor becomes active

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0155, P2197, P2240, P2241, P2247, P2249, P2254, P2630, P2631 |

**Malfunction Threshold**

The VSB2 terminal voltage is 0.3 V or less, and the IPB2 terminal voltage is 1.0 V or more, for at least 5 seconds* (85 seconds)**.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle for 2 minutes.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2270 (161): ADVANCED DIAGNOSTICS

## DTC P2270: REAR SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 1, SENSOR 2)) CIRCUIT SIGNAL STUCK LEAN

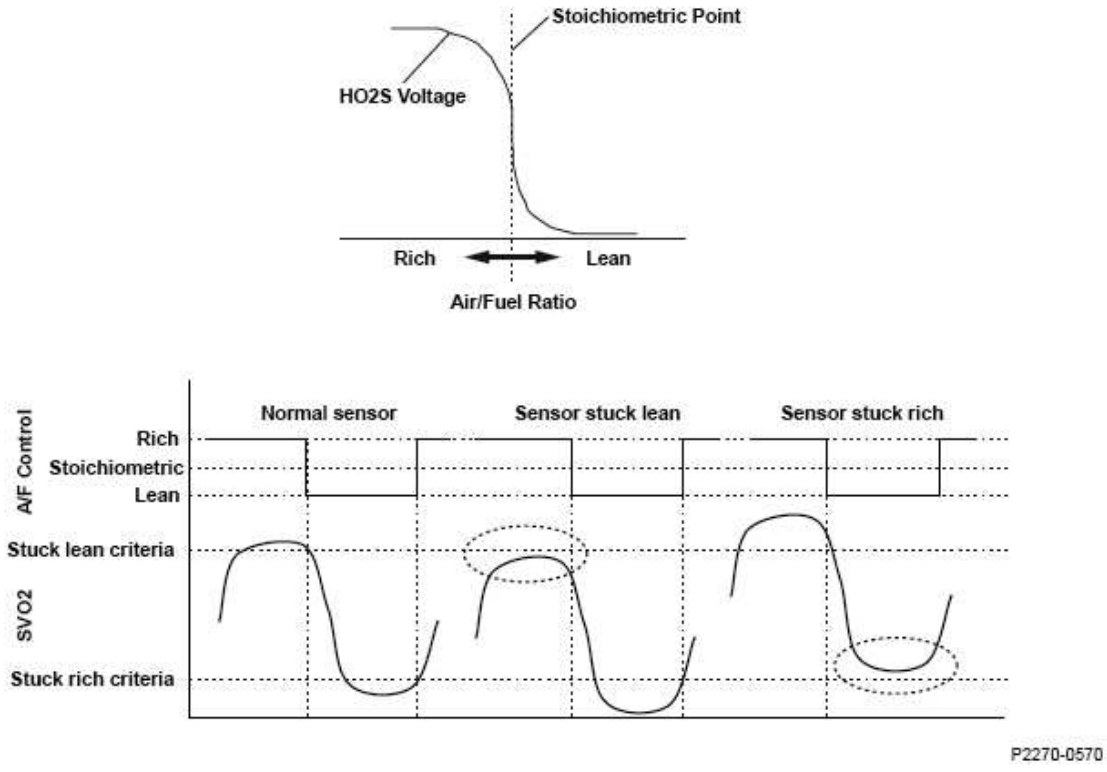



**Fig. 239: Air Fuel Ratio - Graph**

**General Description**

The rear secondary HO2S (bank 1, sensor 2) detects the oxygen concentration in the exhaust gas downstream of the three-way catalyst (TWC). The rear sensor output voltage characteristics are similar to the air/fuel ratio (A/F) sensor. The oxygen concentration is detected after the TWC during fuel feedback control using the A/F sensor, and it optimizes the fuel feedback control to maximize the effect of the TWC. If, after current is applied to the rear secondary HO2S heater, the rear secondary HO2S does not fluctuate and the output is stuck within the specified area, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 29.5 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|

| | | |
|---|---|---|
| Elapsed time that secondary HO2S activity is not monitored after starting the engine | 20 seconds | - |
| Elapsed time after the fuel cut-off | - | 150 seconds |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Engine speed | 1,150 rpm | 1,900 rpm |
| MAP value | 22 kPa (6.3 in.Hg, 160 mmHg) | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Vehicle speed | 30 mph (48 km/h) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0133, P0134, P0135, P0137, P0138, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1172, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2413, P2627, P2628, P2646, P2647, P2648, P2649, P2A00 | |

**Malfunction Threshold**

The rear secondary HO2S (bank 1, sensor 2) output voltage is 0.650 V or less.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Drive the vehicle at a steady speed of 35 mph (57 km/h) or more for at least 29.5 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2271 (161): ADVANCED DIAGNOSTICS

## DTC P2271: REAR SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 1, SENSOR 2)) CIRCUIT SIGNAL STUCK RICH

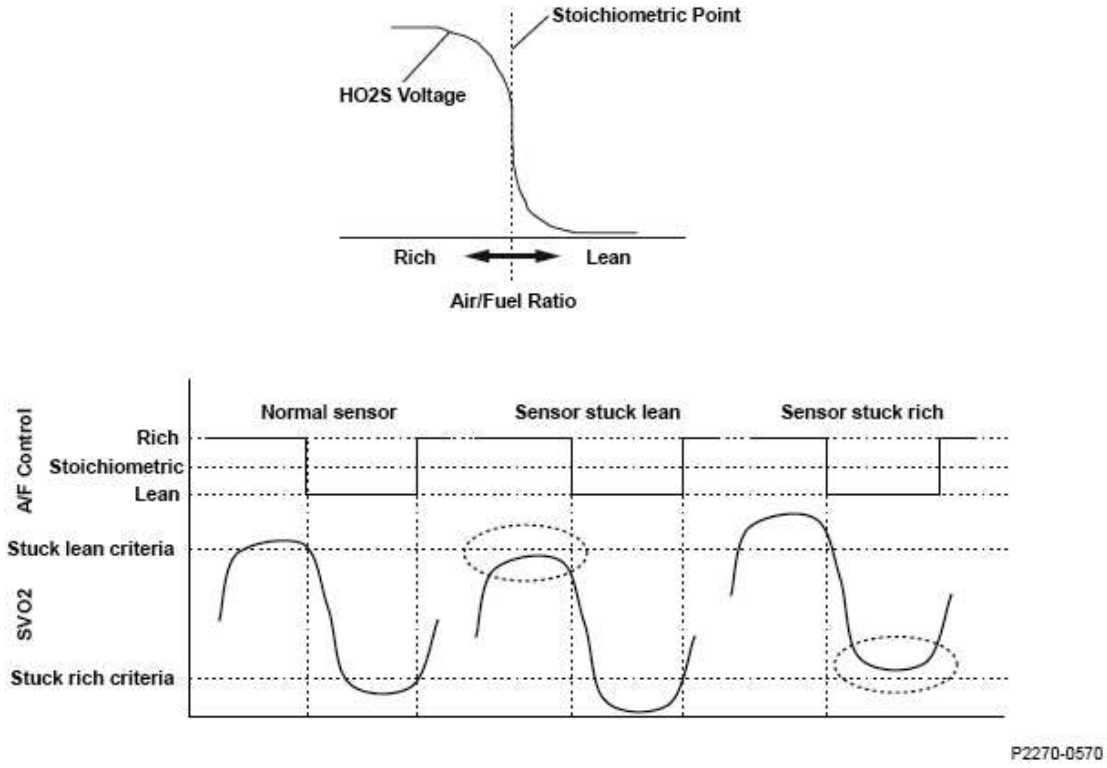



**Fig. 240: Air Fuel Ratio - Graph**

**General Description**

The rear secondary HO2S (bank 1, sensor 2) detects the oxygen concentration in the exhaust gas downstream of the three-way catalyst (TWC). The rear sensor output voltage characteristics are similar to the air/fuel ratio (A/F) sensor. The oxygen concentration is detected after the TWC during fuel feedback control using the A/F sensor, and it optimizes the fuel feedback control to maximize the effect of the TWC. If, after current is applied to the rear secondary HO2S heater, the rear secondary HO2S does not fluctuate and the output is stuck within the specified area, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 29.5 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S activity is not monitored after starting the engine | 20 seconds | - |
| Elapsed time after the fuel cut-off | - | 150 seconds |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Engine speed | 1,150 rpm | 1,900 rpm |
| MAP value | 22 kPa (6.3 in.Hg, 160 mmHg) | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Vehicle speed | 30 mph (48 km/h) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0133, P0134, P0135, P0137, P0138, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1172, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2270, P2413, P2627, P2628, P2646, P2647, P2648, P2649, P2A00 | | |

**Malfunction Threshold**

The rear secondary HO2S (bank 1, sensor 2) output voltage is 0.293 V or more.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Drive the vehicle at a steady speed of 35 mph (57 km/h) or more for at least 29.5 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic

runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2272 (162): ADVANCED DIAGNOSTICS

### DTC P2272: FRONT SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 2, SENSOR 2)) CIRCUIT SIGNAL STUCK LEAN

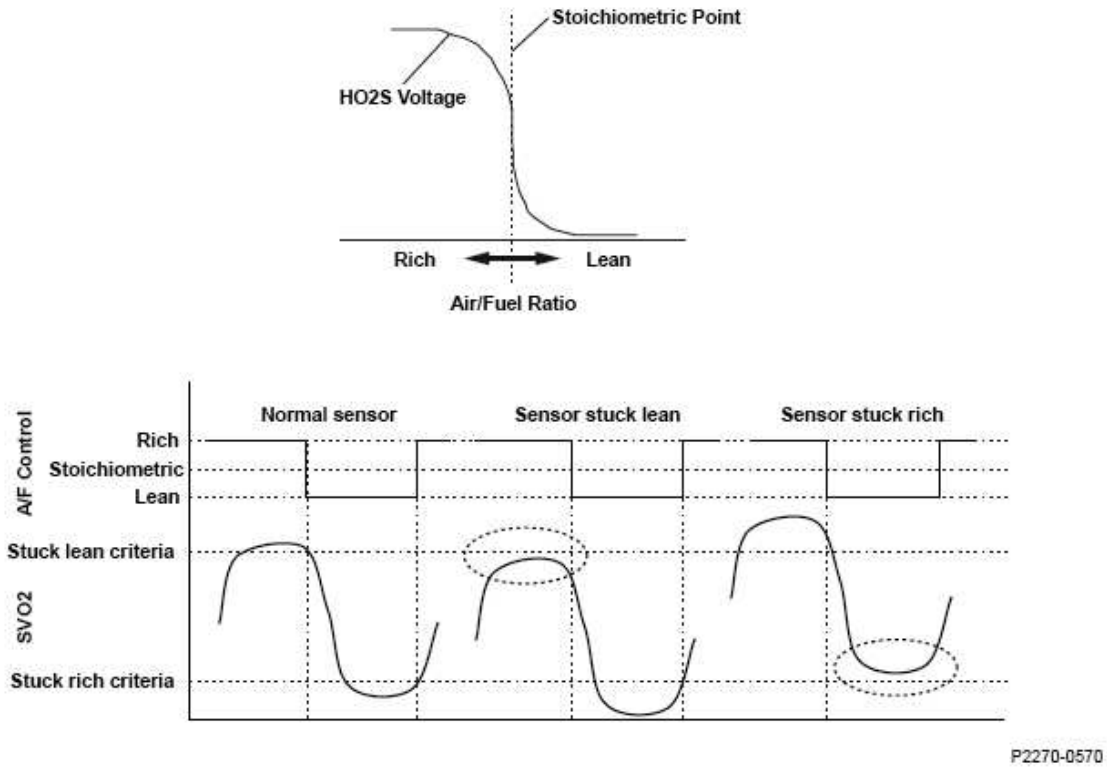



**Fig. 241: Air Fuel Ratio - Graph**

**General Description**

The front secondary HO2S (bank 2, sensor 2) detects the oxygen concentration in the exhaust gas downstream of the three-way catalyst (TWC). The front sensor output voltage characteristics are similar to the air/fuel ratio (A/F) sensor. The oxygen concentration is detected after the TWC during fuel feedback control using the A/F sensor, and it optimizes the fuel feedback control to maximize the effect of the TWC. If, after current is applied to the front secondary HO2S heater, the front secondary HO2S does not fluctuate and the output is stuck within the specified area, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 29.5 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S activity is not monitored after starting the engine | 20 seconds | - |
| Elapsed time after the fuel cut-off | - | 150 seconds |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Engine speed | 1,150 rpm | 1,900 rpm |
| MAP value | 22 kPa (6.3 in.Hg, 160 mmHg) | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Vehicle speed | 30 mph (48 km/h) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0153, P0154, P0155, P0157, P0158, P0161, P0174, P0175, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1174, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2413, P2630, P2631, P2646, P2647, P2648, P2649, P2A03 | |

**Malfunction Threshold**

The front secondary HO2S (bank 2, sensor 2) output voltage is 0.650 V or less.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Drive the vehicle at a steady speed of 35 mph (57 km/h) or more for at least 29.5 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2273 (162): ADVANCED DIAGNOSTICS

### DTC P2273: FRONT SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (BANK 2, SENSOR 2)) CIRCUIT SIGNAL STUCK RICH

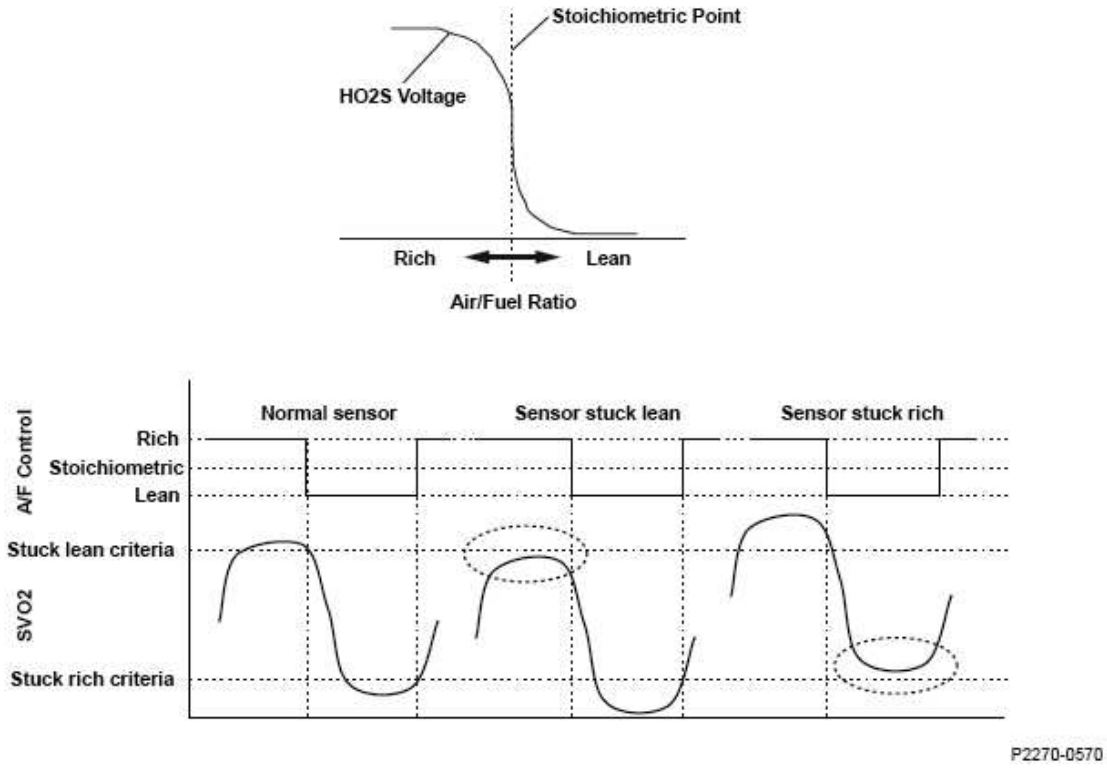



**Fig. 242: Air Fuel Ratio - Graph**

**General Description**

The front secondary HO2S (bank 2, sensor 2) detects the oxygen concentration in the exhaust gas downstream of the three-way catalyst (TWC). The front sensor output voltage characteristics are similar to the air/fuel ratio (A/F) sensor. The oxygen concentration is detected after the TWC during fuel feedback control using the A/F sensor, and it optimizes the fuel feedback control to maximize the effect of the TWC. If, after current is applied

to the front secondary HO2S heater, the front secondary HO2S does not fluctuate and the output is stuck within the specified area, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 29.5 seconds or less |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time that secondary HO2S activity is not monitored after starting the engine | 20 seconds | - |
| Elapsed time after the fuel cut-off | - | 150 seconds |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Engine speed | 1,150 rpm | 1,900 rpm |
| MAP value | 22 kPa (6.3 in.Hg, 160 mmHg) | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Vehicle speed | 30 mph (48 km/h) | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0153, P0154, P0155, P0157, P0158, P0161, P0174, P0175, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0335, P0339, P0340, P0344, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P0657, P1077, P1078, P1128, P1129, P1174, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2272, P2413, P2630, P2631, P2646, P2647, P2648, P2649, P2A03 | |

**Malfunction Threshold**

The front secondary HO2S (bank 2, sensor 2) output voltage is 0.293 V or more.

**Driving Pattern**

1. Start the engine. Let it idle until the radiator fan comes on.
2. Drive the vehicle at a steady speed of 35 mph (57 km/h) or more for at least 29.5 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2279 (109): ADVANCED DIAGNOSTICS

## DTC P2279: INTAKE AIR SYSTEM LEAK

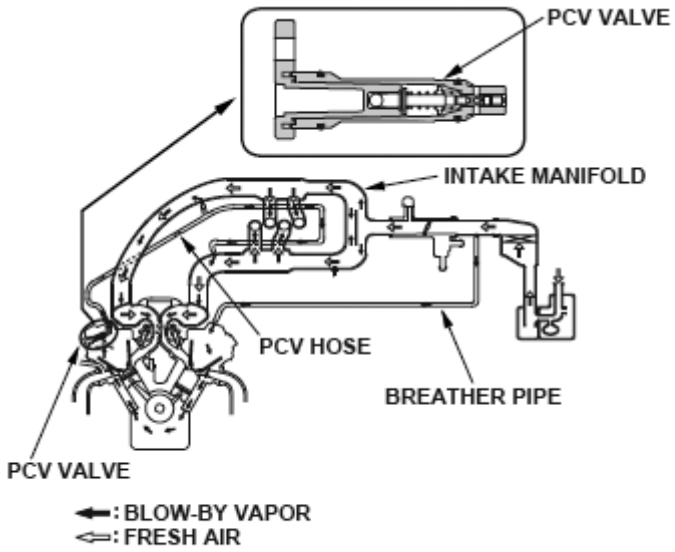



**Fig. 243: Identifying Intake Air System Components**

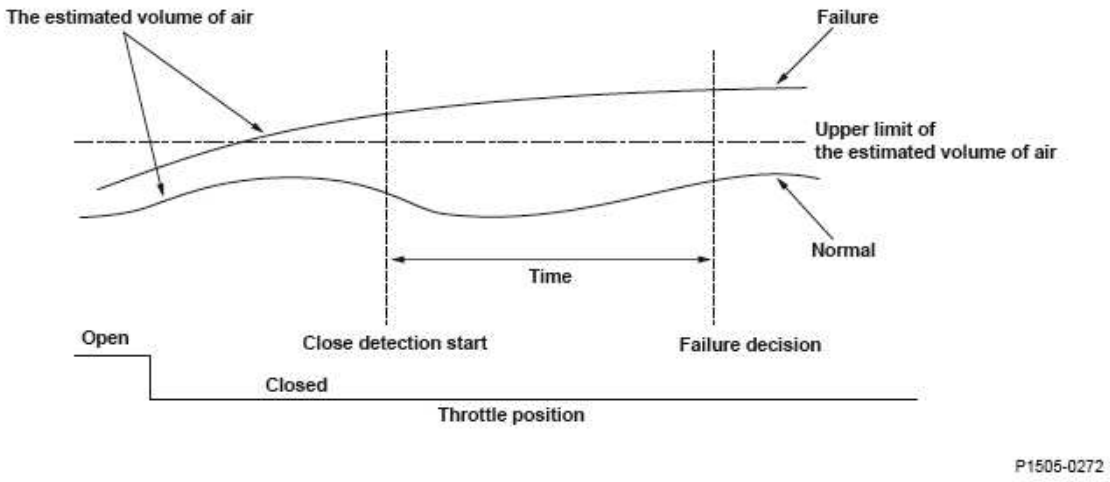



**Fig. 244: Intake Air - Graph**

**General Description**

The positive crankcase ventilation (PCV) system reduces hydrocarbons (HC). The PCV system recirculates unburned air/fuel mixture (blow-by vapor) into the intake manifold so that it is drawn into the engine and burned, thus reducing HC. If the PCV hose comes off while air is supplied mainly via the idle control system with the throttle closed, the amount of air supplied to the engine is considerably more than the amount of air the idle control system supplies.

The powertrain control module (PCM) estimates the amount of air supplied to the engine while the throttle valve is fully closed, and if the estimated amount is more than the upper limit, it detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 22 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time after starting the engine | 15 seconds | - |
| Engine coolant temperature | 156°F (69°C) | - |
| Intake air temperature | 32°F (0°C) | - |
| | | |

| | | |
|---|---|---|
| MAP value | - | 73 kPa (21.6 in.Hg, 550 mmHg) |
| Battery voltage | 10.5 V | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0401, P0403, P0404, P0443, P0496, P0627, P0641, P1109, P1128, P1129, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2227, P2228, P2229, P2413, P2646, P2647, P2648, P2649, U0107 | |
| Other | At idle | |

**Malfunction Threshold**

Either of these conditions is met.

- The estimated volume of intake air is 150 l/min (158.6 US qt/min, 132.0 lmp qt/min) or more when the MAP value is 48 kPa (14.2 in.Hg, 360 mmHg).
- The estimated volume of intake air is 120 l/min (126.9 US qt/min, 105.6 lmp qt/min) or more when the MAP value is 62 kPa (18.2 in.Hg, 460 mmHg).

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Let the engine idle for at least 22 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P2413 (12): ADVANCED DIAGNOSTICS

## DTC P2413: EXHAUST GAS RECIRCULATION (EGR) SYSTEM MALFUNCTION

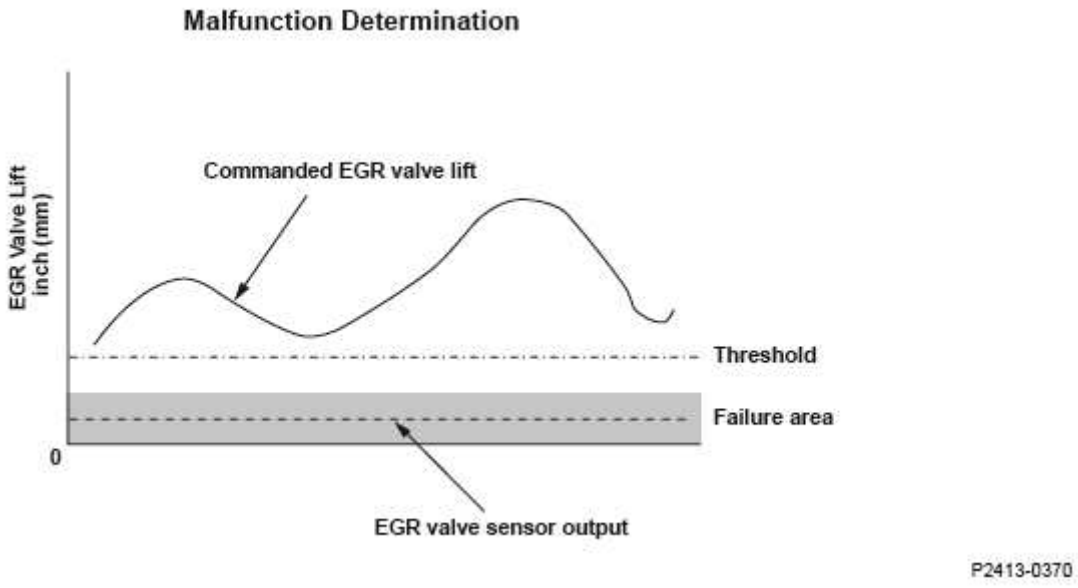



**Fig. 245: EGR Valve Sensor Output And Valve Lifting Position Graph**

**General Description**

The exhaust gas recirculation (EGR) valve, which is controlled by the powertrain control module (PCM), is opened and the exhaust gas flows from the exhaust manifold through the EGR valve and the intake manifold and the EGR passage. The exhaust gas is circulated into the air/fuel mixture and the mixture is drawn into the combustion chamber to lower the combustion temperatures, thus reducing oxides of nitrogen (NOx) emissions.

A sensor (lift sensor) is built into the EGR valve and detects the amount of valve lift. The command value for the target valve lift is stored in the PCM so that exhaust gas recirculation can be optimized according to driving conditions.

Comparing this command value with the lift sensor output signal value, the PCM controls the EGR valve to make the amount of actual valve lift equal to the command value.

If the valve sensor output is insufficient for the commanded valve lift, a malfunction is detected.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine speed | - | 4,000 rpm |
| Battery voltage | 10.5 V | - |
| Commanded EGR valve lift | 0.040 in. (1.00 mm) | - |
| No active DTCs | P0107, P0108, P0112, P0113, P0117, P0118, P0134, P0135, P0154, P0155, P0335, P0339, P0401, P0403, P0406, P0641, P0651, P0657, P1128, P1129, P1172, P1174, P2195, P2197, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2627, P2628, P2630, P2631 | |

**Malfunction Threshold**

If the actual valve lift is 0.006 in. (0.15 mm) or less for at least 5 seconds, the valve is considered stuck closed.

**Confirmation Procedure with the HDS**

Do the EGR TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 15 - 75 mph (24 - 120 km/h) for at least 5 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs. The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2422 (117): ADVANCED DIAGNOSTICS

**DTC P2422: EVAPORATIVE EMISSION (EVAP) CANISTER VENT SHUT VALVE CLOSED**

## MALFUNCTION

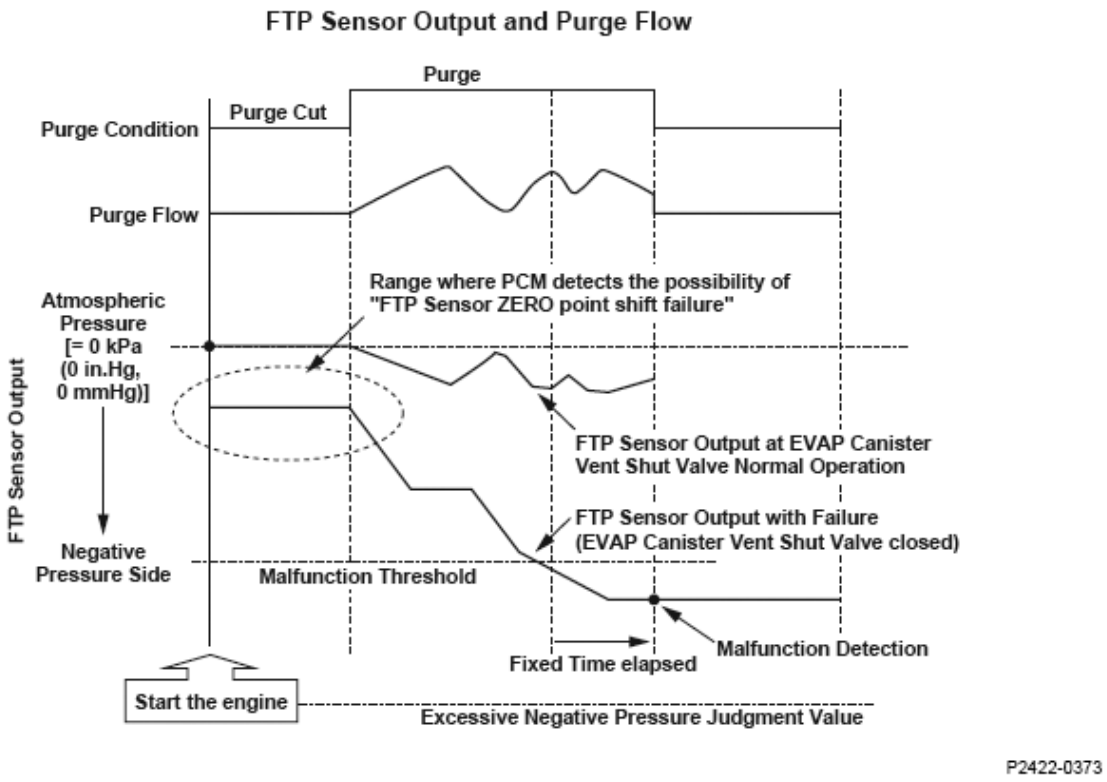



**Fig. 246: FTP Sensor Output And Purge Flow Graph**

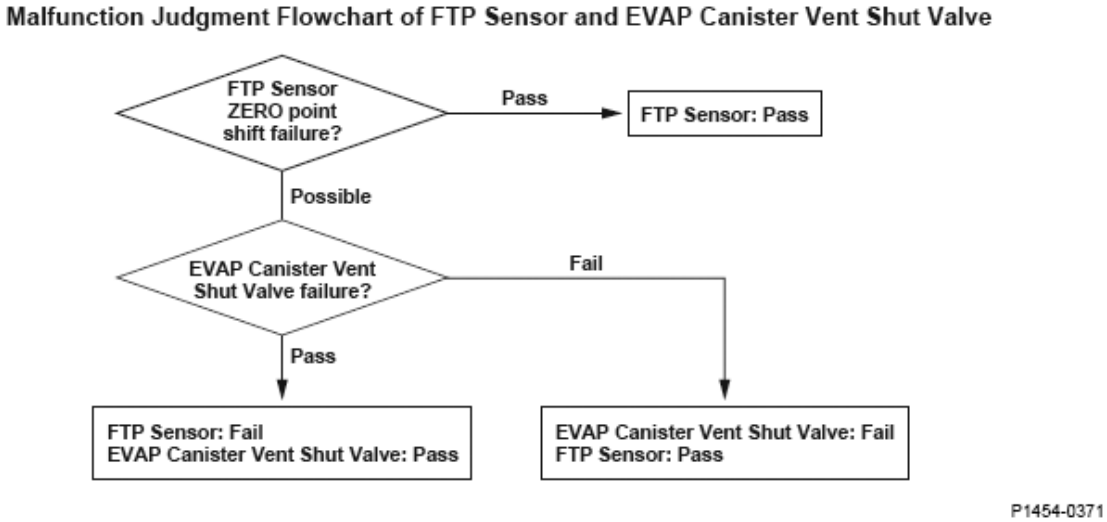



**Fig. 247: FTP Sensor And EVAP Canister Vent Shut Valve Flow Chart**

**General Description**

The fuel tank pressure (FTP) sensor output indicates about atmospheric pressure 0 kPa (0 in.Hg, 0 mmHg)

before purge starts since the evaporative emission (EVAP) canister vent shut valve is normally open (open to the atmosphere). The sensor indicates a negative pressure value (vacuum) during purging.

When the FTP sensor indicates vacuum after starting the engine, there is the possibility of an FTP sensor zero point shift failure or an EVAP canister vent shut valve stuck closed failure. So the powertrain control module (PCM) monitors the FTP sensor output after purge starts. The PCM detects a malfunction of the EVAP canister vent shut valve if the output indicates excessive vacuum.

However, if the fuel tank internal pressure is below the specified value (excessive vacuum is detected) when starting the engine, the malfunction detection should be done as follows because it is difficult to distinguish the FTP sensor range problem (P1454) from the EVAP canister vent shut valve stuck closed (P2422).

1. If neither Temporary DTC (P1454 nor P2422) is stored, both DTCs are stored.
2. If both Temporary DTCs (P1454 and P2422) are stored and excessive vacuum is detected, both DTCs are stored.
3. If either Temporary DTC (P1454 or P2422) is stored and excessive vacuum is detected, the PCM stores the DTC of the Temporary DTC that was stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 3.04 seconds or more(1) |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |
| (1) Elapsed time after the FTP sensor output exceeds the malfunction threshold. | |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time after starting the engine(1) | 10 seconds | - |
| Time to judge excessive negative pressure(1) | 3 seconds | - |
| Engine coolant temperature(2) | 140°F (60°C) | - |
| Fuel tank pressure(1) | - | -2 kPa (-0.4 in.Hg, -10 mmHg) |
| Battery voltage | 10.5 V | - |
| Fuel trim | 0.73 | 1.47 |
| Fuel feedback | Closed loop | |
| Monitoring priority | P0455, P0457, P0497 | |

| | |
|---|---|
| No active DTCs | P0107, P0108, P0116, P0117, P0118, P0125, P0134, P0135, P0154, P0155, P0335, P0339, P0443, P0451, P0452, P0453, P0496, P0498, P0499, P0641, P0651, P0657, P1109, P1116, P1128, P1129, P1172, P1174, P2195, P2197, P2227, P2228, P2229, P2237, P2238, P2240, P2241, P2243, P2245, P2247, P2249, P2251, P2252, P2254, P2255, P2627, P2628, P2630, P2631 |
| (1) Excessive negative pressure is detected.<br>(2) Condition to start the purge control. | |

**Malfunction Threshold**

The output from the fuel tank pressure sensor is -4 kPa (-1.0 in.Hg, -25 mmHg) or less for at least 3.04 seconds.

**Confirmation Procedure with the HDS**

Do the EVAP CVS ON in the INSPECTION MENU with the HDS.

**Driving Pattern**

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2552 (40): ADVANCED DIAGNOSTICS

## DTC P2552: THROTTLE ACTUATOR CONTROL MODULE RELAY MALFUNCTION

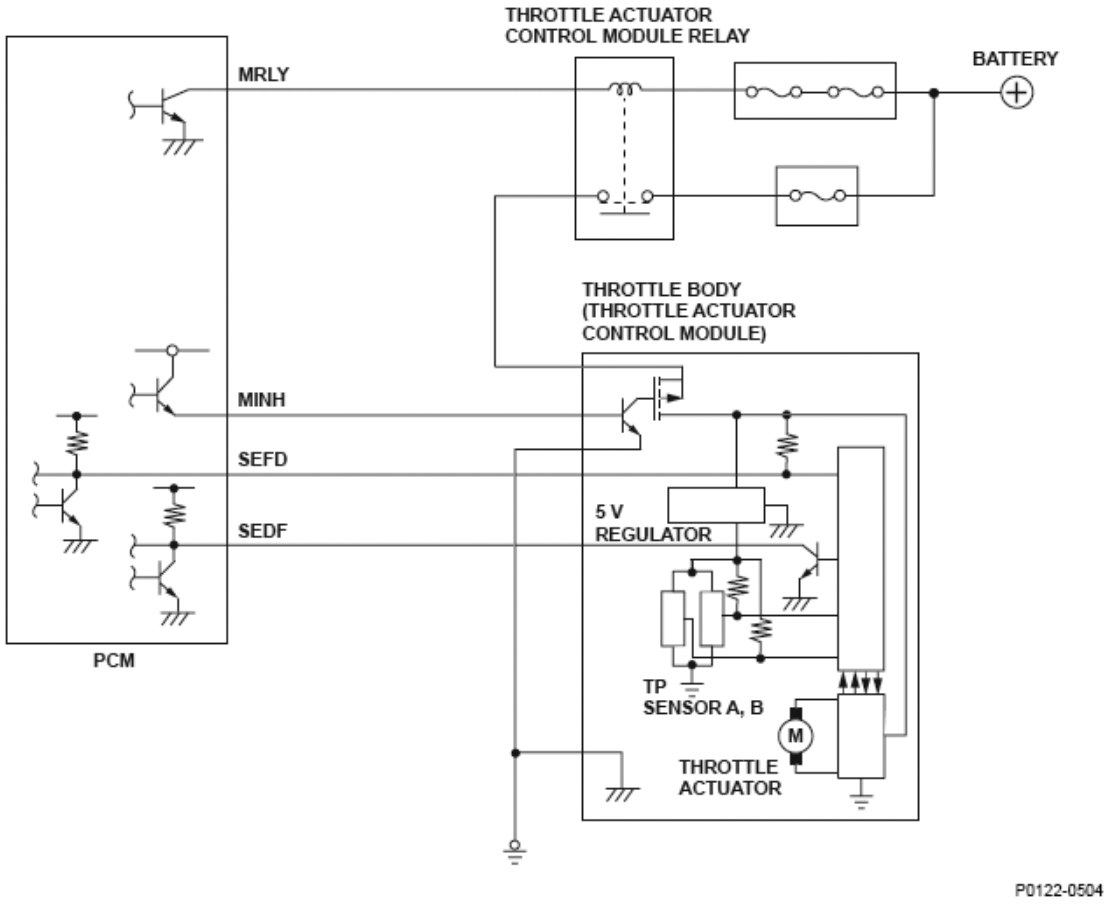



**Fig. 248: Throttle Actuator Control Module Circuit Diagram**

**General Description**

The electronic throttle control system controls the throttle valve opening. The system is composed of the throttle actuator, the throttle valve, throttle position (TP) sensors A and B, the throttle actuator control module, the throttle actuator control module relay in the throttle body, the accelerator pedal position (APP) sensor, and the powertrain control module (PCM).

The accelerator pedal position (APP) sensor is operated via the throttle cable to determine the accelerator opening value when the driver presses the accelerator pedal. The accelerator pedal opening value is converted to a signal in the APP sensor, transmitted to the powertrain control module (PCM), and then transmitted to the throttle actuator control module.

The throttle actuator control module determines the throttle valve target position according to the signal received and operates the throttle actuator to move the throttle valve to the target position. The actual throttle valve position is determined by TP sensors A and B installed in the throttle body.

The PCM detects the malfunction of the throttle actuator control module relay ON, and a DTC is stored if the serial signal from the throttle actuator control module is input for more than a set time after the throttle actuator control module relay is turned OFF and throttle actuator control module operation is stopped.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

### MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 2.0 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

### ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 8.0 V | - |
| Ignition switch | OFF | |
| No active DTCs | P1684, P2101, P2108, P2118, P2135, P2176, U0107 | |

**Malfunction Threshold**

The serial signal is input from the throttle actuator control module for at least 2.0 seconds after the throttle actuator control module relay is turned OFF.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P2610 (132): ADVANCED DIAGNOSTICS

### DTC P2610: POWERTRAIN CONTROL MODULE (PCM) INTERNAL POWER OFF TIMER PERFORMANCE PROBLEM

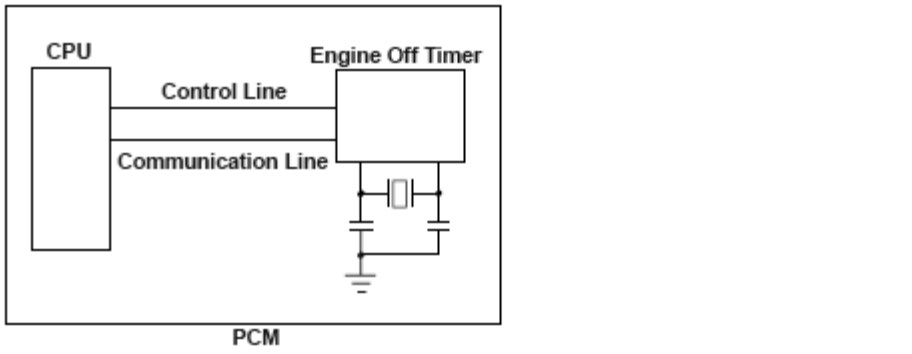



**Fig. 249: Powertrain Control Module Circuit Diagram**

**General Description**

The powertrain control module (PCM) has a built-in power off timer that measures the duration of time from ignition off to the next ignition on. The measured duration is used for EVAP leak detection and temperature assumption of the catalytic converter.

The CPU in the PCM accesses the power off timer when reading the measured duration. When the access process fails, a malfunction is detected and a DTC is stored. When an abnormality is found in the read data, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 10 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON(1) |
| (1) Ignition switch on when a battery is disconnected and connected again is excluded. | |

**Malfunction Threshold**

The access process to the power off timer fails, or a malfunction is found in the read data for at least 10 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2627 (155): ADVANCED DIAGNOSTICS

## DTC P2627: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) LABEL CIRCUIT LOW VOLTAGE

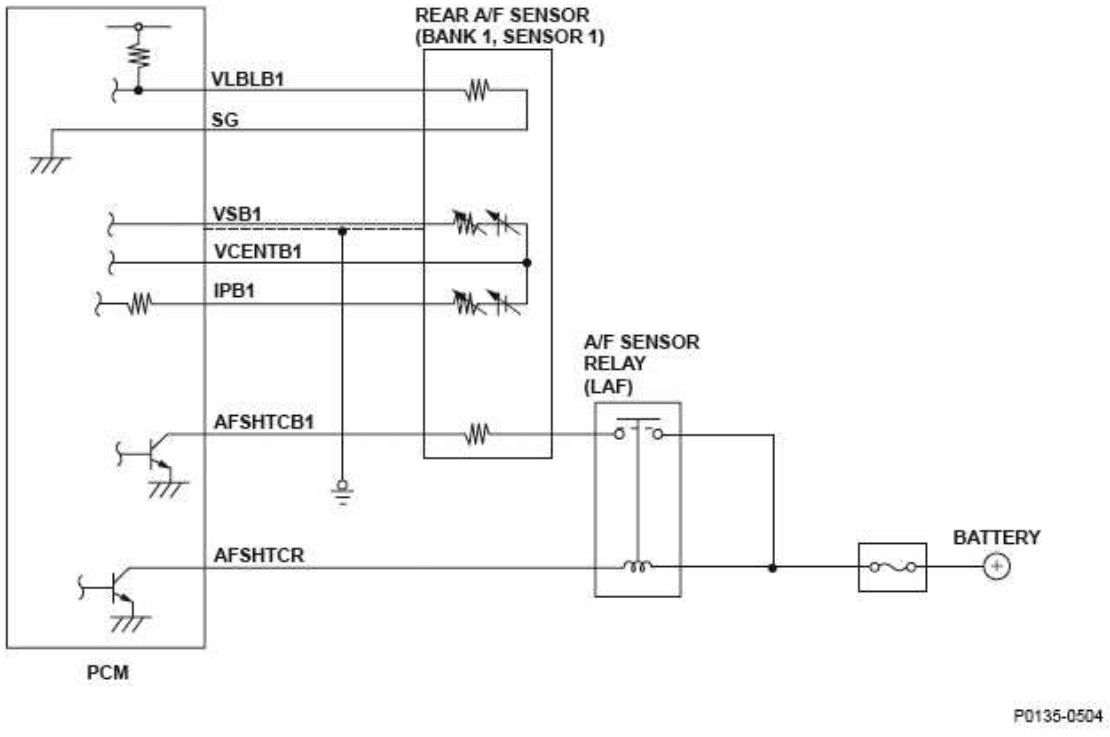



**Fig. 250: Rear Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater,

and it enables overall feedback control.

The rear A/F sensor (bank 1, sensor 1) has a built-in LABEL resistance to regulate the difference of the sensor characteristics. The PCM reads the resistance to regulate the difference properly. If the LABEL resistance (VLBLB1 signal voltage) is a set value or less, the PCM detects a malfunction and stores a DTC.

#### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

#### Enable Conditions

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0135, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2628 |

#### Malfunction Threshold

The VLBLB1 voltage is 0.3 V or less for at least 5 seconds.

#### Diagnosis Details

##### Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

##### Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P2628 (155): ADVANCED DIAGNOSTICS

**DTC P2628: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) LABEL CIRCUIT HIGH VOLTAGE**

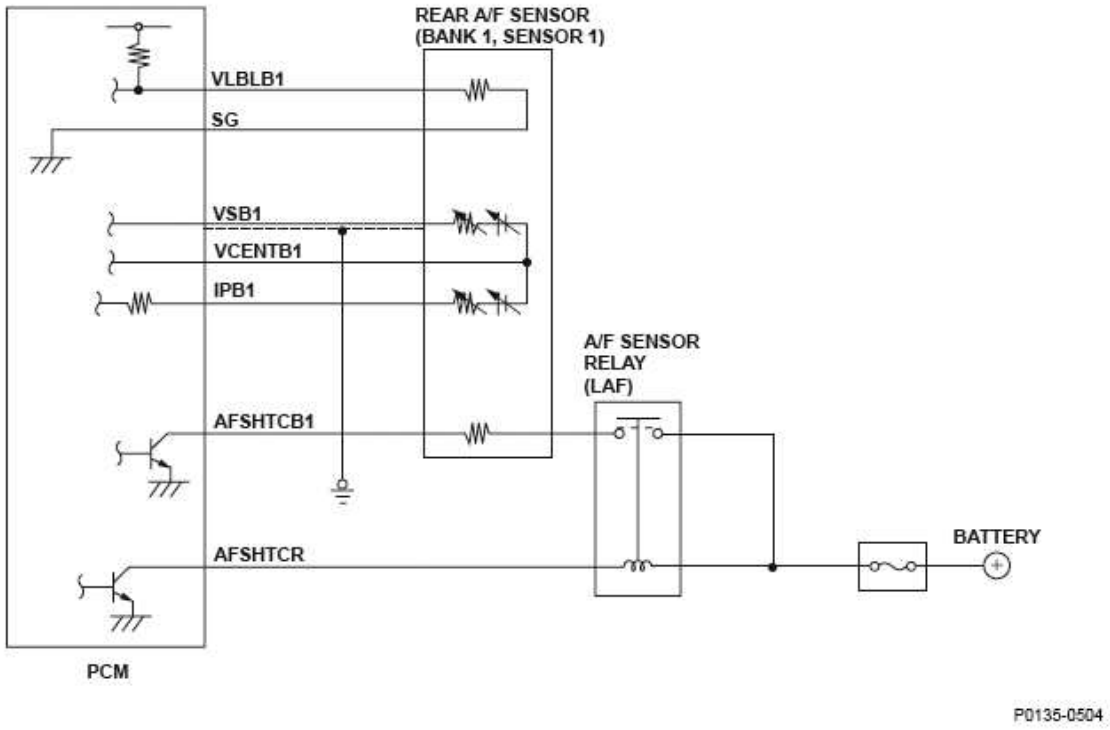



**Fig. 251: Rear Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The rear A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the rear A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

The rear A/F sensor (bank 1, sensor 1) has a built-in LABEL resistance to regulate the differences of the sensor characteristics. The PCM reads the resistance to regulate the difference properly. If the LABEL resistance (VLBLB1 signal voltage) is a set value or more, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0135, P2195, P2237, P2238, P2243, P2245, P2251, P2252, P2627 |

**Malfunction Threshold**

The VLBLB1 voltage is 4.7 V or more for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2630 (156): ADVANCED DIAGNOSTICS

### DTC P2630: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) LABEL CIRCUIT LOW VOLTAGE

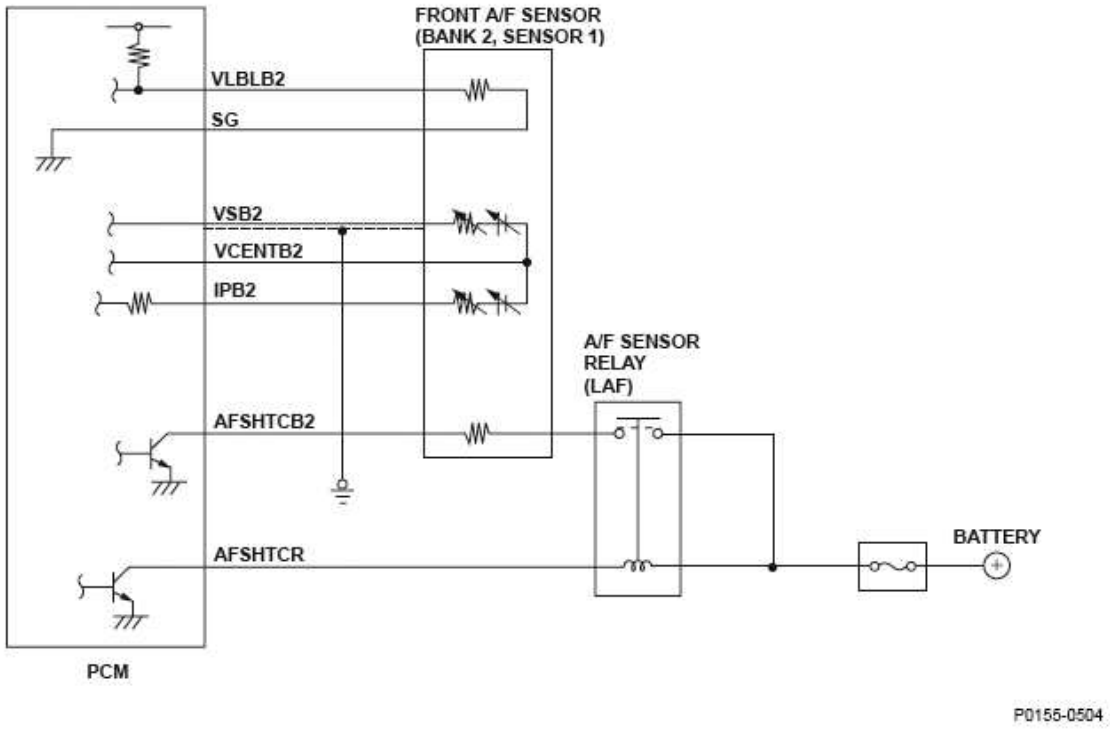



**Fig. 252: Front Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The front A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the front A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

The front A/F sensor (bank 1, sensor 1) has a built-in LABEL resistance to regulate the differences of the sensor characteristics. The PCM reads the resistance to regulate the difference properly. If the LABEL resistance (VLBLB2 signal voltage) is a set value or less, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0155, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2631 |

**Malfunction Threshold**

The VLBLB2 voltage is 0.3 V or less for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2631 (156): ADVANCED DIAGNOSTICS

## DTC P2631: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) LABEL CIRCUIT HIGH VOLTAGE

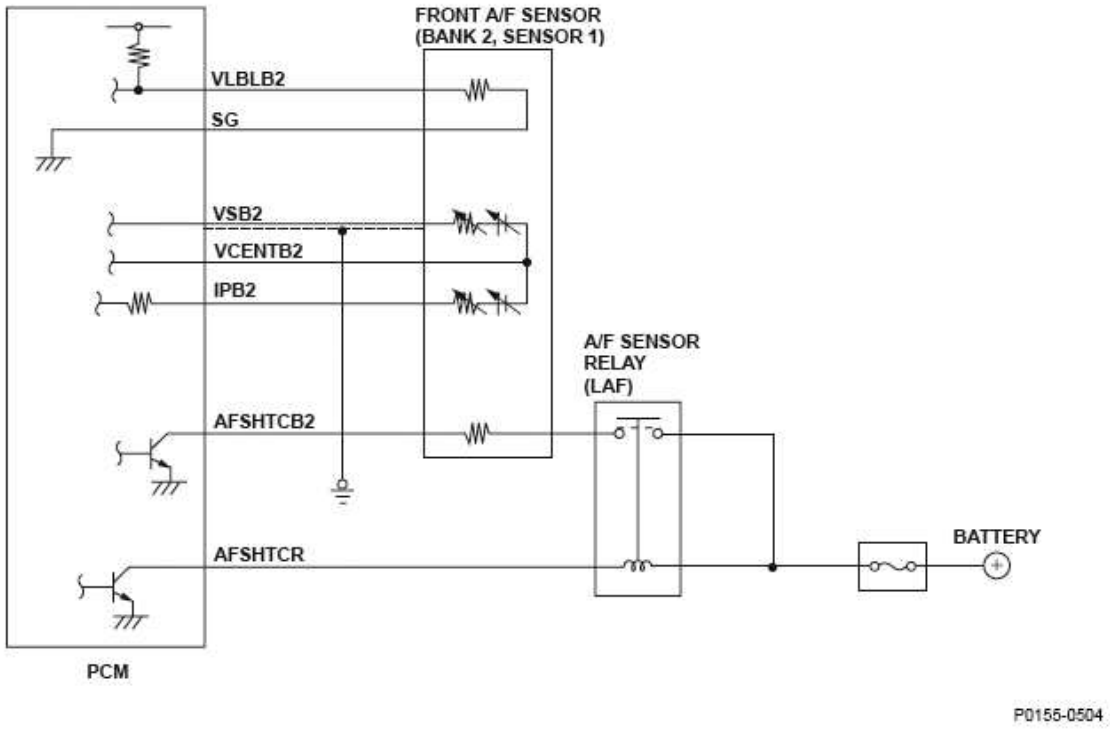



**Fig. 253: Front Air/Fuel Ratio (A/F) Sensor Circuit Diagram**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 1, sensor 1) is installed in the exhaust manifold and detects oxygen content in the exhaust gas. The front A/F sensor transmits a signal to the powertrain control module (PCM). The PCM controls fuel injection duration by comparing the target air/fuel ratio with the front A/F sensor signal. The sensor includes the VS cell, the pump cell, the atmospheric reference cavity, the diffusion layer, and the heater, and it enables overall feedback control.

The front A/F sensor (bank 1, sensor 1) has a built-in LABEL resistance to regulate the differences of the sensor characteristics. The PCM reads the resistance to regulate the difference properly. If the LABEL resistance (VLBLB2 signal voltage) is a set value or more, the PCM detects a malfunction and stores a DTC.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 5 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | |
|---|---|
| Ignition switch | ON |
| No active DTCs | P0155, P2197, P2240, P2241, P2247, P2249, P2254, P2255, P2630 |

**Malfunction Threshold**

The VLBLB2 voltage is 4.7 V or more for at least 5 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2646 (22): ADVANCED DIAGNOSTICS

## DTC P2646: ROCKER ARM OIL PRESSURE SWITCH (VTEC OIL PRESSURE SWITCH) CIRCUIT LOW VOLTAGE

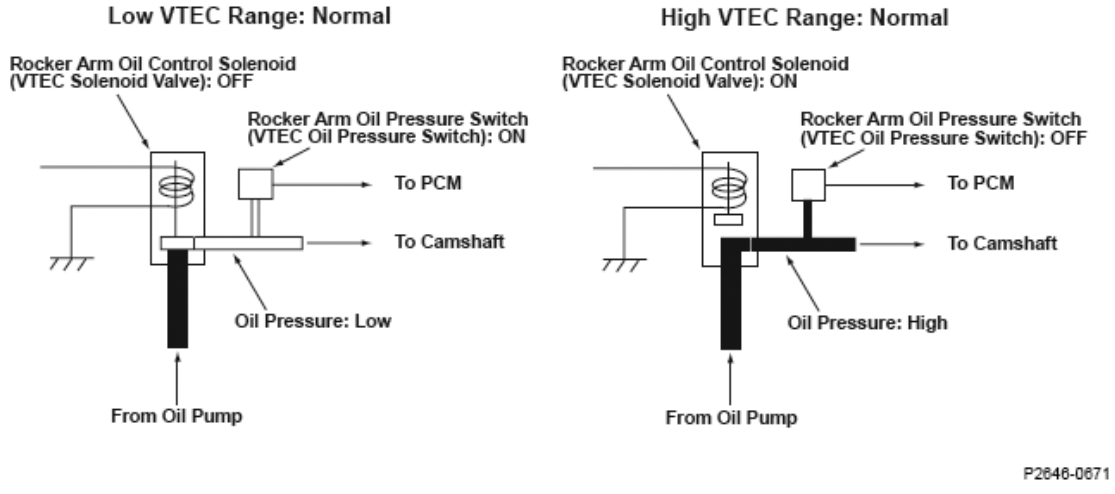



**Fig. 254: Low And High VTEC Range Graph**

**ROCKER ARM OIL PRESSURE SWITCH REFERENCE CHART**

| Logic Decision | Rocker Arm Oil Pressure Switch (VTEC Oil Pressure Switch) | |
|---|---|---|
| | 'ON' | 'OFF' |
| Rocker Arm Oil Control Solenoid (VTEC Solenoid Valve) Command 'ON' | Failure | Normal |
| Rocker Arm Oil Control Solenoid (VTEC Solenoid Valve) Command 'OFF' | Normal | Failure |

**General Description**

The VTEC system activates the rocker arm oil control solenoid (VTEC solenoid valve) by command from the powertrain control module (PCM), and it charges/discharges the hydraulic circuit of the VTEC mechanism that switches valve timing between Low and High. The PCM monitors oil pressure in the hydraulic circuit of the VTEC mechanism using the rocker arm oil pressure switch (VTEC oil pressure switch) downstream of the rocker arm oil control solenoid (VTEC solenoid valve). If there is a difference between the oil pressure condition in the hydraulic circuit that is determined by the PCM command and the oil pressure condition that is determined by the status of the rocker arm oil pressure switch (VTEC oil pressure switch), the system is considered faulty, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 7 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Engine coolant temperature | 50 °F (10 °C) | - |
| Engine speed (High lift cam operation) | 4,200 rpm | - |
| Vehicle speed | 7 mph (10 km/h) | - |
| Battery voltage | 10.5 V | - |
| Gear position | Other than P or N position | |
| No active DTCs | P1109, P2227, P2228, P2229, P2648, P2649 | |

**Malfunction Threshold**

When the rocker arm oil control solenoid (VTEC solenoid valve) is ON, the rocker arm oil pressure switch (VTEC oil pressure switch) remains ON.

**Confirmation Procedure with the HDS**

Do the VTEC TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle in a lower gear at 4,200 rpm or more for at least 7 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2647 (22): ADVANCED DIAGNOSTICS

## DTC P2647: ROCKER ARM OIL PRESSURE SWITCH (VTEC OIL PRESSURE SWITCH) CIRCUIT HIGH VOLTAGE

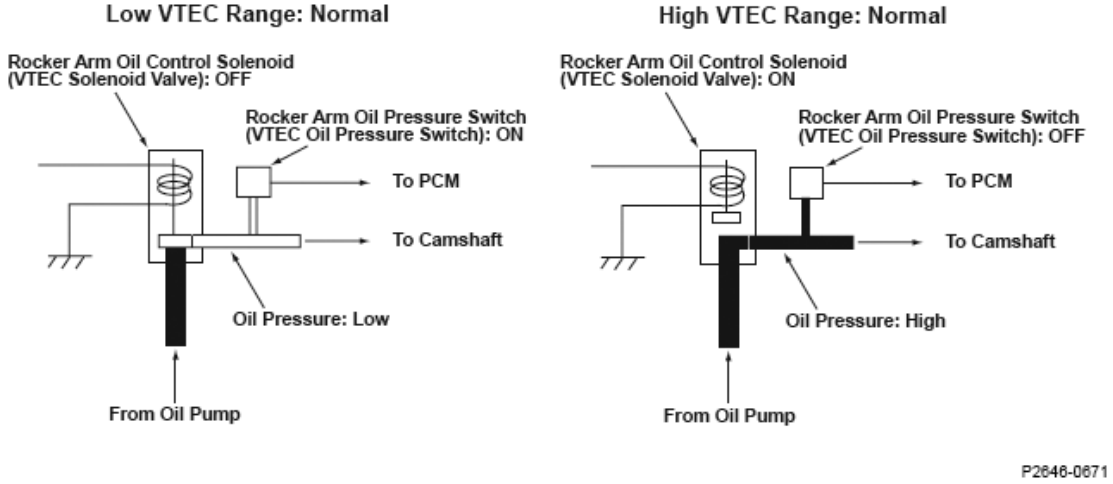



**Fig. 255: Low And High VTEC Range Graph**

## ROCKER ARM OIL PRESSURE SWITCH REFERENCE CHART

| Logic Decision | Rocker Arm Oil Pressure Switch (VTEC Oil Pressure Switch) | |
|---|---|---|
| | 'ON' | 'OFF' |
| Rocker Arm Oil Control Solenoid (VTEC Solenoid Valve) Command 'ON' | Failure | Normal |
| Rocker Arm Oil Control Solenoid (VTEC Solenoid Valve) Command 'OFF' | Normal | Failure |

**General Description**

The VTEC system activates the rocker arm oil control solenoid (VTEC solenoid valve) by command from the powertrain control module (PCM), and it charges/discharges the hydraulic circuit of the VTEC mechanism that switches valve timing between Low and High. The PCM monitors oil pressure in the hydraulic circuit of the VTEC mechanism using the rocker arm oil pressure switch (VTEC oil pressure switch) downstream of the rocker arm oil control solenoid (VTEC solenoid valve). If there is a difference between the oil pressure condition in the hydraulic circuit that is determined by the PCM command and the oil pressure condition that is determined by the status of the rocker arm oil pressure switch (VTEC oil pressure switch), the system is considered faulty, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

## MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS

| | |
|---|---|
| Execution | One per driving cycle |
| Sequence | None |
| Duration | 7 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

## ENABLE CONDITIONS

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.5 V | - |
| No active DTCs | P1109, P2227, P2228, P2229, P2648, P2649 | |
| Other | At idle | |

**Malfunction Threshold**

When the rocker arm oil control solenoid (VTEC solenoid valve) is OFF, the rocker arm oil pressure switch (VTEC oil pressure switch) remains OFF.

**Confirmation Procedure with the HDS**

Do the VTEC TEST in the INSPECTION MENU with the HDS.

**Driving Pattern**

Start the engine, and let it idle for at least 7 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2648 (21): ADVANCED DIAGNOSTICS

## DTC P2648: ROCKER ARM OIL CONTROL SOLENOID (VTEC SOLENOID VALVE) CIRCUIT LOW VOLTAGE

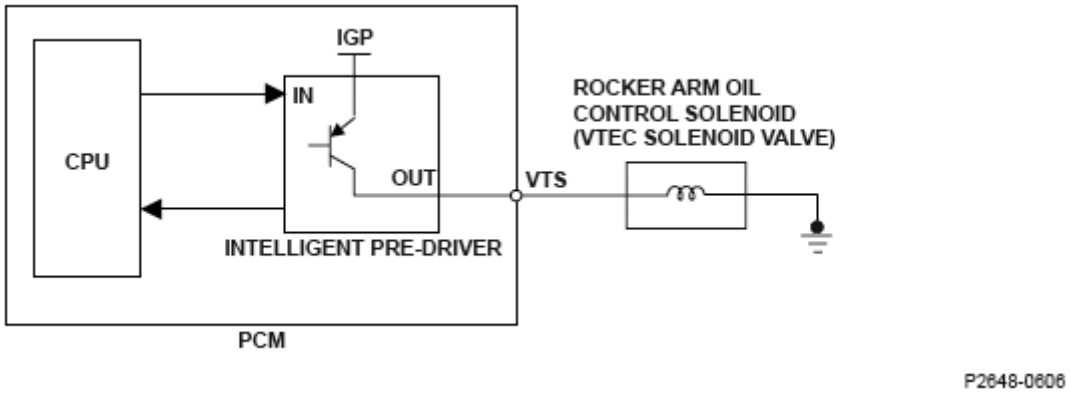



**Fig. 256: Rocker Arm Oil Control Solenoid Circuit Diagram**

**General Description**

The VTEC system switches the valve timing by opening and closing the oil passage to the high/low camshaft switching mechanism. The rocker arm oil control solenoid (VTEC solenoid valve), controlled by the powertrain control module (PCM), opens and closes the oil passage, which controls VTEC operation.

The intelligent pre-driver drives the rocker arm oil control solenoid (VTEC solenoid valve) by receiving the drive direction output at the CPU in the PCM. When the rocker arm oil control solenoid (VTEC solenoid valve) output is OFF (low) and this condition continues for a certain time or more in response to the rocker arm oil

control solenoid (VTEC solenoid valve) ON (high) drive instruction to the intelligent pre-driver, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.0 V | - |
| No active DTCs | P2649 | |

**Malfunction Threshold**

The return signal is OFF (low) for at least 1.2 seconds when the PCM outputs the ON (high) signal to the rocker arm oil control solenoid (VTEC solenoid valve).

**Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle in a lower gear at 4,200 rpm or more for at least 7 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2649 (21): ADVANCED DIAGNOSTICS

## DTC P2649: ROCKER ARM OIL CONTROL SOLENOID (VTEC SOLENOID VALVE) CIRCUIT HIGH VOLTAGE

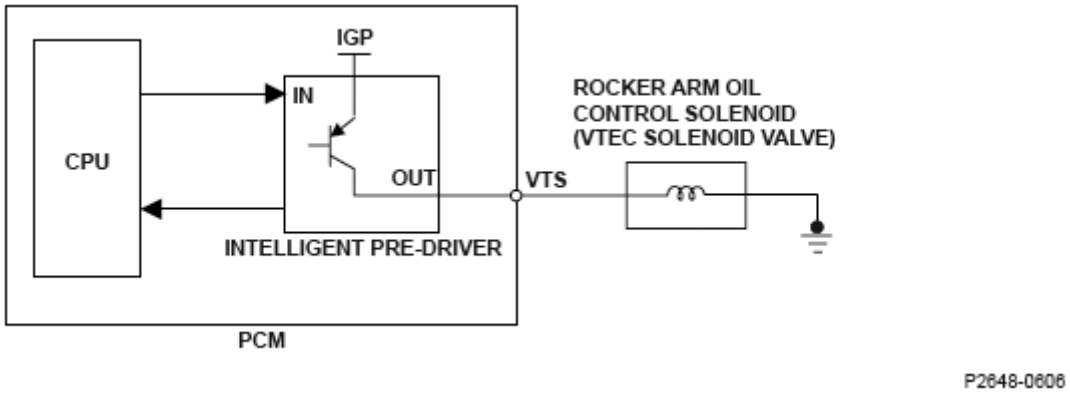



**Fig. 257: Rocker Arm Oil Control Solenoid Circuit Diagram**

**General Description**

The VTEC system switches the valve timing by opening and closing the oil passage to the high/low camshaft switching mechanism. The rocker arm oil control solenoid (VTEC solenoid valve), controlled by the powertrain control module (PCM), opens and closes the oil passage, which controls VTEC operation.

The intelligent pre-driver drives the rocker arm oil control solenoid (VTEC solenoid valve) by receiving the driving direction output at the CPU in the PCM. When the rocker arm oil control solenoid (VTEC solenoid valve) output is ON (high) and this condition continues for a certain time or more in response to the rocker arm oil control solenoid (VTEC solenoid valve) OFF (low) driving instruction to the intelligent pre-driver, a malfunction is detected and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1.2 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.0 V | - |
| | | |

| | |
|---|---|
| State of the engine | Running |
| No active DTCs | P2648 |

**Malfunction Threshold**

The return signal is ON (high) for at least 1.2 seconds when the PCM outputs the OFF (low) signal to the rocker arm oil control solenoid (VTEC solenoid valve).

**Driving Pattern**

Start the engine, and let it idle for at least 7 seconds.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2769 (1): ADVANCED DIAGNOSTICS

## DTC P2769: SHORT IN TORQUE CONVERTER CLUTCH SOLENOID VALVE CIRCUIT

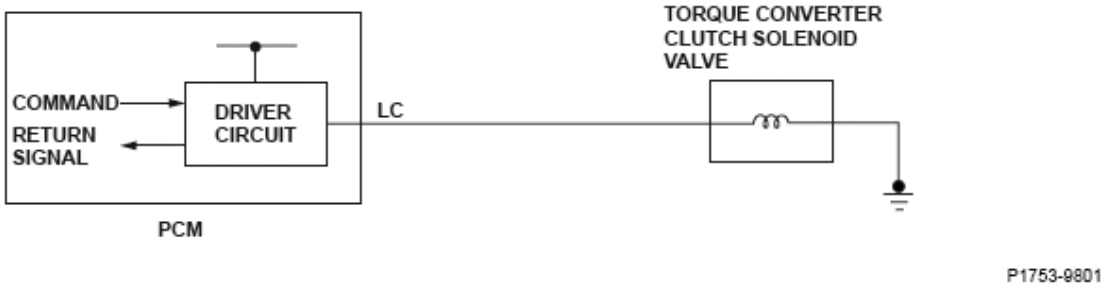



**Fig. 258: Torque Converter Clutch Solenoid Valve Circuit Diagram**

**General Description**

The torque converter clutch solenoid valve switches the hydraulic circuit to engage/disengage the torque converter clutch. When the torque converter clutch solenoid valve is turned ON, hydraulic pressure is applied to the torque converter clutch. When the torque converter clutch solenoid valve is turned OFF, hydraulic pressure

to the torque converter clutch is interrupted. The powertrain control module (PCM) commands the driver circuit to turn on the torque converter clutch solenoid valve. The circuit diagnoses malfunctions such as a circuit short or open, and sends back a return signal during the PCM's command. When the return signal does not match the PCM command, a malfunction is detected by the PCM. The malfunction is detected when the return signal does not match the PCM command to turn ON the torque converter clutch solenoid valve, and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2770 | |

**Malfunction Threshold**

The return signal does not match the command to turn ON the torque converter clutch solenoid valve for at least 1 second.

**Driving Pattern**

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed of 37 mph (60 km/h) until the transmission shifts into 5th gear in D5 position with a constant throttle position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2770 (1): ADVANCED DIAGNOSTICS

### DTC P2770: OPEN IN TORQUE CONVERTER CLUTCH SOLENOID VALVE CIRCUIT

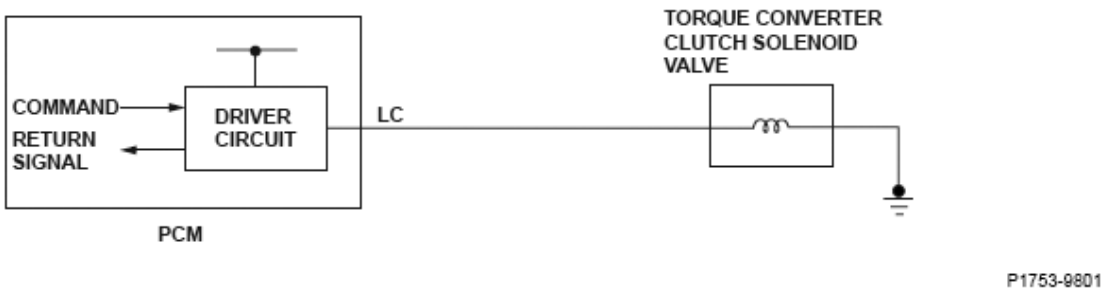



**Fig. 259: Torque Converter Clutch Solenoid Valve Circuit Diagram**

#### General Description

The torque converter clutch solenoid valve switches the hydraulic circuit to engage/disengage the torque converter clutch. When the torque converter clutch solenoid valve is turned ON, hydraulic pressure is applied to the torque converter clutch. When the torque converter clutch solenoid valve is turned OFF, hydraulic pressure to the torque converter clutch is interrupted. The powertrain control module (PCM) commands the driver circuit to turn on the torque converter clutch solenoid valve. The circuit diagnoses malfunctions such as a circuit short or open, and sends back a return signal during the PCM's command. When the return signal does not match the PCM command, a malfunction is detected by the PCM. The malfunction is detected when the return signal does not match the PCM command to turn OFF the torque converter clutch solenoid valve, and a DTC is stored.

#### Monitor Execution, Sequence, Duration, DTC Type, OBD Status

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL ON, D5 indicator blinks |
| OBD Status | PASSED/FAILED/NOT COMPLETED (STILL TESTING) |

#### Enable Conditions

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 11.0 V | - |

| | |
|---|---|
| State of the engine | Running |
| No active DTCs | P0746, P0747, P0751, P0777, P0962, P0963, P0966, P0967, P0970, P0971, P0973, P0974, P0976, P0977, P0979, P0980, P2769 |

**Malfunction Threshold**

The return signal does not match the command to turn OFF the torque converter clutch solenoid valve for at least 1 second.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC P2A00 (157): ADVANCED DIAGNOSTICS

## DTC P2A00: REAR AIR/FUEL RATIO (A/F) SENSOR (BANK 1, SENSOR 1) RANGE/PERFORMANCE PROBLEM

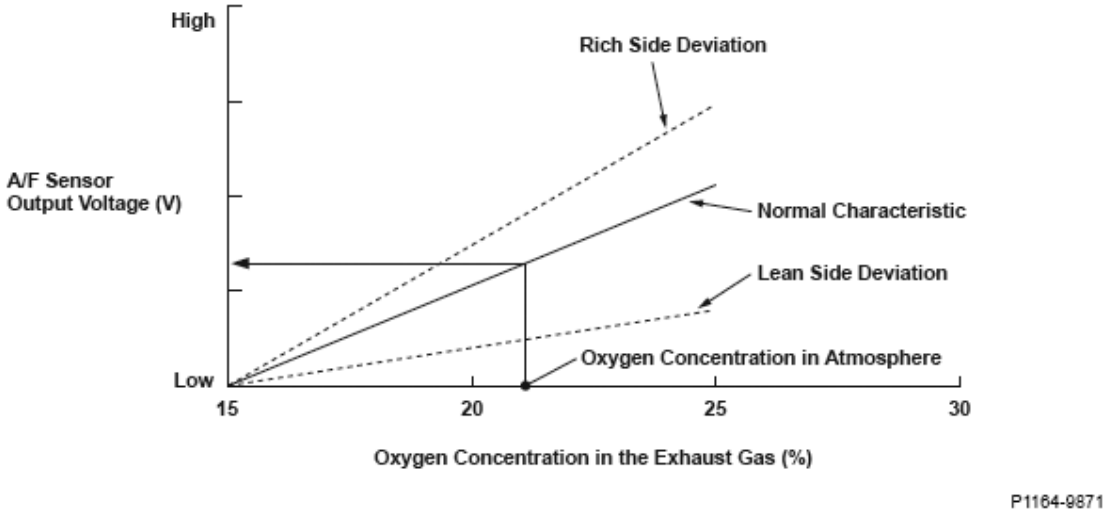



**Fig. 260: A/F Sensor Output Voltage To Oxygen Concentration In Exhaust Gas - Graph**

**General Description**

The rear air/fuel ratio (A/F) sensor (bank 1, sensor 1) has a linear signal output in relation to the oxygen concentration. The powertrain control module (PCM) computes the air/fuel ratio from the rear A/F sensor output voltage and uses the fuel feedback control to improve exhaust emissions. The PCM monitors the rear A/F sensor output voltage during deceleration with the throttle fully closed, and if the output voltage deviates greatly from normal oxygen concentration levels, it detects a malfunction and stores a DTC.

* Output to the scan tool exhibits a relationship between the rear A/F sensor output and oxygen concentration, which is opposite to the characteristic shown in the graph. That is, a deviation toward the rich side increases the output voltage and one toward the lean side decreases the output voltage as the stoichiometric ratio is 0.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 5.3 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time after starting the engine | 5 seconds | - |
| Engine coolant temperature | 157°F (69°C) | - |
| Intake air temperature | 0°F (-18°C) | - |
| Engine speed | - | 2,300 rpm |
| Vehicle speed | 30 mph (48 km/h) | - |
| Fuel feedback | During deceleration | |
| No active DTCs | P0112, P0113, P0117, P0118, P0122, P0123, P0133, P0134, P0135, P0171, P0172, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0443, P0496, P0627, P0641, P0657, P1109, P1172, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2195, P2227, P2228, P2229, P2237, P2238, P2243, P2245, P2251, P2252, P2627, P2628, U0107 | |

**Malfunction Threshold**

The rear A/F sensor (bank 1, sensor 1) output voltage is 2.65 V or less, or 4.50 V or more.

**Driving Pattern**

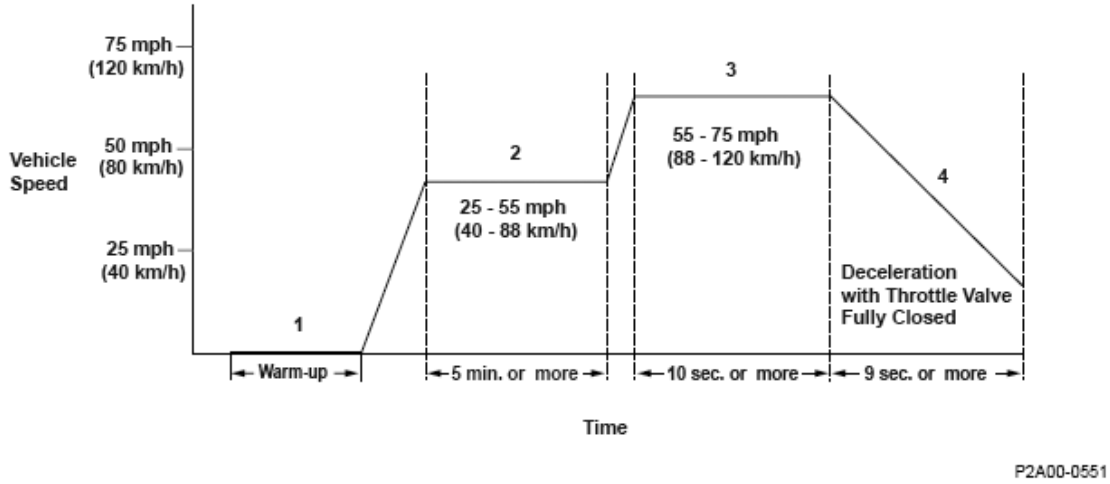



**Fig. 261: Vehicle Speed Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
3. Then, drive immediately at a steady speed between 55 - 75 mph (88 - 120 km/h) for at least 10 seconds.
4. Decelerate with the throttle valve fully closed for at least 9 seconds.

- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

## DTC P2A03 (158): ADVANCED DIAGNOSTICS

**DTC P2A03: FRONT AIR/FUEL RATIO (A/F) SENSOR (BANK 2, SENSOR 1) RANGE/PERFORMANCE PROBLEM**

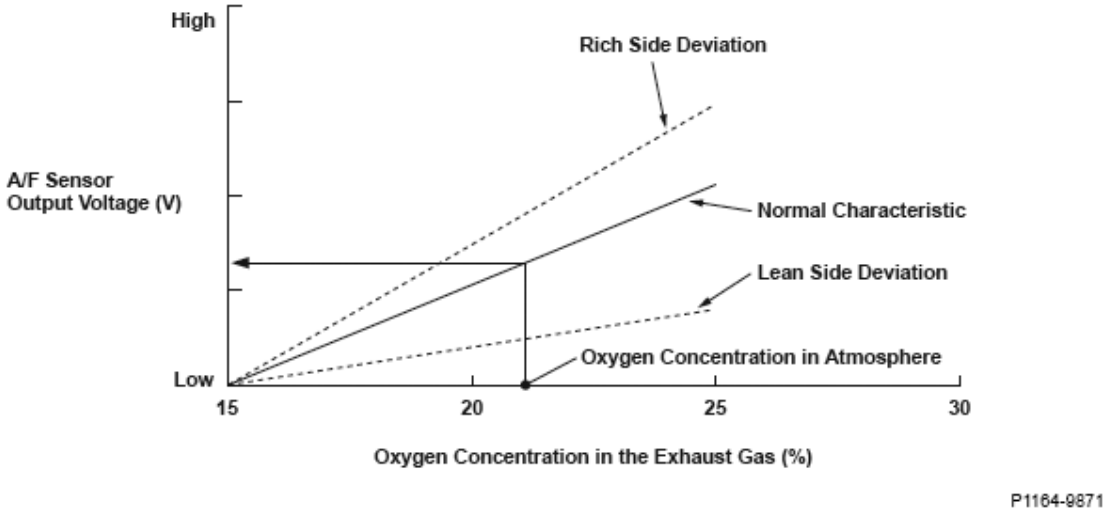



**Fig. 262: A/F Sensor Output Voltage To Oxygen Concentration In Exhaust Gas - Graph**

**General Description**

The front air/fuel ratio (A/F) sensor (bank 2, sensor 1) has a linear signal output in relation to the oxygen concentration. The powertrain control module (PCM) computes the air/fuel ratio from the front A/F sensor output voltage and uses the fuel feedback control to improve exhaust emissions. The PCM monitors the front A/F sensor output voltage during deceleration with the throttle fully closed, and if the output voltage deviates greatly from normal oxygen concentration levels, it detects a malfunction and stores a DTC.

* Output to the scan tool exhibits a relationship between the front A/F sensor output and oxygen concentration, which is opposite to the characteristic shown in the graph. That is, a deviation toward the rich side increases the output voltage and one toward the lean side decreases the output voltage as the stoichiometric ratio is 0.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Once per driving cycle |
| Sequence | None |
| Duration | 5.3 seconds or more |
| DTC Type | Two drive cycles, MIL ON |
| OBD Status | PASSED/FAILED/EXECUTING/OUT OF (TEST) CONDITION |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Elapsed time after starting the engine | 5 seconds | - |
| Engine coolant temperature | 157°F (69°C) | - |

| | | |
|---|---|---|
| Intake air temperature | 0°F (-18°C) | - |
| Engine speed | - | 2,300 rpm |
| Vehicle speed | 30 mph (48 km/h) | - |
| Fuel feedback | During deceleration | |
| No active DTCs | P0112, P0113, P0117, P0118, P0122, P0123, P0153, P0154, P0155, P0174, P0175, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0443, P0496, P0627, P0641, P0657, P1109, P1174, P2101, P2108, P2118, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2197, P2227, P2228, P2229, P2240, P2241, P2247, P2249, P2254, P2255, P2630, P2631, U0107 | |

**Malfunction Threshold**

The front A/F sensor (bank 2, sensor 1) output voltage is 2.65 V or less, or 4.50 V or more.

**Driving Pattern**

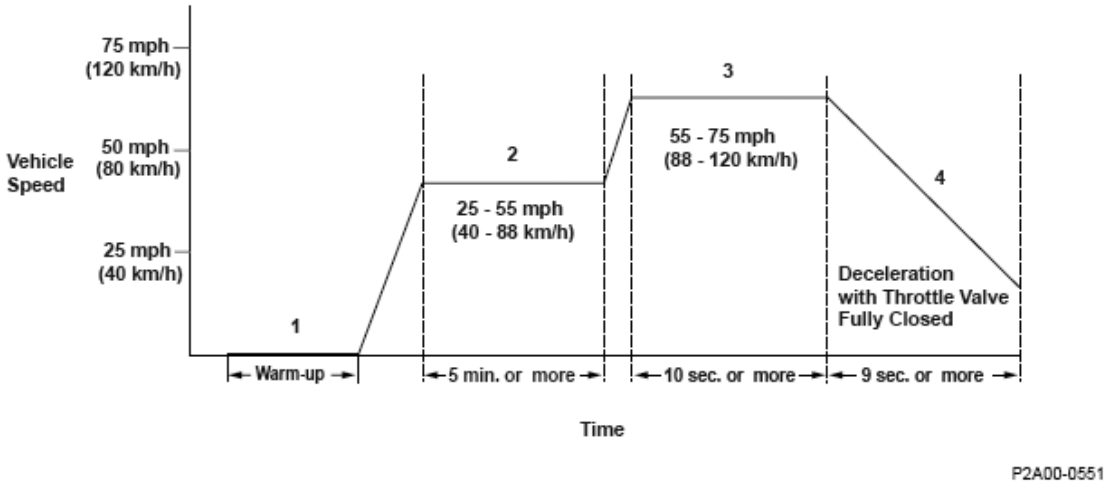



**Fig. 263: A/F Sensor Driving Pattern**

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
3. Then, drive immediately at a steady speed between 55 - 75 mph (88 - 120 km/h) for at least 10 seconds.
4. Decelerate with the throttle valve fully closed for at least 9 seconds.

- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the PCM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC U0073 (126): ADVANCED DIAGNOSTICS

### DTC U0073: FCAN MALFUNCTION (BUS-OFF)

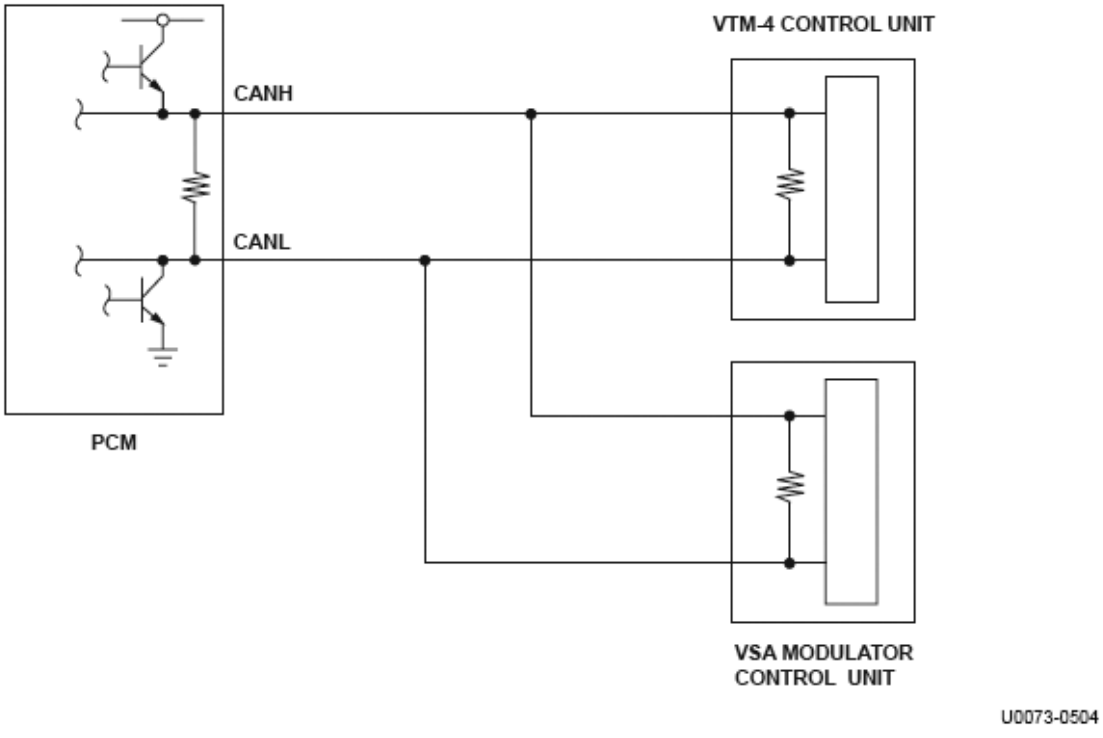



**Fig. 264: FCAN Malfunction (BUS-OFF) Circuit Diagram**

**General Description**

The controller area network (CAN) transmits/receives pulsing signals to/from the control modules simultaneously by using two signal lines (CANH and CANL).

When the powertrain control module (PCM) does not receive the signals via the CAN lines for more than a set

time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.0 V | - |

**Malfunction Threshold**

No signals via the CAN lines are received for at least 1 second.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC U0107 (30): ADVANCED DIAGNOSTICS

## DTC U0107: LOST COMMUNICATION WITH THROTTLE ACTUATOR CONTROL MODULE

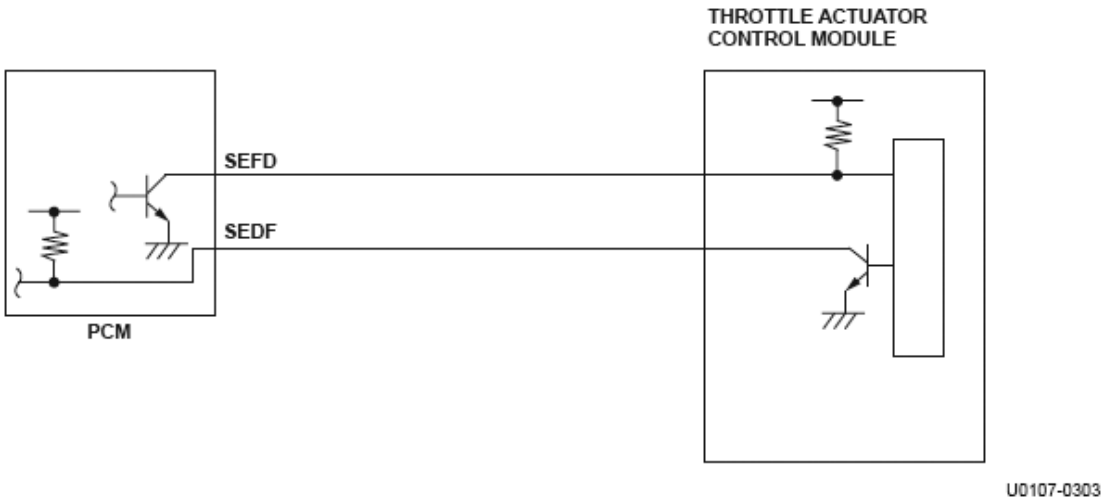



**Fig. 265: Throttle Actuator Control Module Communication Diagram**

**General Description**

The powertrain control module (PCM) uses the serial signal line for two-way communication with the throttle actuator control module.

The PCM transmits the accelerator pedal position signal, etc., to the throttle actuator module, and the throttle actuator control module transmits the actual throttle valve position signal, a malfunction signal, etc., to the PCM.

When no serial signals from the throttle actuator control module are received or the serial signals are abnormal for more than a set time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 0.25 seconds or more |
| DTC Type | One drive cycle, MIL ON |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 8.0 V | - |
| Elapsed time after starting throttle actuator control module | 1 second | - |
| No active DTCs | P2101, P2108, P2118, P2135, P2176 | |

**Malfunction Threshold**

One of these conditions mentioned below must be met for at least 0.25 seconds.

- No serial signals from the throttle actuator control module are detected.
- The serial signals from the throttle actuator control module are abnormal.

**Diagnosis Details**

**Conditions for illuminating the MIL**

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the PCM memory.

**Conditions for clearing the MIL**

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC U0114 (126): ADVANCED DIAGNOSTICS

### DTC U0114: FCAN MALFUNCTION (VTM-4 CONTROL UNIT-PCM)

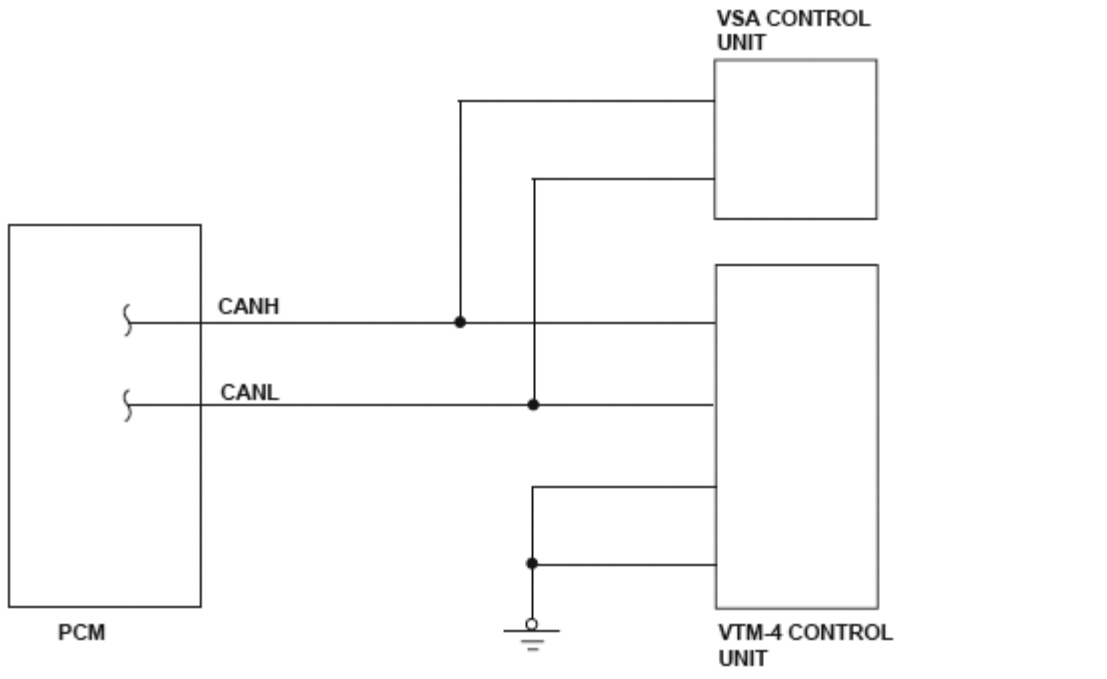


**Fig. 266: FCAN Malfunction (VTM-4 Control UNIT-PCM) Circuit Diagram**

**General Description**

The controller area network (CAN) transmits/receives pulsing signals to/from the control modules simultaneously by using two signal lines (CANH and CANL).

When the powertrain control module (PCM) does not receive the signals via the CAN lines for more than a set time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.0 V | - |

**Malfunction Threshold**

No signals via the CAN lines are received for at least 1 second.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

# DTC U0122 (126): ADVANCED DIAGNOSTICS

**DTC U0122: F-CAN MALFUNCTION (VSA MODULATOR-CONTROL UNIT-PCM)**

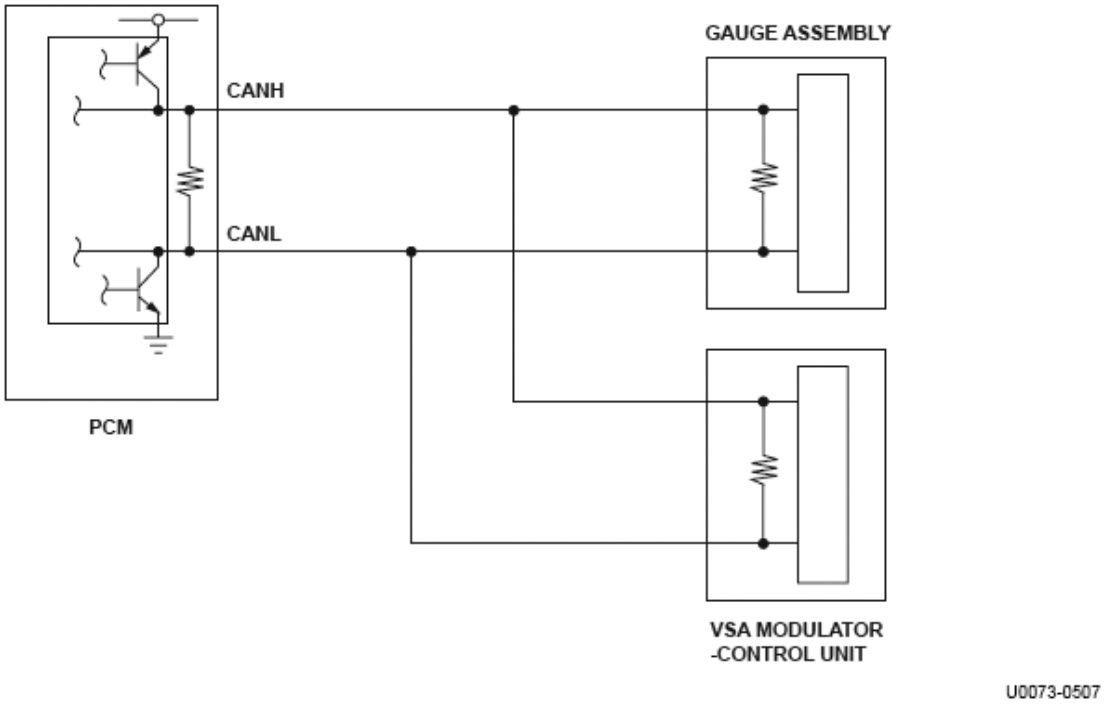



**Fig. 267: F-CAN Malfunction (VSA Modulator-Control UNIT-PCM) Circuit Diagram**

**General Description**

The controller area network (CAN) transmits/receives pulsing signals to/from the control modules simultaneously by using two signal lines (CANH and CANL).

When the powertrain control module (PCM) does not receive the signals via the CAN lines for more than a set time, the PCM detects a malfunction and a DTC is stored.

**Monitor Execution, Sequence, Duration, DTC Type, OBD Status**

**MONITOR EXECUTION, SEQUENCE, DURATION, DTC TYPE, OBD STATUS**

| | |
|---|---|
| Execution | Continuous |
| Sequence | None |
| Duration | 1 second or more |
| DTC Type | One drive cycle, MIL OFF |
| OBD Status | N/A |

**Enable Conditions**

**ENABLE CONDITIONS**

| Condition | Minimum | Maximum |
|---|---|---|
| Battery voltage | 10.0 V | - |

**Malfunction Threshold**

The PCM does not receive any signals for at least 1 second.

**Diagnosis Details**

**Conditions for illuminating the indicator**

When a malfunction is detected, the DTC and the freeze frame data are stored in the PCM memory. The MIL does not come on.

**Conditions for clearing the DTC**

The DTC and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.